Geothermal Progress Monitor

4

Progress Report

September 1980

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U.S. Department of Energy

Assistant Secretary for Resource Applications

Division of Geothermal Energy

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GEOHERMAL PROGRESS MONITOR

REPORT NO. 4

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U.S. Department of Energy
Assistant Secretary for Resource Applications
Division of Geothermal Energy
Washington, D.C. 20461

Prepared in Cooperation With the
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With The Assistance of
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PREFACE

The Geothermal Progress Monitor Report will be issued periodically to inform recipients of changes that have occurred among the activities directed toward the commercialization of geothermal energy, as these changes are reported to and observed by the Geothermal Progress Monitor (GPM) System. Although this is the fourth issue of the Geothermal Progress Monitor Report, it is the first one to receive wide distribution. The first three issues were used for shakedown purposes and, as such, were limited to staff members of the Division of Geothermal Energy, member agencies of the Interagency Geothermal Coordinating Council, and state commercialization and reservoir assessment teams.

The primary purpose of the GPM System is to monitor and report on commercialization activities in the geothermal industry. It will serve both the program management and information dissemination functions of the Division of Geothermal Energy/Resource Applications (DGE/RA) and other member agencies of the Interagency Geothermal Coordinating Council (IGCC).

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 commercialization activities, including 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 will focus on two types of information:

- Status - the baseline of how much energy is being produced from geothermal sources, and what level of activity is 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 will be 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 feedback 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 feedback from DOE Headquarters and the field will shape the contents of the Reports. The Reports are still in the formative stage, and more feedback is needed as to 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 as to 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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Cover: Hot Dry Rock Demonstration Site. Fenton Hill, New Mexico.

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EXECUTIVE SUMMARY

This is the first Geothermal Progress Monitor Report to be widely distributed. It contains updated information for all tables presented in previous issues, including geothermal electric power plants proposed and on-line, direct heat applications proposed and operational, DOE-sponsored feasibility studies and application demonstrations, and trends in drilling activities.

Electric power-on-line projections and data on drilling and leasing activities have been reviewed and analyzed for trends (see Sections 1.0, 3.0, and 5.0 respectively). Analyses contained in the electric uses and leasing sections include reviews of trends with respect to goals set by the IGCC.

Other highlights of this issue are:

ELECTRIC USES

- Comparisons of current operating and planned geothermal electric plants to electricity production goals set by the IGCC reveal that during the 1980-1985 period, the expected operating and planned generating capacity is very close to the IGCC hydrothermal electric capacity goal.

DIRECT HEAT USES

- Current direct heat applications comprise 183 activities in 15 states, totalling 11,487 billion BTUs per year. There are 129 proposed projects in 20 states, totalling approximately 9595 billion BTUs per year. Eight of these projects became operational during 1979 and 1980, providing nearly 197 billion BTUs per year. It is expected that by the end of 1980, an additional 16 projects will be in service, supplying another 166 billion BTUs of energy.

LEASES

- Section 5.0 presents a preliminary analysis of how much federal land needs to be leased for exploration purposes during 1981-1990 to support the IGCC hydrothermal production goals to the year 2000. The current overall rate of 400,000 federal acres leased per year approaches the estimated needed rate of about 500,000 acres per year, and both the Bureau of Land Management and the Forest Service are acting to accelerate the rate of leasing. However, conditions exist which

indicate that the rate of leasing of high quality lands for potential electric power production may be too slow to meet the IGCC year 2000 electric power production goals.

1.0 ELECTRIC USES

A significant part of the Department of Energy's geothermal industrialization efforts to develop geothermal energy has been devoted to aiding the development of electrical generation capacity utilizing geothermal resources. The value of these efforts will be seen by accelerated growth in commercial development of electrical generation capacity.

Currently, nearly all commercial electric power-on-line from geothermal sources is from The Geysers field in Northern California, which has been developed solely by the private sector. With the addition of the 129 MWe PG&E Unit #13 in June, the current Geysers generating capacity is 792 MWe, with the 110 MWe PG&E Unit #14 due to come on-line late this summer. The only geothermal electrical power being produced in the U.S. outside The Geysers is at the Magma Power/San Diego Gas & Electric 10 MWe East Mesa plant, and the Union Oil/Southern California Edison 10 MWe Brawley plant, both of which are in Imperial Valley, California. However, neither of these two plants have achieved full operational status.

Currently operating and planned hydrothermal electric power plants are listed in Tables 1-1 and 1-2 respectively. Figure 1-1 presents a comparison of the IGCC goals for geothermal electricity production with power capacity in operating or planned plants announced by a developer or an electric utility. During the 1980 to 1985 period, the expected operating and planned capacity is very

TABLE 1-1

GEOTHERMAL ELECTRIC PLANTS ON LINE

STATE	AREA	DEVELOPER	UTILITY	PLANT	PLANT TYPE	NET OUTPUT MWE	YEAR ON LINE	PLANT COST \$ 000	NOTES
CA	BRAWLEY	UNION OIL	SCE	SCE PILOT	FLASH	10	1980	10,040	1
CA	EAST MESA	MAGNA POWER	SDG&E		BINARY	10	1980	16,093	2, 3
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT # 1	STEAM	11	1960	2,005	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT # 2	STEAM	13	1963	2,005	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT # 3	STEAM	27	1967	3,805	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT # 4	STEAM	27	1968	3,805	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT # 5	STEAM	53	1971	6,378	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT # 6	STEAM	53	1971	6,378	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT # 7	STEAM	53	1972	5,760	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT # 8	STEAM	53	1972	5,760	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT # 9	STEAM	53	1973	6,760	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT #10	STEAM	53	1973	6,760	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT #11	STEAM	106	1975	19,666	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT #12	STEAM	106	1979	27,580	4
CA	GEYSERS	THERMOGENICS	PG&E	UNIT #15	STEAM	55	1979	25,530	4
CA	GEYSERS	AMINOIL USA	PG&E	UNIT #13	STEAM	129	1980	52,800	4, 5
STATUS TOTAL						812		201,125	

NOTES FOR TABLES 1-1 AND 1-2

- 1 8/ 1/80 SOUTHERN CALIFORNIA EDISON
- 2 8/ 7/80 MAGNA POWER INC.
- 3 8/ 7/80 SAN DIEGO GAS & ELECTRIC
- 4 8/ 6/80 PACIFIC GAS & ELECTRIC
- 5 8/15/80 AMINOIL USA
- 6 7/31/80 CALIFORNIA DEPARTMENT OF WATER RESOURCES
- 7 SCE HAS CONTRACT WITH UNION OIL FOR 450 MWE STEAM SUPPLY
- 8 8/ 6/80 CALIFORNIA ENERGY COMPANY
- 9 8/ 6/80 US NAVY
- 10 8/15/80 REPUBLIC GEOTHERMAL INC.
- 11 7/31/80 ECR GEOTHERMAL INC.
- 12 8/ 5/80 GEOTHERMAL KINETICS INC.
- 13 DEVELOPER REPORTED TO BE IN RECEIVERSHIP
- 14 8/ 7/80 NORTHERN CALIFORNIA POWER AUTHORITY
- 15 8/19/80 SACRAMENTO MUNICIPAL UTILITY DISTRICT
- 16 8/ 7/80 GEOPRODUCTS INC.
- 17 8/14/80 DEPARTMENT OF ENERGY / SAN FRANCISCO
- 18 8/18/80 HAPCO INC.
- 19 8/11/80 HAWAII DEPARTMENT OF PLANNING & ECONOMIC DEVELOPMENT
- 20 8/12/80 IDAHO NATIONAL ENGINEERING LABORATORY
- 21 8/ 8/80 DEPARTMENT OF ENERGY / BACA
- 22 8/14/80 SIERRA PACIFIC POWER COMPANY
- 23 DESERT PEAK IS A TENTATIVE AREA
- 24 UP&L NEGOTIATING WITH PHILLIPS FOR 200 TO 300 MWE STEAM SUPPLY
- 25 8/11/80 UTAH POWER & LIGHT

TABLE 1-2

PROPOSED GEOTHERMAL ELECTRIC PLANTS

STATE	AREA	DEVELOPER	UTILITY	PLANT	PLANT TYPE	NET OUTPUT MWE	YEAR ON LINE	PLANT COST \$ 000	NOTES
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	1984		8, 9
CA	COSO	CALIFORNIA ENERGY	US NAVY	COSO # 2	FLASH	55	1989		8, 9
CA	EAST MESA	REPUBLIC GEOTHERMAL	SDG&E		FLASH	50	1982	80,000	3,10
CA	GEYSERS	HCH GEOTHERMAL	CDWR	BOTTLE ROCK	STEAM	55	1984		6,11
CA	GEYSERS	GEOTHERMAL KINETICS	CDWR	SO. GEYSERS	STEAM	55	1985		6,12
CA	GEYSERS		CDWR	BINKLEY	STEAM	55	1986		6
CA	GEYSERS	RESOURCES FUNDING	NCPA	NCPA # 1	STEAM	66			13,14
CA	GEYSERS	SHELL OIL	NCPA	NCPA # 2	STEAM	110	1982	28,000	14
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT #14	STEAM	110	1980	27,966	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT #17	STEAM	110	1982	41,592	4
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT #18	STEAM	110	1982	48,882	4
CA	GEYSERS	AMINOIL USA	PG&E	UNIT #16	STEAM	110	1983	42,700	4, 5
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT #20	STEAM	110	1984		4
CA	GEYSERS	AMINOIL USA	PG&E	UNIT #19	STEAM	55	1986		4, 5
CA	GEYSERS	UNION-MAGNA-THERMAL	PG&E	UNIT #21	STEAM	110	1986		4
CA	GEYSERS		PG&E	UNIT #22	STEAM	110	1987		4
CA	GEYSERS		PG&E	UNIT #23	STEAM	110	1988		4
CA	GEYSERS		PG&E	UNIT #24	STEAM	110	1988		4
CA	GEYSERS	AMINOIL USA	SHUD	SHUD # 1	STEAM	55	1984		5,15
CA	GEYSERS		SHUD	SHUD # 2	STEAM	55	1985		15
CA	GEYSERS		SHUD	SHUD # 3	STEAM	55	1986		15
CA	HEBER	CHEVRON	SCE	SCE # 1	FLASH	50	1982		1
CA	HEBER	CHEVRON	SCE	SCE # 2	FLASH	100	1986	110,000	1
CA	HEBER	CHEVRON	SDG&E		BINARY	45	1984	128,400	3
CA	BONO-LONG VALLEY	MAGNA POWER	SCE		COGEN	20	1985		1, 2
CA	NILAND	UNION OIL	SCE	SCE					1, 7
CA	NILAND	UNION OIL	SCE	SCE PILOT		10	1982		1
CA	NILAND	MAGNA POWER	SDG&E	SDG&E# 1	FLASH	24	1983	30,000	2, 3
CA	NILAND	MAGNA POWER	SDG&E	SDG&E# 2	FLASH	49	1985	50,000	2, 3
CA	WENDEL-AHEDEF	GEOPRODUCTS	CDWR		COGEN	50	1984	60,000	6,16
CA	WESTNORLAND	REPUBLIC GEOTHERMAL			FLASH	48	1985		10,17,18
HI	PUNA	STATE OF HAWAII	HELCO	HGP-A	FLASH	3	1981	7,000	19
ID	RAFT RIVER	INEL/EG&G			BINARY	5	1980	24,000	20
NH	VALLES CALDERA	UNION OIL	FNN	EACA # 1	FLASH	45	1983		21
NV	DESERT PEAK	PHILLIPS PETROLEUM	SPPC		FLASH	10	1982		22,23
NV	DESERT PEAK	PHILLIPS PETROLEUM	SPPC		FLASH	50	1984		22,23
UT	ROOSEVELT H.S.	PHILLIPS PETROLEUM	UP&L	UP&L	FLASH				24,25
UT	ROOSEVELT H.S.	PHILLIPS PETROLEUM	UP&L	UP&L # 1	FLASH	20	1983	20,000	25
STATUS TOTAL						2,250		698,540

FIGURE 1-1
GEOHERMAL ELECTRIC POWER PLANS AND GOALS

close to the IGCC hydrothermal electric capacity goal, with the 1985 goal being only about 400 megawatts higher than the total for which plans have been announced. While it is possible that additional plants may be planned, announced, and constructed in this period, it is also possible that some of the announced plants may not come on line by 1985, depending on various problems that the developers and utilities might encounter.

For the 1985 to 1990 period, there is a growing difference between the announced plans and the IGCC goal, with a planned capacity shortfall of about 3000 megawatts in 1990. This difference is probably attributable to the fact that geothermal developers have not worked out detailed plans for the plants to be installed at specific prospects during the 1985 to 1990 period. It seems more than likely that successful experience with the plants to be developed by 1985 will lead the developers and utilities into currently unplanned projects that could make up the difference between the announced plans and the IGCC goals for 1990.

It is of further interest that the two curves shown in Figure 1-1 track reasonably closely to the estimates developed in the 1979 EPRI Geothermal Survey of the plans of individual electric utilities with respect to the development of hydrothermal electric plants. The EPRI Survey estimates of probable hydrothermal electric capacity were 2600 megawatts for 1985 and 4600 megawatts for 1990, both of which are close to the corresponding in-operation and planned capacities.

The EPRI Survey estimates of possible hydrothermal electric capacity were 3000 megawatts in 1985 and 6400 megawatts in 1990, both of which are close to the corresponding IGCC goals.

Table 1-3 portrays hydrothermal electric activities in the 14 areas for which plants are planned. It is interesting to note that in The Geysers the year 2000 planned capacity of 2343 MWe is in excess of the previously estimated 30-year reservoir capacity of 1610 MWe, and that the plans for Brawley are quite close to the estimated reservoir capacity. However, there are uncertainties associated with estimating reservoir capacities.

TABLE 1-3

ESTIMATED RESERVOIR CAPACITY AND PROPOSED POWER OUTPUT
FOR 14 HYDROTHERMAL ELECTRIC AREAS

AREA	RESERVOIR CAPACITY * (MWE-30YRS)	----- NET POWER OUTPUT (MWE) -----		
		OPERATING AS OF 7/80	PLANNED BY 1990	TOTAL BY 1990
BRAWLEY, CA	640	10	495	505
COSO HOT SPRINGS, CA	650		75	75
FAST MESA, CA	360	10	50	60
GEYSERS, CA	1610	792	1551	2343
HEBER, CA	650		195	195
MONO LONG VALLEY, CA	2100		20	20
NILAND, (SALTON SEA), CA	3400		533	533
WENDEL-AMEDEE (LASSEN), CA	75		50	50
WESTMORLAND, CA	1710		48	48
PUNA, HI	40		3	3
RAFT RIVER, ID	150		5	5
VALLES CALDERA, NM	2700		45	45
DESERT PEAK, NV	750		60	60
ROOSEVELT H.S., UT	970		220	220
TOTAL	15805	812	3350	4162

* NOTE: RESERVOIR CAPACITY ESTIMATES OBTAINED FROM USGS CIRCULAR 790

[illegible]

2.0 DIRECT HEAT USES

The fastest growing application of geothermal energy is as the direct source of heat for a variety of purposes. Individually, projects utilizing direct geothermal heat use small amounts of energy in comparison to electric plants. However, together projects displace a significant amount of energy from conventional sources.

Current direct heat applications comprise 183 activities in 15 states. These are listed in Table 2-1. Eight of these projects became operational during 1979 and 1980, providing 196.8 billion BTUs per year. It is expected that by the end of 1980, an additional 16 projects will be in service, supplying another 166 billion BTUs of energy. Figure 2-1 shows the types of ongoing "standard" applications (detailed in Table 2-1) in each state. There are 129 planned projects, listed in Table 2-2. 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. A summary of direct heat use is given in Table 2-3.

Recent developments in the area of direct heat use include:

NEVADA

- The Dill Medical Center (30-40 bed hospital) in Caliente, Nevada, converted to geothermal energy for supplying their thermal energy needs. Earlier this year, Oregon Institute of Technology completed a preliminary feasibility study for the hospital which has a maximum load of 700,000 BTU/hr.
Source: DOE, 7/22/80

NEW YORK

- In cooperation with the Division of Geothermal Energy, the New York Energy Research and Development Authority is planning to drill a confirmation well in Cayuga County. Proposed use of well is in starch reduction process at Clinton Corn Products plant. End products are fructose corn syrup, corn oil, gluten, corn starch, animal feed dextrose and liquid fertilizer.

Source: JHU/APL, 7/80

NORTH DAKOTA

- The Patterson Hotel in Bismarck was awarded a drilling permit for a well just behind the hotel. It is expected to be 3,200 feet in depth and produce 1,200 gallons per minute of fluid. The developers are planning to apply for a geothermal guaranty loan. Kohl and Schwartz Engineers were awarded a contract by EG&G Idaho, Inc., to do a preliminary engineering feasibility study on the project under the EG&G Idaho, Inc., 100 hour technical assistance program.

Source: DOE, 4/80

VIRGINIA

- As the result of an engineering economic analysis performed by JHU/APL, the Navy is evaluating the conversion of a Naval Air Rework Facility building at Norfolk, Virginia to geothermal space heat. The Navy is planning to include funds for the conversion project in the construction budget for FY 1983.

The 144,000 square foot facility would obtain about 85 percent of its annual heat requirement (equivalent to about 1700 barrels of oil/year) from a production-injection well pair estimated to cost about \$350,000. The 107°F resource is located at 2500 feet. Project payback is 11-1/2 years, assuming oil price inflation at 3-1/2 percent per year in excess of the general inflation rate. The well would produce enough heat to heat an additional building nearby, and that building may be added to the project.

Source: DOE, 6/20/80

WYOMING

- Preliminary evaluation of the potential for geothermal space heating at the Jackson National Fish Hatchery at Jackson was completed. Existing thermal well water flows have the potential to carry a peak heating load near 900,000 BTU/hr in a water source heat pump system.

Source: DOE, 4/80

*Cascaded applications included; therefore one site may provide energy for multiple uses

FIGURE 2-1
CURRENT DIRECT HEAT USE (ON-LINE)

KEY FOR TABLE 2-1 AND TABLE 2-2

AG	Agriculture
AQ	Aquaculture
BTHHSE	Bath House
BTWTR	Bottled Water
CBNHTNG	Cabin Heating
CMP	Camp
CMPSHNTG	Campus Heating
COMMWTRSP	Community Water Supply
DISTHEAT	District Heating
DRKNG	Drinking
FRSTCMPGR	Forest Camp Ground
FSHFRM	Fish Farm
GRDN	Garden
GRNHSE	Greenhouse
HVAC	Space Conditioning (Heating, Ventilation, Air Conditioning)
IN	Industry
MAD.CO.EGY.COM	Madison County Energy Commission
MU	Multi-Use
NTTRM	Natatorium
PON	Program Opportunity Notice
PRCSHT	Process Heat
PRDA	Program Research and Development Announcement
RE	Residential, Office, Recreational
RSRTCBN	Resort Cabin
SPRGS	Springs
STKWTRGN	Stock Watering
TROPFSH	Tropical Fish
TRTH OR CNSQN	Truth or Consequences
VEG DEHYD	Vegetable Dehydration
WTRSUPPLY	Water Supply

TABLE 2-1
GEOHERMAL DIRECT HEAT APPLICATIONS THAT ARE IN SERVICE

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
AK	R.E. PAULSEN OPHIR CREEK OPHIR CRK NS	HE:HVAC	?				1	.5	ONE RESIDENCE
AK	WICHES SONENBURG 32KM E. OF SITKA BARANOF NS	HE:HVAC	1920				1	1.0	ONE RESIDENCE & BATHHOUSE
AK	JAMES DYKES DELL ISLAND DELL ISLAND NS	HE:HVAC/POOL	1900				1	8.0	HAY GET SALMON HATCHERY
AK	CIRCLE NS RESORT 219KM NE OF FAIRBANK CIRCLE NS	HE:HVAC/POOL	1906				1	9.0	
AK	CHENA NS CORP. 112KM NE OF FAIRBANK CHENA NS	HE:HVAC/GREENHOUSE	1908				1	9.0	RESORT & GREENHOUSE
AK	CHAS. DART 105KM NW OF FAIRBANK HAWLEY NS	HE:GREENHOUSE/HVAC	1900				1	9.0	POOL IN USE. ALSO HAS POTENTIAL FOR ELECTRICAL GENERATION SKW
AK	C.T. PHILLIPS 68KM NE OF HONK FILCHIN NS	HE:HVAC/GRDN	?	1	1		1	10.0	PRIVATE RESORT/SOIL WARMING
AK	UNKNOWN FAIRBANKS HELOZI N.S.	HE:HVAC						.1	RESORTS AND POOL
AK	UNKNOWN TINIANKE CHICAGOP ISLAND	HE:HVAC						.1	RECREATION CENTRES
AR	NAT'L PARK SERVICE HOT SPRINGS HOT SPRINGS	HE:HVAC	1973	21				.1	ENERGY USE UNKNOWN
CA	HYDROPONIC FARMS NEAR WENDILL HONEY LAKE	AG:GREENHOUSES	1979				1,110	29.0	30 GREENHOUSES TO EXPAND TO 205
CA	HYDROPONICS INC HONEY LAKE WENDILL NS	AG:GREENHOUSES	1972				1	18.0	6 GREENHOUSES
CA	ST OF CA HARROTH LAKES VILGE HARROTH LAKES VILGE	HE:HVAC	1977			1		1.0	2 EXPERIMENTAL BLDGS
CA	UNKNOWN CALISTOGA CALISTOGA	HE:HVAC	1975					58.0	FUNDING UNKNOWN
CA	CALAGUA INC. PISO MOLES PISO MOLES	HE:PSHPR/AG	?				1	117.0	
CA	UNKNOWN SUNRISE VALLEY HOT SPRINGS HOTEL	HE:HVAC/POOL	?					.1	ENERGY USE & FUNDING UNKNOWN
CA	SDCEP STYER BERRY	HE:HTWR/CHENPR	1977	1			1	.1	ENERGY USE UNKNOWN
CA	WILLIAMS LITELY WILLIAMS RANCH	HE:HVAC/AG	?					.1	ENERGY USE & FUNDING UNKNOWN
CA	UNKNOWN E. OF LITTLE NS VLLY LITTLE HOT SPRINGS	AG:IRRIGATHLPA	?					.1	ENERGY USE & FUNDING UNKNOWN
CA	H.L. MOLLINGSWORTH FLORAS INDIAN VALLEY NS	HE:HVAC/AG	?				1	.1	ENERGY USE UNKNOWN
CA	H.L. & E. MORTON SONOMA MORTON'S WARM SPRGS	HE:POOLS/HVAC	?				1	.1	ENERGY USE UNKNOWN
CO	H.E. JENKINS ALANOSA SAND DUNES	HE:HOUSE/POOL	?				1	.7	ONE RESIDENCE
CO	H.P. JENKINS ALANOSA SAND DUNES	AG:FISH FARM	?				1	5.6	
CO	F. ECKLING ARCHULETA PAGOSA N.E.	HE	?				1	2.0	10 BLDGS. & SWIMMING POOL

TABLE 2-1 (Continued)
GEOTHERMAL DIRECT HEAT APPLICATIONS THAT ARE IN SERVICE

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
CO	UNKNOWN ARCHULETA BUTCH CROLEY	AQ	?				1	1.0	IRRIGATION
CO	J. FOWLER BOULDER ELDONADO N.E.	HU	?				1	.5	SWIMMING POOL & BOTTLED WATER
CO	UNKNOWN CHAFFEE COTTONWOOD CREEK NS	RE:HVAC	?				1	.7	ONE RESIDENCE & SWIMMING POOL
CO	UNKNOWN CHAFFEE ST. PRINCETON NS	RE:HVAC	?				1	.5	RESORT CABINS & SWIMMING POOL
CO	UNKNOWN CHAFFEE FORCHES NS	RE:HVAC	?				1	.7	ONE RESIDENCE & SWIMMING POOL
CO	BILL WRIGHT CHAFFEE WRIGHT (BUENA VISTA)	HU	?				1	1.5	TWO RESIDENCES, GREENHOUSES, BATHS
CO	UNKNOWN CHAFFEE WILLSVILLE	AQ	?				1	.5	FISH FARMING & ALGAE GROWING
CO	J. HAZWELL CLIFF CREEK IDARO NS	RE:HVAC	?				1	.7	TWO STORY BLDG (7000 SQFT) & SWIMMING POOL
CO	G. WEISSBART CONJOS WEISSBART	HU	?				1	.5	FISH FARMING & FISH FARMING & METHANE PRODUCTION
CO	UNKNOWN GRAND HOT SULPHUR NS	IS:LAUNDRY	?				1	.1	LAUNDRY & SWIMMING POOL
CO	PRINGLE GUNNISON UPPER WAGNITA NS	RE:HVAC	?				1	1.0	NO BLDG, RANCH, & SWIMMING POOL
CO	WEISSBART GURAY GURAY NS	RE:HOTEL	?				1	1.0	2 HOTELS HVAC & SWIMMING POOL
CO	UNKNOWN PUEBLO CLARK ARTESIAN WELL	IS:WATER	?				1	.1	BOTTLED WATER, ENERGY USE UNKNOWN
CO	UNKNOWN SAGUACHE SAGUACHE	RE:HVAC	?				1	.2	
CO	B.R. JENKINS ALABAMA SAND BURNES	AQ:FISH FARMING	?				1	.5	FUNDING UNKNOWN
FL	STATE TALLAHASSEE UNKNOWN	RE:HVAC	?					.1	ENERGY & FUNDING UNKNOWN
ID	DR. SPRINGS WTR DISTRICT IDA BOISE	RE:DISTHEAT	1900				1	30.0	DISTRICT HEATING 150 UNITS
ID	EDWARDS IDA BOISE	AG:GREENHOUSE	?				1	1.0	
ID	HUNT BROTHERS FLORAL IDA BOISE	AG:GREENHOUSE	?				1	1.0	
ID	UNKNOWN ADA DALLAS-MARRIS DEV.	RE:HVAC	?				1	.2	SPACE HEATING
ID	STATE OF IDAHO ADA AGRICULTURE DEPT.	RE:HVAC	1977	920	1			11.0	PHRC, SPACE HEATING
ID	UNKNOWN ADAMS EIN'S RESORT	RE:RESORT	?				1	.5	
ID	UNKNOWN ADAMS STADLEY'S NS	RE:RESORT	?				1	.5	
ID	UNKNOWN ADAMS WHITE LICK'S NS	RE:BATH/CAMP	?				1	.5	

TABLE 2-1 (Continued)
GEOHERMAL DIRECT HEAT APPLICATIONS THAT ARE IN SERVICE

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
ID	UNKNOWN BAMBOCK BOUENATA HS	RE:RESORT	?				1	.5	
ID	LAVA HS FOUNDATION BAMBOCK LAVA HS	RE:RESORT	?		1	1		1.0	RESORT HEALTH SPA
ID	UNKNOWN BEAR LAKE BEAR LAKE HS	RE:RESORT	?				1	.5	
ID	UNKNOWN BLAINE BRANDT'S HS	RE:HOTEL	?				1	1.0	
ID	UNKNOWN BLAINE CLARENDON HS	RE:POOL/RESORT	?				1	.5	POOL RESORT
ID	UNKNOWN BLAINE EASLEY STORES/PLUGGE	RE:RESORT	?				1	.5	RESORT & CAMPING
ID	CITY BLAINE KETCHUM	RE:DISTHEAT	1920				1	1.0	DISTRICT SPACE HEATING
ID	UNKNOWN BOISE BOISEVILLE HS	RE:FEISTCHPGRD	?				1	.1	FOREST CAMP GROUND
ID	UNKNOWN BOISE BOWLAY LODGE HS	AG:GREENHOUSE	?				1	.5	
ID	UNKNOWN BOISE HAVER LODGE HS	RE:HVAC	?				1	.5	RESORT SPACE HEATING
ID	UNKNOWN BOISE KIRKMAN HS	RE:FEISTCHPGRD	?				1	.1	FOREST CAMP GROUND
ID	UNKNOWN BOISE TERREACE LAKE	RE:RESORT	?				1	.5	
ID	UNKNOWN BOISE TWIN SPRINGS HS	RE:RESORT	?				1	.5	POOL
ID	UNKNOWN BOISE WARDS GREENHOUSE	AG:GREENHOUSE	?				1	7.0	
ID	UNKNOWN BOISE WARR SPRINGS	RE:HVAC/POOL	?				1	1.0	RESIDENCES & POOL
ID	UNKNOWN BUTTE BUTTE CITY	RE:HVAC	?				1	1.0	SIX RESIDENCES
ID	UNKNOWN CANAS DAUGARTHER HS	RE:FEISTCHPGRD	?				1	.1	FOREST CAMP GROUND
ID	UNKNOWN CANAS CORRAL	RE:HVAC	?				1	.3	TWO HOMES
ID	SIMPLOT CANYON CALDWELL	RE:WAREHOUSE	?				1	1.0	
ID	UNKNOWN CASSIA CROOK'S	AG:GREENHOUSE	?				1	.5	
ID	UNKNOWN CASSIA OARLEY HS	RE:RESORT	?				1	.5	RESORT & HEALTH SPA
ID	UNKNOWN CASSIA RAVE RIVER	AG:FISH FARM	?					5.0	EXPERIMENTAL FISH FARMING, DISC. EXPERIMENTS
ID	UNKNOWN CUSTER BEARDSLEY HS	RE:RESORT	?				1	.5	RESORT & POOL
ID	UNKNOWN CUSTER CAMPGROUND HS	RE:FEISTCHPGRD	?		1	1		.1	FOREST CAMPGROUND

TABLE 2-1 (Continued)
GEOHERMAL DIRECT HEAT APPLICATIONS THAT ARE IN SERVICE

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
ID	UNKNOWN CUSTER ROCKY MTH. RANCH	RE:RESORT	?				1	.5	
ID	UNKNOWN CUSTER ROBINSON BAR	RE:RESORT	?				1	.5	
ID	UNKNOWN CUSTER MIDDLE FORK LODGE	RE:RESORT	?				1	.5	
ID	SHANE RIVER BS CHCL CUSTER MIDDLE FORK LODGE	RE:CAMP/POOL	?				1	.5	
ID	SANTOOTH LAND CORP. CUSTER SUNDRIAN HS	RE:RESORT	?				1	.5	
ID	UNKNOWN ELMORE PARADISE HS	RE:HVAC	?				1	1.0	SPACE HEATING & RESORT
ID	UNKNOWN GOODING WHITE ARROW RANCH	NU	?				1	1.0	SPACE HEATING, GREENHOUSE, FISH FARMING
ID	UNKNOWN JEFFERSON HEISE HS	RE:RESORT	?				1	.5	RESORT & POOL
ID	UNKNOWN OATHEE COOKY'S	AG:GREENHOUSE	?				1	.5	
ID	UNKNOWN OATHEE JACOBSON'S FEED LOT	AG:STABLES	?				1	1.0	STOCK WATERING
ID	UNKNOWN POWELL INDIAN SPGS MTRN	RE:RESORT	?				1	.5	
ID	ARCHIBALD'S TWIN FALLS BURL	AG:GREENHOUSES	?				1	1.0	
ID	LUNTY R. TWIN FALLS BAUBERT'S	RE:HVAC	?				1	.2	RESIDENCE & RESORT
ID	UNKNOWN TWIN FALLS BURL NEAR LUNTY	NU	?				1	1.0	SEVERAL RESIDENCES & TROPICAL FISH
ID	UNKNOWN TWIN FALLS MIRACLE HS	RE:RESORT	?				1	.5	
ID	VALLEY TROUT FARM TWIN FALLS BURL'S	AG:FISH FARM	?				1	.1	ENERGY USE UNKNOWN
ID	UNKNOWN WASHINGTON WEISER HS	NU	?				1	.5	FISH FARM & RESORT - ONE PROPOSED OTHER IN SERVICE
ID	USFS LYNN WORMY CREEK	RE:CAMPGND	?					.1	CAMPGROUND, FUNDING UNKNOWN
ID	FISH BREEDERS OF IDA TWIN FALLS BURL	AG:FISH FARM	1974					788.0	FUNDING UNKNOWN
ID	R. ELLSWORTH BLAINE ELLSWORTH	RE:RESORT	?				1	.5	
MT	UNKNOWN BEAVERHEAD ELENOR SPRINGS	RE:CASINO/POOL	?				1	1.0	
MT	UNKNOWN BEAVERHEAD JACKSON HS	RE:HOUSE/SPA	?				1	.7	
MT	CHARLES PAGE GALLATIE BOZEMAN HS	RE:HVAC	?				1	2.0	3 HOUSES, 1 LARGE HOUSE, SHOPPING AREA
MT	UNKNOWN JEFFERSON ALBANY HS	RE:HVAC	?				1	1.0	NURSING HOME

TABLE 2-1 (Continued)
GEOHERMAL DIRECT HEAT APPLICATIONS THAT ARE IN SERVICE

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
NY	FRANK GRUBER LEWIS & CLARK BROADWATER HS	HU	1978			1	1	.9	TWO HOUSES(1978), SPA & SPORTS CLUB 1979
NY	NICK STAMOVICH HADISON NEW WILTHORP	RE:HVAC	?				1	1.6	HOME, LOUNGE & SWIMMING POOL
NY	BILL TRENTON HADISON TRENTS	HU	?				1	.5	STORAGE ROOM HVAC & LAUNDRY
NY	PETE GROSS HADISON FOIOSI	RE:CHENING	?				1	1.6	CABIN RADIANT HEATING
NY	JOHN MILLER HADISON SILVER STAR	RE:POOLSBAR	?				1	.5	
NY	UNKNOWN HADISON HORNIS HS	RE:POOL/CNPGED	?				1	.5	SWIMMING POOL & CAMPGROUND
NY	WMT ELPE SPS NYL/SPA REACHER WHITE SULPHUR SPRGS.	RE:SPA	?			6	1	.5	
NY	FIRST NAT'L BANK REACHER WHITE SULPHUR SPRGS.	RE:HVAC	1980		40			.5	COMMERCIAL BLDG
NY	QUINN'S PARADISE SANDHUS PARADISE	RE:RESORT	?				1	.5	
NY	FLATHEAD INDIAN RES. SANDHUS CANAS HS	HU	?	1				.5	SCHOOL,COMMUNITY CENTER,BATHS,SWIM- MING POOL
NY	LLOYD WILDER SILVER BOB FAIRMONT HS	RE:RESORT/POOL	?				1	.5	
NY	UNKNOWN JEFFERSON BOULDER H.S.	HU	?				1	1.5	HOTEL, GREENHOUSE, AND PROPOSED FISH FARM
ND	ADAMAGNES VETTER FR HS KENNOS,LOGAN,SCINTOS JCT OF 3 COUNTIES		?				1	1.0	3X SQ.FT.HOME,DAIRY BARN,WATER FOR CATTLE(82F-9ELL,76F-FRM)
ND	ROBERT HANSON SLOPE WEAR BOWMAN	AG:STOCKTENG	?				1	.5	STOCK WATERING OF 900 HEAD
NM	SANDIA SAVINGS SERNALILLO ALBUQUERQUE	RE:HVAC	?				1	5.0	HEAT PUMP SPACE HEATING 10 STORY BLDG
NM	UNKNOWN CATRON UPPER SAN PABLO HS	RE:CAMPGND	?				1	.1	FOREST CAMPGROUND
NM	KENNEDY COTTON CATRON APACHE TRJO HS	IS:WATERPLY	?				1	.1	WATER SUPPLY, AMOUNT OF ENERGY UNKNOWN
NM	SUBDIVISION BORN AREA LOS ALTURAS	HU	1964					.2	HOUSE HVAC & DRINKING WATER, FUNDING ART & SOURCE UNKNOWN
NM	DOC CAMPBELL GRANT GILA H.S.	HU	1980				1	2.0	HVAC FOR RANCH,LODGE,& OTHER BLDGS. ,SWIMMING POOL, BATHS
NM	BURGITT FLORAL MIDALGO ANINAS VALLEY	AG:GREENHOUSE	1978				200	12.0	100X SQ.FT. GREENHOUSE
NM	TOR MCCANTS MIDALGO ANINAS VALLEY	AG:GREENHOUSE	1967				20	.5	4X SQ.FT. GREENHOUSE
NM	VILGE OF JENEE SPCS SANDOVAL JENEE HS	RE:BATHS/SPRING	?					.5	SPACE HEATING & BATHHOUSE - FUNDING UNKNOWN
NM	ZEN BUDDIST CENTER SANDOVAL JENEE HS	HU	?					.1	GREENHOUSE, SWIMMING POOL & BATHS - FUNDING UNKNOWN
NM	UNKNOWN SANDOVAL SAN ANTONIO HS	RE:WATERPLY	?				1	.1	AMOUNT OF ENERGY UNKNOWN

TABLE 2-1 (Continued)
GEOHERMAL DIRECT HEAT APPLICATIONS THAT ARE IN SERVICE

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
NH	YUCCA LODGE SIBBIA TRIE OR CUSQOCE	RE:HVAC/POOL	?				1	1.0	
NH	UNKNOWN SOCORRO SOCORRO	RE:COMHTSPLY	?					.1	AMOUNT OF FUNDING & ENERGY UNKNOWN
NH	OJO CLITE HIE SPES TACS OJO CALIENTE	RE:HVAC	?				1	.5	SPA BLDGS & RESORT
NV	UNKNOWN CARSON CARSON HS	RE:HVAC/SPA	?				1	.5	ONE BLDG & SPA
NV	UNKNOWN CARSON CARSON HS	RE:HVAC	1979				1	.2	RESIDENCE
NV	UNKNOWN CHURCHILL STILLWATER L. OF FALLOH	RE:HVAC	1912				1	1.0	SIX RESIDENCES
NV	UNKNOWN DOUGLAS VALLEY'S HS	HU	?				1	1.0	TWO OR THREE SMALL BLDGS & SPA
NV	UNKNOWN HERBOLDT S. OF GOLCONDA	HU	?				1	1.0	HVAC (HOUSE, RANCH, BARN) & HOG SCALDING ROOM
NV	UNKNOWN LINCOLN CALIENTE	RE:HVAC	?				1	.5	TRAILER PARK
NV	GEO FOOD PROCESSORS LTON STADY HS	IS:VEG ERYTDS	1979	3,500			1	160.0	FEDERAL FUNDS IN FORM OF LOAN GUARANTEES
NV	UNKNOWN WASHOE TRUCKEE SHADOWS RESO	RE:HVAC	?				1	15.0	66 DWELLINGS, 3 COMM BLDGS, ONE CHURCH
NV	UNKNOWN WASHOE STEAMBOAT HS	RE:HOMES/SPA	?				1	1.0	TWO HOMES, SPA
NV	EXPLOSIVES ENGR. WASHOE STEAMBOAT HS	IS:EXPLVS	?				1	5.0	ANNUAL ENERGY USE UNKNOWN
NV	UNKNOWN RINO MOABA POOL	RE:HVAC	?					.1	POOL, HEATING AND DOMESTIC HOT WATER HEATING
NV	EVADA GREEN HUBBOLDT HOT SPRING ROAD	AG:GREENHOUSE	1979					.1	
OR	KLATH FALLS SCH DIST KLATH FALLS KLATH FALLS SCH DIST	RE:HVAC	1974			1		9.1	HVAC/WATER/PAVEMENT DE-ICING
OR	KINGWOOD APTS. KLATH FALLS APT USE HEATING	RE:HVAC	1960				1	5.5	KINGWOOD APARTMENTS PLUS OTHERS
OR	BOHOFWERS KLATH FALLS 600 INDY HOMES	RE:HVAC	1900				1	13.6	DISTRICT HEATING FUNDED BY BGE/BOE
OR	OR DEPT OF HI ED KLATH FALLS OIT	HU	1963	1	1	1		6.8	HVAC/GREENHOUSE/AQUACULTURE
OR	DIVERSE COMM BUS KLATH FALLS COMMERCIAL BUSINESS	HU	1945	1			1	.7	FOR--DISTHEATING/MILK PASTORIZATION /HOT WATER
OR	LISKY FARMS KLATH FALLS LISKY FARMS	AG:GREENHOUSE	1978				1	1.8	
OR	KLATH CITY & COMM KLATH FALLS MILK WEST HDS CTR	RE:HVAC	1974			1	1	.5	HEATING DEVELOPED/AIR CONDITIONING UNDER CONSIDERATION
OR	STATE OF OREGON KLATH FALLS ST DEPT OF HHS	RE:SNOW MELT	1957		1			.2	MELT SNOW ON HIGHWAYS
OR	NOISE CASCADE/S. CLIN COVE COVE	HU:GREENSE/POOL	1977				1	10.0	HIGH POTENTIAL FOR ADDITIONAL DEVELOP

TABLE 2-1 (Continued)
GEOHERMAL DIRECT HEAT APPLICATIONS THAT ARE IN SERVICE

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
OR	PRIVATE HOMEOWNERS VALE VALLE	HE:HVAC	1940				1	4.1	POTENTIAL FOR GREENHOUSE & MUSHROOM FARMING
OR	KEVIN SMITH KLAMATH FALLS AQUACULTURE	AG:FRAMES	1979				1	1.8	UNLIMITED POTENTIAL FOR EXPANSION
OR	J. STEVENS BAIRES RADION HS	HU:HVAC/GREENSE	1925				1	.5	POOL IN USE. PLANS FOR ADDITIONAL DEVELOPMENT
OR	A. PARKER LAKEVIEW OR DESERT FANS, INC.	HU:HVAC/GREENSES	1970				1	.9	FURTHER DEVELOPMENT UNDER CONSIDERATION
OR	PRIVATE HOMEOWNERS VALE VALLE	HE:HVAC	1950				1	4.6	OTHER USES UNDER CONSIDERATION
OR	S. HANSON HOT LAKE HOT LAKE RESORT	HE:HVAC/POOL	1877				1	1.1	LATE 1800'S
OR	B. COUNTRYRIGHT HOT LAKE HOT LAKE	HE:HVAC	1960				1	1.1	
OR	H. WILHELM HUNTER'S HS HUNTER'S HS	HE:HVAC	1967				1	3.0	SID 1960'S
OR	C. HARTLEY BITTER HS BITTER HS	HE:HVAC/POOL	1900				1	2.3	
OR	MRS. J. MCDANIEL SUNNER LAKE SUNNER LAKE HS	HE:HVAC/POOL	1958				1	2.5	THE HOMES ALSO HAS SPA
OR	H. FAYE MEDICAL SPGS MEDICAL HS	HE:HVAC/SPA	1930				1	.7	
OR	J. NATION BLENHAP HS BLENHAP HS	HE:HVAC/POOL	1900				1	4.0	ALSO HAS SPA
OR	H. NICCIO SPRING CITY BLUE MOUNTAIN HS	HE:HVAC/POOL	1975				1	.7	
OR	KLAMATH CTY INCA KLAMATH COUNTY KLAMATH FALLS	HE:HVAC	1980	200		50		5.0	SP. HEAT. OF PRIV. REC. FACILITY, EXHIBIT USE USE., FOR-79
OR	OUTRICK ENERGY PROD. TREASURE VALLEY TREASURE VALLEY	IN:BIOPPLY	?					.1	600,000 GALLONS TO BE PRODUCED ANNU ALLY
SD	UNKNOWN CHARLES HIE PLATTE	HE:HEATING	?				1	.5	HEATING BARRS
SD	CITY OF MIDLAND HARLOW MIDLAND	HE:HVAC	1968				1	5.0	PUBLIC SCHOOL BLDGS. -- LOCAL FUNDS ???
SD	CITY OF PHILIP HARLOW PHILIP	HE:HVAC	1970				1	5.0	MAINTENANCE SHED & WATER PLANT -- LOCAL FUNDS??
SD	LITTLE ROCKVIEW IND HARLOW PHILIP	HE:HVAC	?				1	1.0	HEATING MANUFACTURING PLANT
SD	JOHN DUNA LYMAN UNKNOWN	HE:HVAC	1979				1	.2	RESIDENCE
UT	CRYSTAL HS ELTH SPA HOT ELDER CRYSTAL HS BUTVILLR	HE:RESORT	?				1	.5	
UT	ALLAN PLANT CO. HOT ELDER UTAH HS	AG:GREENHOUSES	?				1	1.0	
UT	LDS CHURCH SALT LAKE OFFICE BLDG	HE:HVAC	1972				1	.1	ENERGY USE UNKNOWN-HEAT PUMP
UT	UNKNOWN SALT LAKE INT'L CTR	HE:HVAC	?				1	.1	ENERGY USE UNKNOWN-HEAT PUMP

TABLE 2-1 (Concluded)

GEOTHERMAL DIRECT HEAT APPLICATIONS THAT ARE IN SERVICE

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
UT	UNKNOWN SALT LAKE CRYSTAL HS	AQ:TSOPPSH	?				1	.1	TROPICAL FISH RAISING, ENERGY USE UNKNOWN
UT	KARL BRACHMAN SERVIZ HONOLULU CITY	BE:RESORT	?				1	.5	
UT	ROBERT H EASTMOND UTAH SARATOGA HS	BE:RESORT	?				1	.5	
UT	MOUNTAIN SPA WASATCH SIDNEY	BE:RESORT	?				1	.5	
UT	HORSEHEAD WASATCH SIDNEY	BE:RESORT	?				1	.5	
UT	PRIVATE WASATCH SIDNEY	BE:HVAC	?				1	1.0	SEVERAL HOMES
UT	BONGORACE BJANSON WASHINGTON LAVENUE HS	BE:RESORT	?				1	.5	
WA	PVT OWNERSHIP OF WA YAKIMA CYCL WA INC PROJ	AG:IRRIGATION	1940		1		1	2.0	DISTRICT HEATING POSSIBLE
WA	G. LONDER YAKIMA YAKIMA COUNTRY	IR:CAR WASH	1930				1	10.0	SIGNIFICANT POTENTIAL
WA	NAT'L PARK SERVICE SOL DAC SOL DAC HS	BE:HVAC/POOL	1912	1				1.5	ORIGINALLY PRIVATE FUNDING
WY	COUNTRYMAN RANCH FRESHOY NEAR LANDED	AG:GREENHOUSE	?				1	.5	
WY	UNKNOWN HOT SPRINGS NATURAL WELL	BE:HVAC	?				1	.2	1938, 1958 -- RESIDENCE
WY	UNKNOWN HOT SPRINGS NATURAL WELL	BE:HVAC	?				1	.2	1938, 1948 -- RESIDENCE
WY	UNKNOWN HOT SPRINGS VAN MORRIS WELL	BE:HVAC	?				1	.2	1938, 1958 -- RESIDENCE
WY	UNKNOWN TETON BUCKLEBERRY HS	BE	?				1	.1	1928, 19158 JUST E. OF FLAGG RANCH - POOL/BATH, LAUNDRY
WY	UNKNOWN TETON TETON VLLY WRE SPGS	BE	?				1	.5	1928, 19158 NEAR JACOBSON -- EXTENSIVE IRRIG., NATURAL POOL
WY	UNKNOWN TETON UNMARKED SPG	AQ:FISH FARM	?	1				.1	ENERGY USE UNKNOWN
WY	WY. ST. HIGHWAY DEPT RI STYLLIE CREEK STYLLIE CREEK		?		1			.1	SNOW AND ICE MELT
WY	AROCO & OTHERS SALT CREEK OIL FIELD NATRONA	IR	1964				1	10,000.0	ENHANCED OIL RECOVERY
STATUS TOTAL				3,848	49	64	3,481	11,487.1	

TABLE 2-2
GEOHERMAL DIRECT HEAT APPLICATIONS THAT ARE PROPOSED

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	5000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
AK	UNKNOWN ALUTIAN CHAIN ALASKA	?	?					.1	INT. EXPRESSED BY CITY COUN. & 13 S RAFOOD PROC. COMPANIES
AR	UNKNOWN HOT SPRINGS HOT SPRINGS	BE:HVAC	?					.1	FEAS. STUDY REQUESTED BY PARK SERVICE, PERFORMED BY API
AZ	IBM PIMA TUSCON	IS:HVAC	?				1	110.0	4600 TONS
AZ	USAF WILLIAMS AFB	IS:HVAC	?	1				90.0	COOLING 4000 TONS
AZ	SUPERIOR FARMS GHECUM GHECUM	AG:GREENHOUSE	?					.5	WAT CONVERT GREENHOUSE TO GROTHES- HAL, FUNDING UNKNOWN
AZ	U OF A/USU COCHISE DOUGLAS	HU	?					.1	FISH FARM, CATTLE FEED LOTS, FOOD PROCESSING, CROP DRYING
CA	AQUAFERS INT'L RIVERSIDE RYCCA	AG:FRAMES	1981	363			637	170.0	FOR-79, RAISING FRAMES
CA	HOLLY SUGAR CORP IMPERIAL HEAVILY	IS:PULP DRY	1981	3,921			14,200	144.0	FOR-79, PRIV. FUND. ONLY IF PILOT FA CILITY SUCCESS.
CA	CITY OF EL CENTRO IMPERIAL EL CENTRO	BE:HVAC	1981	2,000		800		7.0	FOR-79
CA	CITY OF SUSANVILLE LASSER SUSANVILLE	HU	1981	2,106		2,300		41.0	FOR-79
CA	GEOHERMAL PWR CORP MODOC KELLI HS	HU:HVAC/AG	1982	1,847			5,800	81.0	FOR-79
CA	LASSER COLLEGE ET AL LASSER WINDMILL ANDEER	AG:ALAPPELLEY	?	486				.1	ENERGY USE, 51,785,80 TON PER DAY CO SE PLANT
CA	NAKASHIMA BUNSTRY OASIS SALTON SEA	AG:GREENHOUSE	?					.1	DEV. 40 ACRES FOR GREENHOUSE OPER. AS A RESULT OF 100HR PROC.
CA	SOUTHPARK CARRINO DEL MAR CARRINO DEL MAR	BE:HVAC	?					.1	
CA	SUSAN, OAKLEY HORS. LITCHFIELD SUSANVILLE	AG:GREENHOUSE	?					.1	BANK OF MONTREAL TO SUPPLY 80-9 MIL LOAN
CA	HANDLER INDUSTRIES EL CENTRO UNKNOWN	AG	?		1			.1	FEAS. STUDY FOR ALPAPPA DRYING
CA	UNKNOWN HANNOTH LAKES UNKNOWN	BE:DISTHEAT	?					.0	
CA	FT. BIDWELL IND. RES UNKNOWN MODOC	HU	?					.0	SPACE HEAT., GREENHOUSES 6AQUA. APP L.
CO	TR OF PAGOSA SPRGS. ARCHULETA PAGOSA S.P.	BE:DISTHEAT	1981	779			284	32.0	DISTRICT HEATING, FOR-79
CO	STATE HWY DEPARTMENT GASFIELD GLENWOOD CANTON	BE	?					.1	HEATING BRIDGES, ENERGY USE AND FUNDING UNKNOWN
CO	UNKNOWN CLEAR CREEK GLENWOOD	BE:HVAC	?					4.0	22 UNIT CONDO., FUNDING UNKNOWN
CO	CITY CLEAR CREEK GLENWOOD	HU	?					2.0	HEATING OF ADMIN. COMPLEX @ WASTE WATER TREAT., FUNDING UNKNOWN
CO	CITY CLEAR CREEK IDARO SPRINGS	BE:DISTHEAT	?					5.0	FUNDING UNKNOWN
CO	UNKNOWN CHATTY WILLSVILLE	AG	?				10,000	.5	FISH FARMING AND ALGAE GROWING

TABLE 2-2 (Continued)
GEOHERMAL DIRECT HEAT APPLICATIONS THAT ARE PROPOSED

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FEDS STAT	8000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
CO	A. BENZOG CHAFFEE MT. PRINCETON N.S.	HE:HVAC	?				10,000	.2	RESIDENCE
CO	UNKNOWN BOULDER HAYSTACK	AG:GREENHOUSE	?					1.5	FUNDING UNKNOWN
CO	PAGOSA FAMILY LIFE ARCHAUSTA PAGOSA SPRINGS	HE:HVAC	?					.5	SPORTS-REC. CENTER, FUNDING UNKNOWN
CO	UNKNOWN GLENNWOOD SPRINGS GLENNWOOD SPRINGS	IS	?					.1	DOE FEAS. STUDY FOR HEAT. MUNIC. PAC -CSUPPLY BT TO GEN. TREAT. PAC
CO	COLORADO ST. UNIV. UNKNOWN UNKNOWN	?	?					.1	MOD. THER. PROCESS FOR SAK. ALCO. FROM LIGNOCELL. WASTE, PRDA
CO	CITY GURNEY GURNEY	HE:DISTHEAT	?					.1	CONSIDERING FEASIBILITY
CO	GIBSON BUILDING ALANOSA SAN LUIS VALLEY	HE:HVAC	?					.1	SHOPPING MALL BEING REMODELED TO USE GEO.
HI	PUNA SUGAR CO. PUNA PUNA	IS:PROCESS	?					.1	ENERGY USE & FUNDING UNKNOWN
HI	UNKNOWN PUNA PUNA	AG	?					.1	ENERGY USE & FUNDING UNKNOWN
ID	UNKNOWN ADA DALLAS-HARRIS DEV.	HE:HVAC	1987				10	67.0	1200 HOME SUBDIVISION
ID	STATE OF IDAHO ADA STATE PENITENTIARY	HE:HVAC	1980		1			2.0	SPACE HEATING
ID	WA. SPGS. HOLLOW ADA FOISE	HE:HVAC	1983	5,400	1,000	3,000	6	2,070.0	SPACE HEAT. OF CORR. BLDGS, POW-79, UPGRADE HLL SPGS. DIST. HEAT
ID	STATE OF IDAHO ADA INDUS. ADMIN. BLDG.	HE:HVAC	1982		1			95.0	SPACE HEATING
ID	STATE OF IDAHO ADA CAPITAL MALL	HE:HVAC	1983		190			63.0	SPACE HEATING OF 7 STATE BLDGS.
ID	UNKNOWN ADA ELKS BEHAR. HOSPITAL	HE:HVAC	?				1	5.0	SPACE HEATING OF 75K SQ. FT.
ID	UNKNOWN ACANE NEW WEDONS	HE:HVAC	1985		1	1		40.0	DISTRICT HEATING AND GREENHOUSE
ID	CITY BLAINE KEYCHUS	HE:DISTHEAT	?		1	1		30.0	DISTRICT SPACE HEATING
ID	CITY BLAINE WATLEY	HE:DISTHEAT	?		1	1		30.0	DISTRICT SPACE HEATING
ID	UNKNOWN SCISE CROUCH	HE:HVAC	1985				1	17.0	SPACE HEATING - 50 HOMES
ID	SAR. CO. ENERGY CORP. MADISON SEIBURG	IS	1981	1,650			1,720	680.0	MUN. SP HEAT, FOOD PROC. (POW79)-DRILL L. THER. LOW TEMP.
ID	STATE OF IDAHO THIR FALLS COLLEGE OF S. IDAHO	HE:CHESITING	1983		1			3.0	CAMPUS HEATING
ID	HALAC HIGH SCHOOL CHETDA HAIAS	HE:HVAC	?	600				2.0	SPACE HEATING OF HIGH SCHOOL, FUNDING UNKNOWN
ID	GEO-SOLAR GROUVERS, I IN WASHINGTON WEISER N.S.		?					300.0	PROPOSED INDUSTRIAL PARK, FUNDING UNKNOWN
ID	VALLEY TROUT FARMS THIR FALLS HUNI	IS	?					.1	GREENHOUSE & ETHANOL PLANT, ENERGY USE & FUNDING UNKNOWN

TABLE 2-2 (Continued)

GEOHERMAL DIRECT HEAT APPLICATIONS THAT ARE PROPOSED

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STATE	\$000 LOCAL	PRIV	MTS/YEAR BILLIONS	COMMENTS
ID	J. R. HENRY PRODUCE TWIN FALLS KIMBERLY	IS	?					300.0	ETHANOL PLANT, FUNDING UNKNOWN
ID	R. GLENN QUINCY BRUNEAU	IS:ETHANOL	?					.1	ETHANE PRODUCTION, ENERGY USE & FUNDING UNKNOWN
ID	UNKNOWN QUINCY GIVENS S.S.	IS:HVAC	?					20.0	SPACE HEATING OF 100 HOMES, FUNDING UNKNOWN
ID	UNKNOWN KOOTENAI COEUR D'ALENE	IS:HVAC	?					.2	HEAT PUMP, FUNDING UNKNOWN
ID	CITY COSTER STANLEY	IS:DISTHEAT	?					5.0	PROPOSED-FUNDING UNKNOWN
ID	MR. CROOK CASSIA RAFT RIVER	AG:GREENHOUSE	?					13.9	1 ACRE GREENHOUSE, FUNDING UNKNOWN
ID	CANAS HIGH SCHOOL CANAS FAIRFIELD	IS:HVAC	?					1.0	HIGH SCHOOL, FUNDING UNKNOWN
ID	UNKNOWN CANAS CORRAL	IS:HVAC	?				10,000	.2	HEAT PUMP HOME
ID	UNKNOWN BLAINE MAGIC RES.	IS	?					300.0	ETHANOL, FUNDING UNKNOWN
ID	J.A. ALBERTSON CATTLE AG UNKNOWN ROISE	AG	?					30.0	30K HEAT PUMP, FUNDING UNKNOWN
ID	VA HOSPITAL ADA ECISE	IS:HVAC	?				10,000	10.0	HOSPITAL
ID	MC DONALDS/EGGS RAFT RIVER RAFT RIVER	IS:FOODPROCESS	?					.1	BRING OF POT. FEELINGS, ENERGY USE AND FUNDING UNKNOWN
ID	EGGS, UNIV. OF ID. RAFT RIVER RAFT RIVER	AG:FISHFARM	?					.1	ENERGY USE AND FUNDING UNKNOWN
ID	PRODUCER'S LUMBER CO ROISE HARK SPRINGS VLLG.	IS:HVAC	2001				1	800.0	4000 HOME SUBDIVISION
ID	WESTERN RESOURCE REC TWIN FALLS TWIN FALLS	IS:ALCOFLY	?					.1	FEAS. STUDY PERFORM, CONVERT CULL POTAT., HEAT TO ETH-ALCO.
ID	UNKNOWN UNKNOWN PARKWAY ST. PR	IS:HVAC	?	112				.1	FOR PARK PURPOSES
ID	JANET RICHARDSON BUTTE CITY IDAHO FALLS	AG:GREENHOUSE	?	10				.1	GREENHOUSE FOR ROSES
ID	SOMMERSET CTRY SCHOO CHISFIELD CHISFIELD	IS:HVAC	?					.1	SPACE HEAT. OF H. SCHOOL, FEASIBILITY STUDY PERFORMED BY APL
ID	BURNS & SON SALISBURY SALISBURY	IS:FOODPROCESS	?	1				.1	CAMPBELL SOUP FEAS STUDY
ID	VICORICO CTRY SCHOOL CHISFIELD CHISFIELD	IS:HVAC	?					.1	SP. HEAT. OF MID. SCHOOL, APL PERFORMING FEAS. STUDY
ID	COLUMBIA NATURAL GAS IN COVE POINT COVE POINT	IS	?					.1	PLAN HAS BEEN PRESENTED
ID	COLUMBIA NATURAL GAS IN COVE POINT UNKNOWN	IS	?					.1	WOULD BE USED TO GASIFY LUG
ID	CORN ROSE GROW ASSOC LANSING UNKNOWN	AG:GREENHOUSES	?					.1	ENERGY & FUNDING UNKNOWN
MT	STATE OF MONTANA BEER LODGE US STATE HOSPITAL	IS:HVAC	1981	626	685		38	69.0	HOSPITAL, POK-79

TABLE 2-2 (Continued)

GEOTHERMAL DIRECT HEAT APPLICATIONS THAT ARE PROPOSED

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
MT	UNKNOWN LEWIS & CLARK BROADWATER MS	RE:HVAC	?				1	300.0	100-300 HOME SUBDIVISION
MT	FLATHEAD INDIAN RES. HS SANDERS CARLS MS	HS	?	1				5.0	SCHOOL, COMMUNITY CENTER, BATHS, SWIMMING POOL
MT	CYPRESS MINES MADISON FENNIS	RE:HVAC	?					1.0	OFFICES, FUNDING UNKNOWN
MT	FRANK GRUBER LEWIS & CLARK BROADWATER M.S.	RE:HVAC	?					30.0	100-300 HOME SUBDIVISION, FUNDING UNKNOWN
MT	UNKNOWN JEFFERSON BOULDER M.S.	HS	?				10	5.0	DIST. HEAT. AND GREENHOUSE PROPOSED FUNDING UNKNOWN
MT	STATE FISH AND GAME DEER LODGE WARR SPRINGS	AG	?					3.0	WILDLANDS FISH HATCHERY, FUNDING UNKNOWN
MT	ENERGY ENG. INC. HOT SPRINGS UNKNOWN	IN:ALCOFLY	?					.4	GEOTHERMALLY HEAT ETH. PLANT
MT	CITY WHITE SULPHUR SPGS UNKNOWN	RE	?					.4	PREHEAT WATERS FOR HOSPITAL
ND	UNKNOWN UNKNOWN O'NEILL	HS	?					.1	DOE GRANT; FEAS. STUDY, CROP DRYING ON SPACE HEAT.
ND	UNKNOWN BISMARCK PATTERSON PLACE	RE:HVAC	?					.4	9 STORY BUILDING, HOPE TO OBTAIN DOE LOAN (OLGP)
ND	ALCO INC. GRAND UNKNOWN	IN:ALCOFLY	?					.1	
ND	NAPOL. FARMER UNION UNKNOWN UNKNOWN	IN:ALCOFLY	?					.1	
NM	UNIVERSITY OF NM SERNALILLO ALBUQUERQUE	RE:CHPSSTNG	?	125	50			770.0	CAMPUS HEATING-PEDA-ENG. AND ECON. EVAL.
NM	WEST MESA APARTMENTS SERNALILLO WEST MESA	RE:HVAC	?					.1	PROPOSED AMOUNT OF ENERGY AND FUNDING UNKNOWN
NM	HIGH SCHOOL SERNALILLO WEST MESA	RE:HVAC	?					.1	PROPOSED RETROFIT, AMOUNT OF ENERGY & FUNDING UNKNOWN
NM	WESD. HEAT DIST. SERNALILLO WEST MESA	RE:HVAC	?					.1	PROPOSED AMOUNT OF ENERGY & FUNDING UNKNOWN
NM	U OF ALBUQUERQUE SERNALILLO WEST MESA	RE:CHPSSTNG	?					52.0	CAMPUS HEATING RETROFIT, AMOUNT OF FUNDING UNKNOWN
NM	HAYES L'EGGS PROD. SOMA AND LAS CRUCES	HS:HVAC/PCSSTNG	1981	10	56			110.0	PEDA, SPACE HEATING & DRYING, WASHING, ETC.
NM	RESILLA VALLEY HALL SOMA AND LAS CRUCES	RE:HVAC	1981					400.0	HEAT PUMP, AMOUNT OF FUNDING & SOURCE UNKNOWN - PRIVATE??
NM	NM STATE UNIV. SOMA AND LAS CRUCES	RE:CHPSSTNG	?		25			100.0	CAMPUS HEATING-AMOUNT OF FEDERAL FUNDING UNKNOWN UNKNOWN
NM	PAYWOOD GREENHOUSES GRANT PAYWOOD MS	AG:GREENHOUSES	1980		21		30	1.0	STATE FUNDING??
NM	BURGITT FLORAL SIDAIGO ANINIS VALLEY	AG:GREENHOUSE	1980				1,000	600.0	5,000K SQ. FT. GREENHOUSE ADDITION
NM	TOR MCCANTS SIDAIGO ANINIS VALLEY	AG:GREENHOUSE	1980	20			1	12.0	FEDERAL FUNDS &/ APPROP. TECH. -- 100 K SQ. FT. EXPANSION
NM	VLLGE OF JENEX SPGS SARDOVAL JENEX MS	RE:HVAC	1980	0	3		6	2.0	PUBLIC BLDGS. -- STATE FUNDS??

TABLE 2-2 (Continued)
GEOHERMAL DIRECT HEAT APPLICATIONS THAT ARE PROPOSED

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FEDS STAT	8000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
NH	CARRIE TINGLEY HOSP SILVER TOWN OR CHENOCHE	HE:DCILEDWATER	1980	45		45		1.6	PREHEATED BOILER WATER --LOCAL FUNDS???
NH	SENIOR CITIZENS CTR. SILVER TOWN OR CHENOCHE	HE:HVAC	1980	25	20			1.0	
NH	SOLAR AMERICA TIGOS TIGOS	AG:GREENHOUSE	1981	41	41			1.0	
NH	CANDLE LIGHT HOMES DOHA AND LAS CRUCES	HE:HVAC	1981					.1	CONSIDERING GEOTHERMAL HEATING
NH	J. HILL & ASSOC. SILVER CITY UNKNOWN	IN:ALCOFLY	?					.1	CONSID. FUEL ALCO. PROD. PLANT
NV	ELKO HEAT CO. ELKO ELKO	HU	1982	800			480	38.0	THREE COMMERCIAL BLDGS., CASINO & LA SUDET, FOR-79 2
NV	HYDO ENERGY CORP WASHOE RENO	HE:HVAC/HOTE	1981	410		50		.1	SUNDANCE APT COMPLEX, FOR-79
NV	DESERT RES. INSTITUTE IN HUMBOLDT WINDHOLCA		?					300.0	ETHANOL PLANT, FUNDING UNKNOWN
NV	HALF CIRCLE RANCH ELKO RENOVATE	AG:PROCESSING	?					30.0	FUNDING UNKNOWN
NV	UNKNOWN FURTER CRESTVIEW VALLEY	IN	?					300.0	ETHANOLPLANT, FUNDING UNKNOWN
NV	AGRY CEN. & LOC. ELKO RIVERSIDE N.S.	IN	?					300.0	540 MIL. ETHANOL PLANT, FUNDING UNKNOWN
NV	USAF CHURCHILL FALLON AIR STATION	HE:HVAC	?					5.0	SPACE HEATING OF FACILITIES PROPOS- ED, FUNDING UNKNOWN
NV	THE PEPPER HILL RENO UNKNOWN	HE:HVAC	?					.1	EXPANDED RESTAURANT/HOTEL
NV	UNKNOWN CARSON CITY PIVON HILLS	HE:HVAC	?					.1	HEATING OF RESIDENCES
NV	WARREN PROPERTIES RENO HUMBOLDT	HE:DISTHEAT	?					.1	DIST. HEAT-RESOURCE EXPL. & ENG. ST UDIES
NV	ABC CONCRETE PROD. UNKNOWN STANBOST N.S.	IN	?					.1	INDUST. CONCRETE PROD. PLANT, UNDER DEVELOPMENT
NV	ALEXANDER SANSON CO. HU WAPRUSKA N.S. UNKNOWN	HU	?					.1	ETH. PLANT, GREENHOUSE, AQUA. APP., ENERGY USE UNKNOWN
NV	UNKNOWN RAVISONNE UNKNOWN	HE:DISTHEAT	?					.1	
NV	TOWNSEND GROUP WAPRUSKA N.S. UNKNOWN	IN:ALCOFLY	?					.1	FEEDSTOCK-CORN, PROV. 400,000 GAL/YR ETH.
NV	BILL MEDICAL CENTER CALIENTE UNKNOWN	HE:HVAC	?					.1	FEAS. STUDY HAS PERFORM. BY GIX
NV	BY ENERGY ADMIN. CLINT. CORN PROD. PLANT CAYUGA COUNTY	IN	?					.1	STARCH RED. PROCESS
OR	J. DAVIS BOSTONBUSH HS BOSTONBUSH HS	HE:HVAC/POOL	1981					3.6	GREENHOUSE UNDER CONSIDERATION
OR	OR. TRAIL MUSHROOMS VILL UNKNOWN	IN:MUSHROOM PLA	?			48		.1	\$4.6 BILLION MUSHROOM PLANT
OR	KLAMATH ENERGY, INC. HEARSH FALLS LYNNET FALLS	IN:ALCOHOL PLANT	1981					.1	2.4 MIL. ALCOHOL PRODUCTION PLANT

TABLE 2-2 (Continued)
GEOHERMAL DIRECT HEAT APPLICATIONS THAT ARE PROPOSED

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	FED	BTU/YEAR BILLIONS	COMMENTS
OR	INDIAN ROCK GREENH. AG:GREENHOUSES KLAMATH FALLS LISKY FARMS		1980			100	100	.1	10 GREENHOUSES
OR	CITY OF KLAMATH FALL RE:DISTHEAT KLAMATH FALLS KLAMATH FALLS		1981	960	50	390		35.4	DIST. HEAT OF 14 CITY, CTY, ST, & FED BLDGS., FOR
OR	UNKNOWN KLAMATH FALLS KLAMATH FALLS	RE:DISTHEAT	?	452				25.8	DISTRICT HEAT OF 125 HOMES, HUD FOR L.
OR	OIT KLAMATH FALLS KLAMATH FALLS	AG:FISHFARM	?					.1	RAISING FRESHWATER FARMNS, ENERGY USE AND FUNDING UNKNOWN
OR	POWER ALCOHOL FUELS, IN:ALCOFLY BODUC UNDETERMINED		?					.1	SPENDING FEDERAL FUNDING
OR	UNKNOWN LAQUANDE GRAND RONDE NCSP.	RE:HVAC	?					.1	ENG. AND ECON. ANALYSIS TO BE COMPL ETI 7/80
OR	UNKNOWN ST. HOOD GOVERNMENT CAMP	RE:HVAC	?					.1	FEASIBILITY STUDY FOR CONDOMINIUM
OR	WESTERN RENEWABLE RE IN:ALCOFLY TREASURE VALLEY TREASURE VALLEY		?					.1	1.5 BILLION GALLONS ANNUALLY
SD	GESE ARMSTRONG HARCON DIA. KING BARCH	RE	1980	200			100	36.0	FOR-78, HEATING FARM BLDGS., DRY GRASS, WARM STOCK WATER
SD	HARCON SCHOOL DIST. HARCON PHILIP	RE:HVAC	1980	698		175		5.0	FOR-78, 5 SCHOOL BLDGS.
SD	ST MARY'S HOSP. HUGHES PIERRE	RE:HVAC	1980	500			120	19.0	FOR-78, HOSPITAL SPACE HEATING
SD	SC HIGHWAY DEPT LIBAN UNESCO	RE:HVAC	1980	1	1			.1	HIGHWAY REST STOP
SD	CAPITOL HALL HUGHES PIERRE	RE:HVAC	?					3.0	PROPOSED HEATING OF HALL, FUNDING UNKNOWN
SD	PIERRE FLOWER SHOP HUGHES PIERRE	AG:GREENHOUSE	?					1.5	FUNDING UNKNOWN
SD	9 LOCAL BUSINESSES HARCON PHILIP	RE:HVAC	?					7.0	FUNDING UNKNOWN
TX	UNKNOWN CORNICANA NAVARRO COL. & HOSP	RE:HVAC	1981	866				35.0	SPACE HEATING-COLLEGE BUILDING & HOSPITAL, FOR-79
TX	UNKNOWN HARLIN T.M.S HOSPITAL	RE:HVAC	1980	497				11.0	SPACE HEATING-HOSPITAL, FOR-79
UT	R & B ENERGIES FORT COVE FORT COVE	IN	1980					.1	ALCOHOL PROD., FAC., ENERGY USE AND FUNDING UNKNOWN
UT	U.S.A.F. DAVIS HILL AFB	RE:HVAC	1981	1				10.0	PILOT PROJECT
UT	CHRISTENSON BROS. IPON SEACASTLE	AG:GREENHOUSE	1980				1	.1	HYDROPONIC GREENHOUSE --ENERGY USE UNKNOWN
UT	UTAH ROSES, INC. SALT LAKE CRYSTAL HS	AG:GREENHOUSES	1980				1	.1	ENERGY USE UNKNOWN
UT	UTAH ROSES, INC. SALT LAKE SANDY	AG:GREENHOUSES	1980	460			349	75.0	FOR-79
UT	UT STATE PRISON SALT LAKE CRYSTAL HS	RE	1981	432	179			11.0	FOR-79, SPACE & WATER HEATING
UT	UTAH TECH COLLEGE UTAH SARATOGA HS	RE:HVAC	?		1			.1	ENERGY USE UNKNOWN

TABLE 2-2 (Concluded)									
GEOTHERMAL DIRECT HEAT APPLICATIONS THAT ARE PROPOSED									
STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	PRIV	BTU/YEAR BILLIONS	COMMENTS
UT	MARYVALE CONVENT UNKNOWN UNKNOWN	HE:HVAC	?					.1	COSTS EXPECTED TO TOTAL \$80K
VA	NAVAL AIR REFIT FAC. HOSPOLK SPURILLIS PT. COMPLEX	HE:HVAC	?					.1	FEAS. STUDY COMPLETE-RECON. GEOTHE MAL USE W/O HEAT PUMP
WA	JOHN GRANAS ASSOC. TAKIMA ST. ELIZ. HOSP.	HE:HVAC	?					.1	ENGINEERING AND ECON. ANALYSIS UNDER OIT TECH. ASSIS. PROG.
WA	UNKNOWN TAKIMA DAVIS HIGH SCHOOL	HE:HVAC	?					.1	PROJECT UNDER OIT TECH. ASSIS. PROG
WA	UNKNOWN TAKIMA ST. ELIZ. HOSPITAL	HE:HVAC	?				1,000	.1	
WY	JACK. FISH HATCH TYPON JACKSON	HE:HVAC	?	100				.5	FUNDING UNKNOWN
WY	AL-AGHA INC. PARK CODY	IS	?					300.0	GASOLIN PLANT, FUNDING UNKNOWN
WY	UNKNOWN HIDWEST EDGEMONT	ED	?					.1	FISH FARM AND VEG. GREENHOUSE PRO- POSED
STATUS TOTAL				26,474	3,441	6,911	65,099	9,595.1	

TABLE 2-3							
SUMMARY OF DIRECT HEAT USE							
AREA OF USE	NUMBER OF USERS	FUNDING (\$000)-----				BTU/YEAR (10 ⁹)	
		FEDERAL	STATE	LOCAL	PRIVATE		
Current Uses On-Line	187	3,848	49	64	1,481	1,487.1	
Enhanced Oil Recovery	1				Unknown	10,000.0	
Baths and Pools	90		2	9	73	51.8	
TOTAL	278	3,848	51	73	1,554	11,538.9	

Source: Table 2-1, this report.

3.0 DRILLING ACTIVITIES

Information on drilling activities is currently being obtained from a number of sources including Geothermal Energy Magazine, Lawrence Berkeley Laboratory, Munger Oil Information Service, Petroleum Information Corporation, and the U.S. Geological Survey. These data are being entered into a computer file which includes the following information for each well: state, county, location (township, range, section), prospect name, operator name, well name and number, well type (geopressured, geothermal, hot dry rock, injection, observation, temperature gradient), well status (abandoned, active, drilling, location, producible, shut in, suspended, testing), spud date, completion date, total depth, and information source.

The GPM drilling data file at MITRE currently contains 1786 well records of which 400 are for deep holes drilled in the 1973 to 1979 time frame. Although not all of the 1979 wells have been reported, the data currently available does provides some interesting insights. These 400 wells were categorized as being in The Geysers, Imperial Valley, or in all other areas and were tabulated by year as shown in Figure 3-1. This figure shows relatively steady activity at The Geysers and in the Imperial Valley with an average annual increase in the drilling rate of one well per year, over these seven years. In the other areas, however, the average annual drilling rate increase is more than 4 wells per year across all seven years, and is even higher after the 1976-1977 period of decline. Even though the

FIGURE 3-1

TRENDS IN THE DRILLING OF DEEP GEOTHERMAL WELLS

effects of the DOE Industry Coupled Drilling Program have not been factored out of the data, these results indicate an upturn of interest in geothermal resources outside The Geysers and Imperial Valley.

Figure 3-2 presents a state-by-state summary of deep geothermal wells drilled in the 1973 to 1979 period. California, with 280 deep wells drilled mainly in The Geysers and Imperial Valley, is clearly the most active state. Nevada with 39 wells drilled mainly in Beowawe and Dixie Valley, and Utah with 32 wells drilled mainly in Cove Fort-Sulphurdale and Roosevelt Hot Springs, comprise the second and third most active states. A group of states including Oregon with 12 wells, New Mexico with 11 wells mainly in the Valles Caldera area, and Idaho with 9 wells mainly in Boise and Raft River is moderately active. The remaining 8 states, accounting for a total of 17 wells, comprise the lowest activity level.

Major drilling activities for the last three months are highlighted below:

- USGS To Drill on Mt. Hood

A contract has been let by the USGS to drill four thermal gradient holes on the east and southeast flanks of Mt. Hood, as part of the DGE effort to assess the hydrothermal potential at Mt. Hood.

Source: DOE, 7/22/80

- New Wells Drilled in Nevada

A new well 350 feet deep, producing 117°F water, was drilled at Pinon Hills in Carson City. It will probably be used to heat houses in the area.

FIGURE 3-2

FOURTEEN-STATE COMPARISON OF DEEP GEOTHERMAL WELL DRILLING
FOR THE 1973 - 1979 PERIOD

The Pepper Mill, a newly expanded restaurant/motel complex in Reno, has drilled two wells, one to a depth of 600 feet with 112°F fluid and the other is 750 feet deep with a temperature of 130°F.

A well drilled at Hawthorne in Mineral County produced 210°F water at 750 gpm. It is being considered for district heating use.

Source: DOE, 4/80

- Well Drilled by Atlantic Richfield Produces Geothermal Fluids

The Atlantic Richfield Hamilton Dome Oil Field in Wyoming is producing 120,000 barrels per day of 150°F water. The geothermal fluid is being used for oil separation and the heating of a few buildings.

Source: DOE, 4/80

- DOE to Support Eastern Geothermal Drilling Project

The Idaho Operations Office mailed the Eastern Geothermal Drilling Project Solicitation for Cooperative Agreement (SCA) to prospective proposers on March 20, 1980. Closing date for the SCA was June 9, 1980. The purpose of the solicitation is to seek proposals from the private sector for resource confirmation of a low-to-moderate temperature hydrothermal reservoir in the Delmarva Peninsula of Delaware, Maryland and Virginia.

The project calls for DOE to assume a large part of the risk in exploratory drilling and confirming the geothermal resource with temperatures to 300°F. Up to \$1 million would be provided by DOE to cover costs for one production well and one injection well, if injection is required. Only one proposal will be selected for funding.

Source: DOE, 4/28/80

- DOE Solicits Proposals Under User-Coupled Confirmation Drilling Program

The Idaho Operations Office, U.S. Department of Energy, is accepting proposals for drilling, testing, and completion of geothermal wells throughout the U.S., or for testing wells that have been drilled but not tested for geothermal use. Federal support will range from 20 percent of the costs for a successful well to 90 percent of the costs for an unsuccessful well. Total program funding for all awards in 1981 will approximate \$10 million. Proposals are due by September.

Source: DOE, 5/80

 

4.0 EXPLORATION

This section presents periodic reports of exploration activities pertinent to geothermal energy interests.

- Geothermal Potential at Kings Bay, Georgia to be Assessed

The Navy has requested DGE to determine the geothermal potential at Kings Bay, Georgia, where a new submarine base is to be constructed. Geologists at Virginia Polytechnic Institute will conduct the relevant surveys and drill a thermal gradient hole.

Source: DOE, 5/9/80

- Targeting and Assessment of Geothermal Resources Along the Atlantic Coastal Plain

Virginia Polytechnic Institute and State University, as part of a DGE program, are locating and assessing geothermal resources along the Atlantic Coastal Plain through thermal gradient measurements and heat flow determinations. This effort is currently being extended to include the southeastern Coastal Plain, South Carolina, and Georgia.

Source: VPI, 8/80

5.0 LEASES

Leasing occurs prior to development and is therefore both an indicator and a bottleneck. The acquisition of leases by commercial developers is an indicator both of their longer term expectations for developing general areas and their near-term requirements for developing specific sites. This section presents an analysis of how well the current pace of leasing of federal lands for geothermal exploration is matched to the Interagency Geothermal Coordinating Council (IGCC) goals for geothermal development, general statistics on the status of federal geothermal leases at the end of FY 1979, and leasing activities reported recently.

The current overall rate of 400,000 federal acres leased per year approaches the estimated needed rate of about 500,000 acres per year, and both the Bureau of Land Management and the Forest Service are acting to accelerate the rate of leasing. However, conditions exist which indicate that the rate of leasing of high quality lands for potential electric power production may be too slow to meet the IGCC year 2000 electric power production goals.

MATCH BETWEEN IGCC GOALS AND LEASING

The Division of Geothermal Energy/Resource Applications (DGE/RA) is currently funding a study to establish goals for geothermal energy production from all lands in the United States. DOE's Office of Leasing Policy Development will set goals for geothermal energy production from federal lands. Although the final results of these

studies will not be available until the fall of 1980, preliminary overall leasing targets for the 1980s have been developed and are presented here.

The production goals used are the IGCC goals from the IGCC Fourth Annual Report (1980). Allowing an average seven-year post-lease exploration and development period for electric uses, land for year 2000 production goals should be leased by 1990 or soon thereafter. The time from lease to development for direct heat uses is less than five years, so land for 1995 production goals should be leased by 1990. Although federal regulations discourage development of federal lands when alternatives exist, the high percentage of federal ownership of both Known Geothermal Resources Areas (KGRAs) and Potential Geothermal Resources Areas suggest that over 50 percent of geothermal production will be from federal resources for both electric and direct use projects.

The following assumptions about the relationships between land acreage and geothermal exploration and production activities are based on geothermal experience in the 1970s. A 300 MWe capacity electric development will require 7,500 acres for production and reinjection. For relatively new areas this will require a pre-lease examination of 30 to 35 such areas (225,000 to 262,000 acres) and leasing of about 18 areas (135,000 acres) for exploration. Once a region is well known, then a developer would only have to lease two or three areas (15,000 to 22,500 acres) from which to select a single

7,500 acre area on which to develop 300 MWe of energy production. For direct heat uses it has been assumed that 300 acres are needed for development of 100 MWt production. This requires 3000 acres to be leased for exploration purposes for each 100 MWt of eventual production.

Table 5-1 presents the production goals and production acreage under the above assumptions, and the leasing acreage targets for the production goals. The IGCC goals, when compared with the above assumptions, imply that about 1.7 million acres of federal land would have to be leased by 1980, 3.3 million acres by 1985, and 6.0 million acres by 1990.

About 3.3 million acres of federal land have been leased for geothermal development. However, about 0.9 million acres have been relinquished or terminated by the end of FY 1979. Table 5-2 displays some of the relevant statistics on geothermal leasing of federal lands.

When the total amount of federal land ever leased by the end of 1979 (about 3.3 million acres) is compared to the 1980 goal of about 1.7 million acres, it appears that leasing shortfalls are not a current barrier to geothermal development. These totals are misleading, however, as they do not take into account (1) how much of the leased land is in KGRAs, (2) how the leased land is allocated among states with the better geothermal resources, and (3) what amount of land has been leased primarily for speculation. These points will be considered in turn.

TABLE 5-1

**PRODUCTION AND LEASING GOALS FOR
GEOTHERMAL ENERGY, 1980-2000**

	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
A. <u>PRODUCTION GOALS</u>					
Electric, MWe			7,000	14,000	25,000
Direct Heat, MWt		3,340	6,680	13,360	-
B. <u>PRODUCTION ACREAGE (1000 Acres)</u>					
Electric Use			175	350	625
Direct Heat Use		10	20	40	-
C. <u>ACREAGE LEASED FOR EXPLORATION (1000 Acres)</u>					
Electric Use	3,150	6,300	11,250	-	-
Direct Heat Use	<u>100</u>	<u>200</u>	<u>400</u>	-	-
Total	3,250	6,500	11,650	-	-
Approximate Federal Lands Share ¹	1,700	3,300	6,000	-	-

Notes: (1) Assumes 50 percent of lands needed are federal lands.
 (-) Value omitted because it should not impact on leasing in the 1980-1990 period.

Source: IGCC Fourth Annual Report, and MITRE analysis based on assumptions in the text.

TABLE 5-2
OVERVIEW OF GEOTHERMAL LEASING STATUS AND NEEDS (1000 ACRES)¹

STATE	FEDERAL LANDS	PROSPECTIVELY VALUABLE FOR GEOTHERMAL ²	LAND LEASED UNDER NON-COMPETITIVE APPLICATIONS ³	PENDING NON-COMPETITIVE APPLICATIONS ⁴	EGRA LANDS ⁵	FEDERAL LANDS OF IMMEDIATE CURRENT INTEREST ⁶	FEDERAL LANDS LEASED ⁷	NEEDED TO BE LEASED BY 1990 TO MEET 2000 GOALS ⁸
Arizona	31,600	3,000	22	210	4	236	22	150
California	44,200	16,000	33	969	1,476	2,478	67	1,450
Colorado	22,600	3,300	50	166	21	237	35	150
Idaho	32,900	18,100	294	747	178	1,219	161	700
Montana	27,700	4,000	11	22	59	92	0	50
Nevada	61,600	14,100	986	553	665	2,206	985	1,300
New Mexico	25,800	8,100	194	47	328	569	228	350
Oregon	32,400	15,200	204	1,130	432	1,786	227	1,050
Utah	33,500	5,900	494	208	124	826	465	500
Washington	12,900	6,100	0	390	36	426	0	250
Wyoming	30,300	900	7	50	0	57	7	50
TOTAL	829,000	94,600	2,293	4,514	3,323	10,132	2,247	6,000

NOTES: ¹Column sums may not be identical to totals, due to rounding.

²As classified by the USGS; includes non-federal lands.

³As of September 1979; includes some relinquished leases. Source: USGS

⁴As of July 1980. Source: BLM.

⁵As of September 1979. Source: USGS.

⁶Sum of preceding three columns. Note that this includes some relinquished leases.

⁷As of July 1980. Source: BLM. Does not include about 680,000 acres once leases but now relinquished.

⁸Federal lands. A fraction of 6 million acres is tentatively assigned to each state in proportion to the amount of land in each state classified as "federal lands of immediate current interest," rounded to the nearest 50 thousand acres.

Source: MITRE analysis, August 1980, from U.S.G.S. and BLM figures.

(1) About 1.6 million acres of federal land are indicated as needed to be leased by 1980 for exploration for electric development. The KGRAs are those areas deemed most suitable for electric development. About 62 percent, or 2.1 million acres, of the 3.4 million KGRA acres are federal lands. As of June 1980, less than 0.6 million federal KGRA acres were under lease. It therefore appears that the competitive leasing of federal KGRA lands needs to be accelerated. However, outstanding and new applications for noncompetitive leases also need to be processed as quickly as possible as these represent areas of expressed industrial interest.

(2) Bureau of Land Management (BLM) and U.S. Forest Service (USFS) leasing activities have been pursued much more vigorously in some states than in others. Approximate goals for how much land needs to be leased in each state by 1990 are shown in Table 5-2. The goal for each state represents the six million acre total leasing goal for 1990 divided among the states in proportion to amount of federal land that appears to be of immediate current interest in each state. This allocation among states does not take account of the proportion of prospectively valuable land that is federally-owned in each state, or the relative per acre value of the resource by state. These two considerations require that a finer analysis be made before final leasing goals can be set.

It is emphasized that the leasing goals shown in the last column of Table 5-2 are MITRE estimates of what the goals perhaps should be, under one plausible set of assumptions.

Comparison of these goals to lands now leased in each state yields the following conclusions:

- Three states, Nevada, New Mexico, and Utah, have already achieved fractions of the preliminary leasing goal for 2000;
- Three states, Colorado, Idaho, and Oregon, have already leased a little more than 20 percent of the goal;
- The remaining five states - Arizona, California, Montana, Washington, and Wyoming - have each achieved less than 20 percent of the goal.

It is of further interest that in every one of these states, except Nevada and Utah, the sum of KGRA lands in addition to lands

applied for under noncompetitive leasing regulations exceeds the 1990 leasing goal. This indicates that the geothermal industry or speculators associated with it have shown sufficient interest in geothermal leases to ensure that the 1990 leasing goals can be met. Across all the states listed in Table 5-2, the industry is aware of or has expressed interest in more than 10 million acres, or about 1.5 times the year 2000 leasing goal of 6 million acres. (However, included in these 10 million acres are some KGRA lands that have been offered but not bid on.)

(3) Some portion of the existing federal leases are held by speculators or smaller firms that entered this market unaware of many of the problems involved in geothermal projects. These areas may not be explored by the current lease holders and will eventually need to be released. Many low-potential tracts may exist in the already leased acreage that would not attract interest on the basis of present knowledge of these lands. Additionally, some of the leases contain restrictions which effectively reduce the amount of leased land actually open to exploration and development. These situations require that even more acreage should be leased to meet production goals.

Thus the acreage goals in Table 5-1 represent the minimum of the better geothermal resources on federal lands that need to be leased for exploration by diligent developers. These numbers do not indicate the acreage that must be reviewed by BLM or USGS to achieve these goals.

Given the approximate federal share of acreage to be leased for exploration (not development) in Table 5-1, the above situations, and additional contingencies, it appears that the Department of the Interior will have to lease for exploration about 500,000 new acres per

year during this decade. Additionally, at least twice this acreage may be needed for pre-lease exploration. Moreover, the Department of the Interior should rapidly reoffer relinquished leases, especially where it appears that the original leases were relinquished due to acreage limitation restrictions.

Source: MITRE Analysis

STATUS OF FEDERAL GEOTHERMAL LEASES AT END OF FY 1979

The general status of geothermal leases indicates that federal geothermal leasing is proceeding at a rate of about 400,000 acres per year. This approaches the rate of leasing (500,000 acres per year) indicated as necessary by the analysis in the section above. As indicated below, both BLM and USFS have recently initiated steps to increase the pace of leasing, and DGE/RA has initiated a process to aid BLM and USGS in selecting specific areas for quicker leasing.

Table 5-3 shows changes in the status of geothermal leasing of federal land during FY 1979. The amount of federal land currently leased rose by 221,880 acres to 2,286,210 acres, a 10.7 percent increase.

The historical patterns of federal geothermal leasing are shown for competitive leases (leases of KGRA lands) in Figure 5-1 and for noncompetitive leases (leases of non-KGRA lands) in Figure 5-2.

Figure 5-1 suggests that first offers of KGRA lands were being made at a generally declining rate in 1977-1979, following the first large sales in 1975 and 1976. The amount of KGRA land currently leased

TABLE 5-3
CHANGES IN THE STATUS OF GEOTHERMAL LEASING
ON PUBLIC LAND DURING FY 1979

<u>STATE</u>	<u>-NUMBER OF LEASES¹-</u>			<u>-----ACREAGE LEASED¹-----</u>		
	<u>1978</u>	<u>1979</u>	<u>CHANGE</u>	<u>1978</u>	<u>1979</u>	<u>CHANGE</u>
Alaska	-0-	-0-	-0-	-0-	-0-	-0-
Arizona	5	13	8	7,148	21,541	14,393
California ²	45	57	12	61,798	68,943	7,145
Colorado	25	25	-0-	31,360	34,927	3,567
Idaho	182	136	-46	324,813	246,722	-78,091
Montana	6	6	-0-	10,687	10,687	-0-
Nevada ³	413	499	86	793,510	954,577	161,067
New Mexico	88	121	33	160,387	220,155	59,768
Oregon	150	150	-0-	236,058	228,929	- 7,129
Utah	244	278	34	411,347	472,507	61,160
Virginia	11	11	-0-	19,774	19,744	-0-
Washington	-0-	-0-	-0-	-0-	-0-	-0-
Wyoming	4	4	-0-	7,448	7,448	-0-
TOTAL	1,173	1,300	127	2,064,330	2,286,210	221,880

¹ As of the 30th of September in the respective years.

² Includes two leases totaling 6000 acres on Indian land.

³ Includes one prospecting permit on 79,590 acres of 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

shows signs of leveling off in 1978 to 1979, as terminations and relinquishments of five-year leases have begun to appear. Further analysis is needed to determine if the firms most active in geothermal exploration have generally reached their individual acreage limits, or are merely awaiting the first sale of more attractive parcels.

Figure 5-2 indicates that the acreage covered by noncompetitive applications has increased at a constant annual rate of about 1.3 million acres per year since the first large set of applications received following passage of the Geothermal Steam Act in 1974. During 1977-1979, applications were acted on at a rate of about 0.9 million acres per year, and acreage covered by applications awaiting action grew at a rate 0.2 to 0.4 million acres per year.

It should be noted with respect to Figure 5-2 that "Applications Acted On" is the sum of "Land Ever Leased", "Applications Rejected" (by a Federal agency), and "Applications Withdrawn" (by the applicant). About one third of the land ever leased had been relinquished by the end of FY 1979. No detailed study has been done to examine whether any particular cause predominates others in withdrawing applications and relinquishing leases.

Tables 5-4 through 5-7 present general statistics that describe competitive leasing of KGRA lands in greater detail. Only 25,000 acres were added to lands with KGRA status in 1979, resulting in 3,410,000 acres being so designated (Table 5-4). FY 1979 saw only

TABLE 5-4
STATUS OF KNOWN GEOTHERMAL RESOURCE AREAS (KGRAS)¹

<u>STATE</u>	<u>---NUMBER---</u>		<u>-----TOTAL ACREAGE-----</u>		
	<u>1978</u>	<u>1979</u>	<u>1978</u>	<u>1979</u>	<u>CHANGE</u>
Alaska	3	3	88,160	88,160	-0-
Arizona	2	2	3,700	3,700	-0-
California	23	23	1,475,641	1,475,641	-0-
Colorado	4	4	20,825	20,825	-0-
Idaho	9	9	178,018	178,018	-0-
Montana	4	4	58,655	58,655	-0-
Nevada	30	30	635,462	664,736	29,274
New Mexico	8	8	327,853	327,853	-0-
Oregon	13	13	431,936	431,936	-0-
Utah	9	9	128,494	124,494	- 3,900
Virginia	-0-	-0-	-0-	-0-	-0-
Washington	3	3	35,612	35,612	-0-
Wyoming	-0-	-0-	-0-	-0-	-0-
TOTAL	108	108	3,384,356	3,409,730	25,374

¹ As classified by the Area Geologists of the Western and Central Regions.

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

TABLE 5-5
DISTRIBUTION OF COMPETITIVE LEASE SALES
BY STATE AND CALENDAR YEAR

<u>STATE</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980*</u>	<u>TOTAL</u>
Western Region								
Nevada	2	3	7	3	1	1	0	17
California	3	1	0	1	2	1	0	8
Oregon	1	5	3	1	2	0	1	13
Idaho	0	2	2	1	0	0	0	5
Arizona	0	1	0	0	0	0	0	1
Subtotal	6	12	12	6	5	2	1	44
Central Region								
New Mexico	0	1	2	3	1	1	0	8
Utah	1	2	1	1	1	0	0	6
Colorado	0	1	0	1	0	0	0	2
Montana	0	0	0	1	0	1	0	2
Subtotal	1	4	3	6	2	2	0	18
TOTAL	7	16	15	12	7	4	1	62

* April 14, 1980.

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

TABLE 5-6
COMPETITIVE LEASING BY STATE,
TOTAL ACREAGE LEASED, BY YEAR

<u>STATE</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980*</u>	<u>TOTAL</u>
Nevada	31,499	28,557	60,940	36,663	9,322	21,920	-0-	188,901
Utah	23,400	26,171	26,968	12,788	1,658	-0-	-0-	90,985
New Mexico	-0-	18,476	14,088	48,065	8,767	7,062	-0-	96,458
Utah	23,400	26,171	26,968	12,788	1,658	-0-	-0-	90,985
Oregon	1,347	47,689	19,836	-0-	5,818	-0-	10,617	85,307
California	26,354	10,583	-0-	2,856	4,395	6,958	-0-	51,146
Idaho	-0-	20,963	3,940	6,985	-0-	-0-	-0-	31,888
Colorado	-0-	5,036	-0-	-0-	-0-	-0-	-0-	5,036
Total Acres Leased	82,600	157,475	125,772	107,357	29,960	35,940	10,617	549,721

* April 14, 1980

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

TABLE 5-7
TOTAL HIGH BONUS BIDS BY STATE AND YEAR (IN DOLLARS)

<u>STATE</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980*</u>	<u>TOTAL</u>
California	8,614,912	134,532	-0-	780,451	16,016,169	798,595	-0-	26,344,659
Utah	877,188	2,705,661	96,688	668,825	33,862	-0-	-0-	4,382,181
Nevada	1,030,172	392,160	757,991	451,984	480,893	657,469	-0-	3,770,669
New Mexico	-0-	359,682	54,901	1,089,213	72,639	240,631	-0-	1,817,066
Oregon	13,831	296,798	140,251	-0-	86,581	-0-	347,941	885,402
Idaho	-0-	164,470	27,006	30,452	-0-	-0-	-0-	221,928
Colorado	-0-	13,577	-0-	-0-	-0-	-0-	-0-	13,577
TOTAL	10,536,103	4,066,837	1,076,837	3,020,925	16,690,144	1,696,695	347,941	37,435,482

* April 14, 1980

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

four competitive lease sales held, compared to at least 12 sales held per year in FY 1975 through FY 1977 (Table 5-5). Nevada and Oregon lead the other states in number of KGRA lease sales held. The greatest amount of bonus bid money received has come from California (Table 5-7) and by far the greatest share of this has come from leases at The Geysers.

The progress for noncompetitive leasing is detailed in Tables 5-8 through 5-10.

BLM and USFS are taking steps to accelerate leasing for geothermal use. In FY 1980 BLM has focused activity on relieving two major obstacles to federal leasing. First, regulations have been drafted to allow reissuance of relinquished and terminated leases. Second, a new environmental assessment procedure has been implemented to match the level of review with the proposed activity. These two changes, accompanied by a legislative revision of maximum acreage limitation currently being considered by the Congress should very substantially affect the amount of acreage leased.

Believing that the key to direct use development lies in cooperation among state and federal agencies, local governments, and small businesses, BLM is planning state-specific, multi-agency training and orientation meetings for its managers.

A letter drafted late in FY 1979 by USFS advised its regional foresters of a reorientation in the policy concerning mineral-related activities. Citing a backlog of several hundred geothermal leases,

TABLE 5-8 CUMULATIVE NONCOMPETITIVE LEASE TOTALS, 1976 - 1979					
Year (June 30)	Filings	Withdrawn, Rejected, & Refused	Awaiting Action	Leases Issued	Acreage Leased
1976	5,432	2,734	2,012	656	1,141,980
1977	6,043	3,232	1,831	904	1,500,005
1978	6,655	3,673	1,806	1,117	1,930,163
1979	7,315	4,027	1,956	1,332	2,314,670

Note: (1) Includes acreage subsequently relinquished by lessee.

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

TABLE 5-9
NONCOMPETITIVE GEOTHERMAL LEASING, 1979

STATE	APPLICATIONS						LEASES								
	FILED			INACTIVE			AWAITING ACTION		ISSUED			ACRES			SUBTOTAL
	BLM	FS	SUBTOTAL	WITHDRAWN	REJECTED	REFUSED	BLM	FS	BLM	FS	SUBTOTAL	BLM	FS	SUBTOTAL	
Alaska	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arizona	64	67	131	7	35	8	13	55	12	1	13	19,621	1,920	21,541	
California	730	460	1190	389	303	0	245	233	20	0	20	32,584	0	32,584	
Colorado	113	83	196	100	17	2	6	38	42	1	43	49,565	680	50,245	
Idaho	649	332	981	270	175	30	164	176	165	1	166	291,385	2,560	293,945	
Montana	38	66	104	54	26	0	18	0	6	0	6	10,687	0	10,687	
Nevada	1655	13	1668	542	356	78	165	0	524	3	527	981,184	4,434	985,618	
New Mexico	629	42	671	337	83	10	109	19	113	0	113	194,318	0	194,318	
Oregon	638	526	1164	243	295	0	134	351	118	26	144	161,041	43,437	204,478	
Utah	584	108	692	172	149	22	31	33	274	11	285	480,551	13,513	494,064	
Washington	0	342	342	105	61	0	0	176	0	0	0	0	0	0	
Wyoming	26	138	164	141	16	0	1	2	0	4	4	0	7,448	7,448	
East'n. States	0	12	12	0	1	0	0	0	0	11	11	0	19,744	19,744	
TOTALS	5,126	2,189	7,315	2,360	1,517	150	886	1,083	1,274	58	1,332	2,220,936	93,736	2,314,672	

(1) Applications awaiting action for the following reasons:

- 34 Awaiting KGRA report from USGS
- 1 Pre-lease plan of development
- 597 Pending preparation of EAR (BLM only)
- 1004 Awaiting comment of other agencies
- 30 Lease forwarded for signature
- 290 Processing (Adjudication) -- BLM

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

TABLE 5-10
NONCOMPETITIVE GEOTHERMAL LEASING
APPLICATIONS AWAITING ACTION

STATE	AWAITING KGRA REPORT FROM USGS	AWAITING PRE- LEASE PLAN OF DEV. FROM APPLICANT	PENDING PREP OF EAR (BLM ONLY)	AWAITING COMMENT OF OTHER AGENCIES		LEASE FORWARDED FOR SIGNATURE BY APPLICANT	PROCESSING (ADJUDICATION) BLM	TOTALS
				Other	FS			
Alaska								
Arizona			13		55			68
California			230	11	233		4	478
Colorado					28		6	34
Idaho	3		130		173		34	340
Montana			8		10			18
Nevada	26		9		14	15	101	165
New Mexico	5		65		29	8	21	128
Oregon			134		340	6	2	482
Utah		1	7	4	33	1	18	64
Washington					72		104	176
Wyoming			1		2			3
Eastern States								
SUBTOTAL	34	1	597	15	989	30	290	1,956

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

the letter states, "Our objective is to eliminate this backlog within 2 years, while keeping current with new applications."

To accomplish this, regional foresters were advised that there is no legal reason to withhold action on leasing pending completion of land management plans under the provisions of the National Forest Management Act of 1976. This advice is intended to speed up leasing by allowing applications to be processed before completion of Forest Plans under the National Forest Management Act. Further, the regional foresters were advised of plans to establish reasonable time limits for leasing and permitting decisions, to require that applicants be promptly notified of decision schedules and appeal rights.

Based on recommendations of the IGCC's Streamlining Task Force, a pilot test of staged leasing using a conditional development stipulation was approved for use in Oregon and Washington State National Forests. A successful outcome will encourage staged leasing elsewhere on USFS lands. Staged leasing derives from the idea that to perform a full-scale environmental review of possible development before any leasing begins is often to waste both money and time, since the location, type, and scale of development are unknown. As set up in the USFS test areas, lease issuance will be based primarily on existing land management plans and environmental review of exploration. If the lessee discovers a commercially viable resource and presents a plan of development, a comprehensive environmental review of that plan will be conducted before development can begin. Essentially,

this process is already in effect. The value of the stipulation is primarily to serve notice of the process and thereby provide a clear rationale for not attempting to fully address development in the pre-lease review.

DGE/RA has been working to furnish additional guidance to BLM and USFS with respect to which federal lands should receive highest priority for geothermal leases. In 1979, DGE requested its State Resource Assessment Teams to identify specific parcels where new federal leases would be most important for geothermal development. Late in 1979, the teams responded with the locations of 115 areas for priority actions. Thirty-three of these areas are potential electric sites, 82 areas are potential direct heat use sites. Sixty of these areas are on BLM lands and the other 55 are on USFS lands. DGE has forwarded these nominations to BLM and USFS.

Source: USGS
IGCC Fourth Annual Report
MITRE Analysis

6.0 OUTREACH AND TECHNICAL ASSISTANCE

This section provides resource information on outreach and technical information programs as well as general information on successful applications of geothermal energy. Information, generally obtained through state energy offices or DOE/RA, includes directories of agencies, contractors, consultants, and equipment suppliers in the geothermal arena and summaries of geothermal energy uses aimed at potential markets in residential heating, agriculture, food processing, and other applications.

The following comprise recent outreach and technical assistance activities:

- OIT Completes Evaluation of Caliente District Heating System

The Oregon Institute of Technology's economic and engineering evaluation indicates development of the Caliente District Heating System is economically feasible. The Resource Assessment Team of the Nevada Bureau of Mines and Geology identified two recommended well locations. A 50-unit mobile home development is currently using this geothermal resource. Source: DOE, 4/80

- Division of Geothermal Energy Offers Geothermal Materials Analysis

DOE-DGE offers a geothermal components analysis program at no cost to the requestor. The objective of the program is to increase understanding of geothermal materials performance in field applications. The analysis of electric and non-electric components is provided at no cost, and the materials need not be considered "failed" to qualify under the program. Through the materials analysis program, DOE-DGE is able to identify and study materials problems, review designs, and recommend solutions.

Geothermal materials for analysis are currently being solicited. For additional information contact B.J. Mueller,

DOE-DGE Chicago Operations Program, (312) 972-2037. All components received will be considered for analysis at no cost.
Source: Geothermal Materials Review, Spring 1980

- National Conference of State Legislatures Offers Technical Assistance

The NCSL Energy Program conducts technical assistance projects with the state legislatures. The Geothermal Project is designed to encourage and facilitate state policy reviews to assist 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.

Source: National Conference of State Legislatures, 5/28/80

- Geothermal Space Heating at Norfolk, Virginia Naval Base

The potential for heating a large aircraft hangar at the Naval Air Rework Facility has been examined. The geothermal resource temperature in the Norfolk area is estimated to be 107°F. The analysis examined the ability of this resource to carry the base heat load by (1) radiant floor heat, and (2) hybrid systems with heat pumps; the direct radiant heat system being the least costly. Eight other buildings, using various systems for space heating, could also be assessed.

Source: JHU/APL, 7/80

7.0 FEASIBILITY STUDIES AND APPLICATION DEMONSTRATIONS

This section reports on specific projects for which federal support is being provided. Table 7-1 lists technical and economic feasibility studies being funded by DOE. Table 7-2 lists application demonstrations for which some or all of the funding is being provided by DOE.

Recent activities include:

- Raft River Geothermal Pilot Plant

A 5 MWe pilot plant is being constructed (80 percent complete) at DOE's Raft River Geothermal Site in South Central Idaho. The purpose of the pilot plant is to determine the feasibility, costs, and environmental acceptability of generating electric power from a moderate-temperature (300°F) hydrothermal resource. Three production wells and two injection wells have been drilled to supply hot water to the plant and to dispose of the water after the heat has been extracted by the plant.

Source: DOE, 4/80

- 22 Direct Heat Applications Received

The San Francisco Operations Office has received approximately 22 proposals for the Geothermal Direct Heat Industrial Applications Engineering and Economic Feasibility Study Announcement. About 17 of the proposals are related to alcohol fuels production.

Source: DOE, 6/10/80

- Monroe City (DOE Field Demo)

Under a federally-funded direct use program, the City of Monroe, Utah is considering a revised scope-of-use for the Monroe Hot Spring resource. The DOE agreed with Monroe City's assessment that the present project, a large district heating system, is not economically viable with the present available resource. This project has been stopped pending further recommendations by Monroe City and approval by DOE-ID.

Source: DOE, 4/80

TABLE 7-1
TECHNICAL AND ECONOMIC FEASIBILITY STUDIES

PROJECT	LOCATION	NTIS REFERENCE NUMBER
Agribusiness		
Salmon Aquaculture	Alaska	
Livestock Controlled Environment	Susanville, CA	
Agribusiness	Lake, Napa, and Sonoma Counties, CA	
Greenhouse Crops, Mushroom Culture, Fish Farming, and Biogas Generation	Lake County, CA	
Vertically-Integrated Livestock, Meat and Feed Processing Facility	Mountain Home, ID	
Integrated Feed Lot and Farming Operation Producing Methane From Animal Waste	Vale, OR	
Industrial Process Heating		
Industrial Park	Puna, HI	
Wetcorn Milling Plant	East Mesa, CA	
Hosiery Factory	Las Cruces, NM	
Frozen Food Plant	Salisbury, MD	
Sugar Beet and Barley Processing	San Luis Valley, CO	
Food Processing Using Geopressure/Geothermal Resource	Louisiana Geopressured Resources	
Holly Beet Sugar Refinery	Imperial Valley, CA	SAN-1743-3
Fertilizer Production, Valley Nitrogen	Heber KGRA Near El Centro, CA	
Preliminary Potato Processing, Onion Dehydration, Alfalfa Drying, Greenhouses, and Sugar Refinery Feasibility	Klamath and Snake River Basin, OR	
Refrigeration for Food Processing Including Freezer Drying and Meat Packing	Raft River, ID, Weiser-Crane Creek, ID, Vale, OR, Coso Hot Springs, CA, and Imperial Valley, CA	SAN/1319-1
Industrial Complexes, Including Forest Products, Caustic/Chlorine, and Corn Products	Calistoga, CA, Brawley, CA, Surprise, Valley, CA, Lakeview, OR, Vale, OR, BrumEAU Granview, ID, Steamboat Springs, NV, and Core/Ft. Sulphurdale, UT	

TABLE 7-1 (Concluded)
TECHNICAL AND ECONOMIC FEASIBILITY STUDIES

PROJECT	LOCATION	NTIS REFERENCE NUMBER
Alfalfa Dehydration Plant	El Centro, CA	
Evaporation/Crystallization Industry, Including Tomato Paste Processing, Sugar Beet Refining, and Sodium Chloride Production	Not Site-Specific	
District and Institutional Heating		
Mini Core District System and Municipal Waste Treatment	Glenwood Springs, CO	
Community District System	Lakeview, OR	
District System for 1,000 Planned Homes		
University of New Mexico Campus System	Albuquerque, NM	
District Heating	Mammoth Lakes, CA	
District Heating with Possible Augmentation	Susanville, CA	
Six Rural Alaskan Towns Using Normal Gradient	AK	
District Heating for Baca Grand Community Development Project	Alamosa, CO	
Space Heating for Edgemont School Complex	Edgemont, SD	
District Heating and Cooling System, Including Industrial Park	El Centro, CA	
Space Heating	Midland and Philip, SD	
Space Heating and Agribusiness	City of Desert Hot Springs, CA	
District Heating	Boise City, ID	

SOURCE: Division of Geothermal Energy, 8/80.

TABLE 7-2
APPLICATION DEMONSTRATIONS

STATE	OPERATOR LOCATION	TYPE OF USE	FIRST YEAR	FED	FUNDS STAT	\$000 LOCAL	PRIV	BTS/YEAR BILLIONS	COMMENTS
CA	AGUAIRRES INT'L RIVERSIDE MCCA	AG:FRAMES	1981	363			637	171.0	FOR-79, RAISING FRAMES
CA	BOLLY SUGAR CORP BRANLEY IMPERIAL	IB:PULP DRY	1981	3,921			14,200	148.0	FOR-79, PRIV. FUND. ONLY IF PILOT FA C. SUCCESS
CA	CITY OF EL CENTRO EL CENTRO IMPERIAL	BE:HVAC	1981	2,000		800		7.0	FOR-79, SP. COOLING OF CORR. CENTER
CA	CITY OF SUSANVILLE SUSANVILLE LASSEN	BE:DISTHEAT	1981	2,106		2,300		41.0	FOR-79
CA	GEOTHERMAL PUB CORP KILLY HS KILLY HS	BU:HVAC/AG	1982	1,847			5,000	81.0	FOR-79
CO	TR OF PAGOSA SPGS. PAGOSA NS ARCHULETA	BE:DISTHEAT	1981	779			284	14.0	DISTRICT HEATING, FOR-79
ID	BR. SPGS. HOLLOW BOISI ADA	BE:HVAC	1983	5,400	1,200	3,000	6,000	95.0	SPACE HEAT. OF CORR. BLDGS, FOR-79, UPGRADE BR. SPGS. DIST. HEAT.
ID	HAD. CO. ENERGY CORP. MADISON RUTHERFORD	BU	1981	1,650			1,720	.0	HUN. SP. HEAT, FOOD PROC., FOR-79, F TURE OF PROJ. UNCERTAIN
MT	STATE OF MONTANA NS STATE HOSPITAL DEER LODGE	BE:HVAC	1981	626	685		380	6.4	HOSPITAL, FOR-79
NV	HYDO ENERGY CORP WASHOE RENO	BE:HVAC/HVTR	1981	410		50		.1	SUNDANCE APT COMPLEX, FOR-79, EBERG U SI UNKNOWN
NV	ELKO HEAT CO. ELKO ELKO	BU	1982	800			480	42.0	3 CORR. BLDGS, 6 LAUNDRY, FOR-79
OR	CTY OF Klamath Falls Klamath Falls Klamath Falls	BE:DISTHEAT	1981	960	50	390		35.4	DIST. HEAT OF 14 CITY, CTY, 6 FED BL SGS., FOR
OR	Klamath Cty YNCA Klamath Falls Klamath County	BE:HVAC	1980	200		50		5.0	SP. HEAT OF PRIV. REC. FACILITY
SD	GENE ARNSTEDT BISHOP RING RANCH BISHOP	BU	1980	200			100	5.5	FOR-78, HEAT. FARM BLDGS., DRY GRAI N, WARE STOCK WATER
SD	BARKER SCHOOL DIST. BARKER PHILIP	BE:HVAC	1980	698		175		5.2	FOR-78, 5 SCHOOL BLDGS.
SD	ST. MARY'S HOSP. FINDER HUGHES	BE:HVAC	1980	500			120	8.4	FOR-78, HOSP. SPACE HEAT.
TX	NAVARRO COL. GHOSP. CORNICANA CORNICANA	BE:HVAC	1981	866				.1	SP. HEAT.-COLLEGE BUILDING & HOSP., FOR-79
TX	T.H.S. HOSPITAL MARLIN MARLIN	BE:HVAC	1980	497				.1	SP. HEAT.-HOSP., FOR-79
UT	UTAH ROSES, INC. SALT LAKE SANDY	AG:GREENHOUSES	1980	460			349	97.0	FOR-79
UT	UT STATE PRISON CRYSTAL HS SALT LAKE	BU	1981	432	179			21.0	FOR-79, SPACE & WATER HEATING

- Utah Roses (DOE Field Demo)

Utah Roses has completed a series of tests and are evaluating the data to determine the best method to stimulate the well. The greenhouse design is continuing based on well head temperatures of 120°F. Well temperature is about 130°F with a flow rate of about 300 gpm.

Source: DOE, 4/80

- L'eggs Plant DOE-Funded Feasibility Study

The first progress report for the L'eggs plant study by Energetics Corp. of Dallas, Texas has been completed. The report shows that either the plant site or the University sites are the best locations. A progress review was held at the L'eggs Plant.

Source: DOE, 4/80

8.0 GEOTHERMAL LOAN GUARANTY PROGRAM

The Geothermal Loan Guaranty Program (GLGP) was established in 1974 under the provisions of P.L. 93-410. The basic aim is to provide a federal guaranty of repayment of a commercially obtained loan in order to reduce the risk in development of geothermal resources and thus to remove a barrier to acquiring private funding of geothermal energy projects.

The program presently has guaranteed parts of five loans, guarantying loans now totalling \$137.8 million for projects totalling \$209.0 million in cost. Three projects will provide an added 230 MWe (gross) to current electricity production, and the other project will provide 117 billion BTU/yr for food processing (dehydration of onions, celery). Applications are now pending for loan guaranties totalling \$248.5 million for projects totalling \$330.5 million. The overall status of this program is presented in Table 8-1.

Changes in loan guaranty status since this table was last presented in GPM Report No. 1 include: (1) The CU-I Venture application for full-scale field development for a 45 MWe (gross) power plant at South Brawley was approved (Item 7). (2) The application for the Northern California Power Association loan guaranty has been approved by DOE Headquarters. Still to be negotiated are agreements between DOE-SAN, NCPA, and the lender. This \$45 million loan guaranty is expected to close in the next couple of weeks. (3) Applications have been received for field and/or plant development at Rorabaugh,

TABLE 8-1
GEOHERMAL LOAN GUARANTY PROGRAM

PLANT NAME	LOCATION	STATE	BORROWER	EXPECTED BUYER	LENDER	GUARANTY STATUS	PURPOSE	GROSS POWER (MWe)	NET POWER (MWe)	BTU/YR (10 ⁹)	GUAR AMOUNT (\$10 ⁶)	PROJECT AMOUNT (\$10 ⁶)	YEAR ON LINE	COMMENTS (Status as of July 1980)
1. East Mesa	East Mesa, Imperial Valley	CA	RCI	SDG&E	BOA	G	I	20	-	-	9.0	17.9	1983	For exploration and partial field development. Applications for field and plant development are being analyzed, Items 8 and 9 below.
2. CU-I Venture	South Brawley, Imperial Valley	CA	MCI, CHAC	CDWR	BOM	G	E	2	2	-	1.8	2.8	-	For exploration only. Exploration successful. Loan refinanced under field development project, Item 7 below.
3. Geothermal Food Processors	Brady Hot Springs	NV	GFP	-	STWSC	G	D	-	-	117	3.3	4.9	1978	Vegetable dehydration plant. BTU estimate based on 128 day onion processing season; will be more as other crops are added.
4. Westmorland	Westmorland, Imperial Valley	CA	RCI, MAPCO	SDG&E	BOA	G	F	55	-	-	29.1	40.9	?	Field development project. Currently (7/80) running 30-day flow test.
5. NCPA #2	The Geysers	CA	NCPA	NCPA	BOM	G	F	110	106	-	45.0	60.0	1982	Will buy steam from Shell Oil. Preliminary construction has started.
6. Oregon Trail	Vail	OR	GEC	-	BT	A	D	-	-	200	3.0	6.6	1981	To grow 3 million lbs. mushrooms per year. Project being restructured at borrower's request. Revised application expected 9/80.
7. CU-I Venture	South Brawley, Imperial Valley	CA	MCI, CHAC	CDWR	BOM	G	F	45	36	-	49.4	82.5	1984	To complete field development. Mercur #2-28 deepened as a production well. 30-day flow test expected Aug/Sep. CDWR holds 25% interest in field development.
8. East Mesa	East Mesa, Imperial Valley	CA	RCI Subsid	-	BOA	A	F	64	48	-	115.0	134.0	1983	To complete field development. To provide fluid to plant, see Item 9.
9. East Mesa	East Mesa, Imperial Valley	CA	JK	-	BOA	A	F	64	48	-	77.0	105.0	1983	For power plant construction. Fluid to come from field, see Item 8.
10. Borabough	The Geysers	CA	GKI	CDWR	BOA	A	F	35	-	-	28.6	38.3	1984	Field development.
11. Coco Hot Springs	Layo County	CA	GEC subeild	US Navy	BOM	A	F	20	-	-	22.9	30.6	1983	Expect application for power plant project. Navy will purchase power. Borrower will drill the first exploration well at his own risk.
12. Half Circle Ranch	North Central Nevada	NV	CVGEC	-	BOM	PA	F,D	-	-	450	37.5	48.2	1982	Preliminary application. Cascading direct use for ethanol production of 6 million gallons per year. BTU consumption estimate based on heat of combustion of product.
13. Other						PA,E								A number of preliminary applications are being reviewed for completeness.

Source: Geothermal Loan Guaranty Office, DOE San Francisco Operations Office

BORROWER

CVGEC - Crescent Valley Geothermal Ethanol Co.
GEC - Geothermal Energy Corp.
GFP - Geothermal Food Processors, Inc.
GKI - Geothermal Kinetics, Inc.
CHAC - GKI Subsidiary
JK - Jacobsen Engineering
MAPCO - Mid-American Pipeline Co.
MCI - MCI Geothermal, Inc.
NCPA - Northern California Power Association
RCI - Republic Geothermal, Inc.
SDG&E - San Diego Gas & Electric Co.

EXPECTED BUYER

CDWR - California Department of Water Resources
NCPA - Northern California Power Association
SDG&E - San Diego Gas & Electric Co.

LENDER

BOA - Bank of America
BOM - Bank of Montreal (CA)
BT - Bankers Trust
STWSC - State Teacher's Retirement System of Georgia

GUARANTY STATUS

A - Application Pending
E - Expect Application
G - Guaranteed
PA - Preliminary Application

PURPOSE

D - Direct Use
E - Exploration
F - Full Field Development
I - Initial Field Development
P - Power Plant

The Geysers, East Mesa, and Coso. (4) A preliminary application for a geothermal-fueled ethanol plant in North Central Nevada has been received and is being reviewed for completeness. (5) The application for the Honey Lake Farms greenhouse project in Susanville, California (Item 5 in GPM Report #1) has been withdrawn by the applicant.

A number of additional preliminary applications for loan guaranties are being reviewed for completeness, prior to their submission as formal applications.

9.0 RESEARCH AND DEVELOPMENT ACTIVITIES

This section reports on new technology developments and initiatives. The emphasis is on activities of general interest, where reports in trade publications may not be adequate for the GPM audience.

- L'Garde Develops Rubber Compounds for Use as Seals and Packing

Under a contract to the Department of Energy, L'Garde, Inc., has developed rubber compounds suitable for use as seals and packing in high temperature and corrosive geothermal environments. These elastomers were initially developed for use in casing packers. These seals have survived a minimum of four 24-hour cycles at 275°C with one excursion to 340° and pressure differentials of 7500 psi. These tests, in both water and oil, are the first time that elastomers have survived more than one cycle. LASL experimenters plan further laboratory and field tests to establish ultimate limits for the newly developed seal materials. The excellent resistance to oil environments indicates a high potential for pump seal applications.

Source: DOE, 7/22

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10.0 LEGAL, INSTITUTIONAL, AND REGULATORY ACTIVITIES

This section relies on information obtained from member agencies of the IGCC, the Congressional Record, State and regional offices and other sources, and reports on legislative and regulatory activities on the federal and state levels. Legislative reports include the introduction of bills, the results of hearings, and the passage of new laws affecting geothermal energy. Also, activities of DOE, EPA, BLM, other federal agencies, state agencies, and boards relating to the legal, institutional, and regulatory aspects of geothermal energy are reported here.

Recent activities include:

- HUD Receives Two Geothermal Heat Pump District Heating Proposals

The HUD Innovative Technical Grants Program received proposals from Bellows Falls, Vermont and Ephrata, Washington. Bellows Falls is requesting approximately \$250K funding to identify the resource and design a system for four large downtown buildings. Ephrata is requesting \$468K to demonstrate the potential of using the existing domestic water distribution, which has warm water, for heat pumps. DOE has contributed \$1 million to the innovative grants program.
Source: DOE, 7/3/80

- Hazardous Waste Regulations

EPA has issued hazardous waste regulations under the Resource Conservation and Recovery Act of 1976 (RCRA). Congress is temporarily excluding geothermal solid wastes from control under the regulations while EPA conducts studies to determine whether such wastes are hazardous, appropriate management methods, and costs of waste management. If geothermal wastes are determined by EPA not to be hazardous, their disposal will be regulated as nonhazardous solid wastes under RCRA.
Source: Federal Register, 5/19/80

- Underground Injection Regulations

Regulations to protect underground drinking water aquifers from contamination or other endangerment by subsurface-injected fluids have been promulgated by EPA. The regulations, which set forth minimum requirements for the State Underground Injection Control Program mandated by the Federal Safe Drinking Water Act, allow states to exempt geothermal energy-producing aquifers from classification as drinking water sources. This exemption allows injection to such aquifers regardless of whether they otherwise meet the criteria for drinking water sources. The program, to be administered by the states, will require injection permits based on analysis of the planned injection and geological, hydrological, and other aspects of the surrounding area. The regulations prescribe requirements for well construction and operating, monitoring, and reporting.

Source: Federal Register, 6/24/80

- Maryland Geothermal Resources Act Reviewed

The National Conference of State Legislatures Workshop met with the State Energy Special Subcommittee and reviewed the Maryland Geothermal Resources Act. A consensus was reached on proposed revisions that would remove ownership ambiguity.

Source: JHU/APL, 7/80

FEDERAL LEGISLATIVE STATUS

Energy Security Act

The Energy Security Act (P.L. 96-294) was enacted on June 30, 1980. Title VI, the Geothermal Energy Act of 1979, contains the following major provisions:

(1) A \$750 million five-year program under which the federal government will share the risks of drilling for commercially viable geothermal resources. Loans will cover 50 percent of the cost of surface exploration and drilling and 90 percent of the cost of a project to use geothermal for space conditioning or process heat. The loans will be repayable out of project revenues and will be wholly or partially forgivable if a project is unsuccessful. Because the high economic risk perceived by drillers and developers is considered to be one of the major forces slowing development, the reservoir confirmation loan program is expected to accelerate the rate of exploration for and confirmation of geothermal reservoirs. Authorization is \$150 million for each of fiscal years 1981 through 1985.

(2) A program authorizing DOE to grant low-interest forgivable loans to cover up to 90 percent of the cost of feasibility studies and regulatory applications and up to 75 percent of the construction costs of nonelectric systems.

(3) A DOE study to examine the need for and feasibility of a federal reservoir insurance and reinsurance program. On the basis of the report, Congress will determine whether to authorize a program of insurance against the risk of reservoir failure after investment of at least \$1 million has been made in reservoir development and use. The direct insurance would be provided only where the developer could not obtain private insurance at reasonable premiums.

(4) Modification of Geothermal Loan Guaranty Program (GLGP). The law extends the life of the GLGP from 1984 to 1989 and provides an increased level of assistance under the program. Loans to municipalities and public cooperatives will be increased from 75 percent to 90 percent of project costs. In addition, supplemental funding for loans and loan guaranties will be made available to the Small Business Administration, the Farmers Home Administration, the Rural Electrification Administration, and HUD for their existing programs. P.L. 96-294 also includes provisions to expedite processing of loan guarantees; such reforms include a four-month deadline for processing applications, requirements to give faster consideration to applicants for nonelectric projects, and elimination of requirements for duplicative Environmental Impact Statements under NEPA for loan guaranty applications.

(5) A program to use geothermal energy in federal buildings, similar to the existing program for conservation and solar energy in federal buildings.

(6) New authorities under PURPA. The law explicitly includes geothermal facilities of 80 MWe or less in the small power producer category under the Public Utility Regulatory Policies Act (PURPA). Geothermal facilities qualifying as small power producers are eligible for interconnection, wheeling of power through grid transmission lines, special consideration in ratemaking, and other utility orders as determined by FERC. Multiple geothermal units at a site are also eligible for exemption from public utility regulation, provided their combined capacity does not exceed 140 MWe.

Regulations to implement Title VI are to be promulgated no later than six months after enactment (on June 30, 1980) of P.L. 96-294.

Windfall Profits Tax Act

The President signed the Crude Oil Windfall Profits Tax Act (P.L. 96-223) on April 2, 1980. The law provides tax credit increases over those provided by the National Energy Act. The investment tax credit for geothermal equipment is increased to 15 percent in excess of the normal 10 percent and extended through 1985. The residential credit is increased to 40 percent of the first \$10,000 in expenditures for geothermal equipment, for a maximum of \$4000. Finally, a tax credit is provided equal to 10 percent of the cost of cogeneration equipment. Geothermal systems designed to tap waste heat or steam would qualify.

Leasing Reform Legislation

H.R. 6080, the proposed Geothermal Resources Act Amendments of 1979, was passed by the House of Representatives on February 11, 1980. This bill incorporates some of the recommendations of the IGCC Streamlining Task Force to remove disincentives to geothermal exploration and development posed by the federal leasing and permitting process. Major leasing provisions in the bill are summarized as follows:

- An increase in the acreage limitation for lease in any one state from 20,480 to 51,200.
- Amendment of KGRA definition to limit KGRAs to prospects with potential for electric power generation.
- Redesignation of KGRAs through a competitive bidding procedure. If qualified bids are not received, the KGRA designation will be withdrawn and the lands made available for noncompetitive leasing.
- Reoffering of relinquished leaseholds.
- Authorization of federal use of geothermal resources on federal lands.
- Free use permits for noncommercial nonelectric applications.
- Establishment of expedited leasing procedures.
- Establishment of geothermal production goals for federal lands by DOE.
- Protection of "nationally significant" thermal features of national parks and monuments from disruption by geothermal

developments on adjacent lands. DOI would be required to designate such features so that leasing in their vicinity would be prohibited until determinations were made of whether geothermal activity had potential for adverse effects on such resources. An extensive exploration and monitoring program over several years would be required for such determinations.

The bill has been referred to the Senate Committee on Energy and Natural Resources.

S. 1388, Geothermal Steam Act Amendments of 1979, passed the Senate on June 24, 1980. This bill, though similar in most respects to H.R. 6080, includes, among others, the following departures from the House version: (1) a "conditioned" leasing provision to allow exploration of lands without environmental review of possible production and utilization until such developments are planned, (2) strict diligence requirements for lessees, (3) a reduction of the royalty rate to 5 percent for nonelectric applications, (4) stricter requirements for permitting federal use of geothermal resources on federal lands, and (5) a relaxation of the requirements of the national parks protection amendments to require analysis of the potential impacts of exploration only (rather than full development) on thermal features of national parks and monuments.

STATE LEGISLATIVE STATUS

- Alaska Legislature Passes Geothermal Bill

The Alaska legislature has passed the Comprehensive Geothermal Resources Act (SB 779) governing geothermal resource definition ownership, leasing, and regulation. Governor Hammond calls it "Model Legislation" and is expected to sign the bill. He gave credit to the DOE-funded NCSL Geothermal State Law project for assistance in preparing the legislation. The Act treats low-temperature waters (less than 120°C) as "Hot Ground Water," and thus not subject to leasing, severance prospecting permits, followed by leases, for high-temperature water, similar to the phased leasing system in pending federal legislation. High-temperature resources are excluded from the water appropriation system, eliminating a dual jurisdiction problem.

Source: DOE, 7/80

 

11.0 ENVIRONMENTAL ACTIVITIES

This section contains information on the initiation, progress, and results of Environmental Assessments and Environmental Impact Statements related to geothermal energy. New environmental impact concerns and new approaches and developments in environmental control technology are also reported. This information will be obtained from the geothermal commercialization activity reports and other sources.

- Environmental Controls Panel of the IGCC Holds Open Meetings

The Environmental Controls Panel of the Interagency Geothermal Coordinating Council (IGCC) held open meetings in Denver, Colorado, and San Francisco, California, on July 8-9, 1980. The meetings were sponsored by the Geothermal Resources Council (GRC) and attended by representatives from utilities, operators, consultants, architects and engineers, and government. Total attendance in Denver was 23 (66 percent from industry) and in San Francisco was 33 (71 percent industry). The purpose of the meetings was to review the proposed future government program in the environmental controls technology area for hydrothermal energy.

Source: DOE, 7/15/80

12.0 STATE, LOCAL, AND PRIVATE SECTOR ACTIVITIES

This section summarizes reports of new geothermal techniques and technology, meetings and symposia scheduled or held and other significant activities in the development and application of geothermal energy. The information is obtained from DGE, regional and state offices, laboratories, and industry. The following comprise recent activities within these sectors:

- Western Interstate Energy Board Review of Impediments to Hydrothermal Development

The Western Interstate Energy Board annual meeting on May 1-2 had as its primary topic "Impediments to Geothermal Development." The Board expressed considerable dissatisfaction with BLM and Forest Service inaction on geothermal leasing, and with restrictive land use policies. The Board also has indicated it will express to members of Congress its disagreement with House Science and Technology Committee cuts in the FY 1981 DOE geothermal budget, especially as they may apply to state resource and planning teams.

Source: DOE, 5/9/80

- Delaware Geothermal State Team Formed

A State team has been formed to prepare the State Geothermal Prospectus and to coordinate geothermal activities in Delaware pending funding from DOE.

Source: JHU/APL, 7/80

13.0 REPORTS AND PUBLICATIONS

This section presents abstracts and references of significant reports to members of the geothermal community. This information is obtained from EPRI, NTIS, TIC, and other sources.

- DOE-Industry Coupled Program Case Studies Available

The University of Utah Research Institute has announced a data release through the DOE-Industry Coupled Program. Case studies for Utah are available entitled "Subsurface Investigations at the Roosevelt KGRA, Utah" and "Union Oil Company Final Report, Geothermal Reservoir Assessment, Cove Fort-Sulphurdale Unit."

Source: DOE, 4/80

- Mineral Resources of the Gila Primitive Area and Gila Wilderness, New Mexico

The U.S. Geological Survey has available "Mineral Resources of the Gila Primitive Area and Gila Wilderness, New Mexico," published as USGS Bulletin 1451. It describes geothermal energy potential in a zone of springs near Gila Hot Springs as well as potential for occurrence of economic deposits of gold, silver, copper, molybdenum, lead, zinc, fluorspar and other minerals. Copies are available for \$8.00 each from:

USGS Branch of Distribution
1200 South Eads Street
Arlington, VA 22202
Source: DOE, 4/80

- Idaho Geothermal Resources Map Available

A public map depicting geothermal resources of Idaho is now printed and available for distribution. The data were collected by the Idaho Department of Water Resources (IDWR) personnel under a contract to DOE as part of the State Resource Assessment Program. The maps were prepared and printed by NOAA as part of their assistance contract with DOE for this program. For a copy of the map contact:

John Mitchell
Idaho Department of Water Resources
Boise, ID 83720
Source: DOE, 4/80

- Technical Assistance Report No. 5: Geothermal Space Heating - Naval Air Rework Facility, Norfolk, Virginia

This report examines the feasibility of using a low temperature geothermal well to heat a large aircraft hangar. Four optional arrangements, three employing heat pumps, are assessed and amortization periods are estimated. It is available from:

The Johns Hopkins University
Applied Physics Laboratory
Johns Hopkins Road
Laurel, MD 20870
Source: JHU/APL, 7/80

- Technical Assistance Report No. 4: Geothermal Space Heating - Pittsville Middle/Elementary School, Pittsville, Maryland

Space heating a new school and this school plus an existing wing with geothermal energy from a low temperature well are examined. Displacement of fuel oil is estimated; capital recovery times versus grant money are determined for various oil price increase rates. The report is available from:

The Johns Hopkins University
Applied Physics Laboratory
Johns Hopkins Road
Laurel, MD 20810
Source: JHU/APL, 7/80

- Definition of Markets for Geothermal Energy in the Northern Atlantic Coastal Plain, GEMS-002

This report includes the results of a detailed energy use study of four potential geothermal resource areas on the Atlantic Coastal Plain; southeastern New Jersey; the Delmarva Peninsula; the vicinity of Norfolk, Virginia; and eastern North Carolina. Demands for space heating, water heating, and process heating (at temperatures less than 250°F) are presented. This publication is available from:

The Johns Hopkins University
Applied Physics Laboratory
Johns Hopkins Road
Laurel, MD 20810
Source: JHU/APL, 7/80

- Direct Application in Frozen Food Plant, Salisbury, Maryland

This report presents a technical and economic analysis of the use of a low temperature geothermal source for producing some of the hot water temperatures required in a Campbell Soup Company frozen food process.

Source: JHU/APL, 7/80

- IGCC Fourth Annual Report

The Fourth Annual Report of the Interagency Geothermal Coordinating Council to the Congress, covering Fiscal Year 1979 activities and F.Y. 1980 plans was printed in June. This report details the goals, plans, and program status of all Federal agencies engaged in geothermal energy development and regulation. It is a rich compendium of information about all facets of recent government policies and actions concerning geothermal energy. It is available from:

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

as Document No. DOE/RA-050, for \$9.25 in paper or \$4.00 in microfiche.

- Direct Utilization of Geothermal Energy: A Technical Handbook, GRC Special Report No. 7

This technical handbook, published by the Geothermal Resources Council, presents information on various aspects of direct geothermal use. Exploration, confirmation, and evaluation of the resource, reservoir development and management, and financing direct-use projects are among the subjects covered.

- Commercial Uses of Geothermal Heat, GRC Special Report No. 9

Within this report, articles on dealing with the commercial application of geothermal energy are presented. Subjects include individual applications projects, exploration, financing of geothermal projects, and materials and equipment. The report was published by the Geothermal Resources Council under a DOE grant.

- DOE-Funded Geothermal Newsletters

The Division of Geothermal Energy Supports the following geothermal newsletters:

- News of Geothermal Energy Conversion Technology. Published by Earth Sciences Division, Lawrence Berkeley Laboratory, University of California, Berkeley.
- Geothermal Materials Review. Published by Radian Corporation, Austin, Texas.
- Quarterly Bulletin. Published by Geo-Heat Utilization Center, Oregon Institute of Technology, Klamath Falls, Oregon.

Source: DOE, 7/80

- Geothermal Energy as a Source of Electricity

This book, authored by Dr. Ronald DiPippo of Southeastern Massachusetts University and Brown University for DGE, has been published and is being distributed. It provides a worldwide survey of the design and operation of geothermal power plants; it is intended to help communicate the message, based on actual experience, that geothermal energy is a reliable and economic energy alternative.

Source: DOE, 7/15/80

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APPENDIX

The Geothermal Progress Monitor System Organization

The GPM is intended to be an operation of DGE Headquarters, managed by DGE while developed and implemented by MITRE. However, the Headquarters and MITRE operations of the GPM represent only a small part of the overall system, the point where information is assembled and processed. Most of the data collection is done by DGE field teams. Figure 1 illustrates the overall scheme of the GPM System, including the executive levels served by the GPM and the field elements where the information originates. The actual configuration of the field elements is considerably more complex than depicted here, with a lot of information flowing among the participants in more or less informal ways.

The primary formal source of information for the GPM is the DGE field organization. This organization is comprised of DOE Regional and Operations Offices and their designated contractors and State Teams. The principal Regional and Operations offices involved with the GPM are:

- Region IX
- Region X
- DOE-Seattle
- DOE-SAN
- DOE-Idaho
- DOE-Nevada

FIGURE 1
GEOTHERMAL PROGRESS MONITOR SYSTEM

Each of these offices serves as a funnel to DGE Headquarters for information developed or collected by their contractors and state teams.

Other participants in the GPM include the member agencies of the Interagency Geothermal Coordinating Council (IGCC). Of particular note is the U.S. Geological Survey (USGS), which maintains automated files on the geothermal resources, the leasing activities on Federal land (data is from the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS)), and on drilling activities on Federal land. The USGS issues reports from these files periodically, which are a significant input to the GPM.

DGE is the coordinator and central point of contact for the GPM information collection system. MITRE serves to process, store, and prepare for dissemination the information received by the GPM System.

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GLOSSARY

APL	Applied Physics Laboratory (of Johns Hopkins University)
ASEV	Assistant Secretary, Environment (DOE)
ASRA	Assistant Secretary, Resource Applications (DOE)
BLM	Bureau of Land Management
BPWG	Budget and Planning Working Group (of the IGCC)
BTU	British Thermal Unit
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
GLGP	Geothermal Loan Guaranty Program
GPM	Geothermal Progress Monitor
GRIPS	Geothermal Resource Information and Planning Service (CA)
HELCO	Hawaii Electric Company
HUD	Housing and Urban Development
IGCC	Interagency Geothermal Coordinating Council
IMAGE	Inyo Mono Association of Government Entities
INEL	Idaho National Engineering Laboratory
KGRA	Known Geothermal Resource Area
LBL	Lawrence Berkeley Laboratory
MOU	Memorandum of Understanding
MWe	Megawatts (electric)
MWt	Megawatts (thermal)
NCPA	Northern California Power Association
NMEI	New Mexico Energy Institute
NTIS	National Technical Information Service

GLOSSARY (Concluded)

OIIT	Oregon Institute of Technology
PG&E	Pacific Gas and Electric Company
PIC	Petroleum Information Corporation
PNM	Public Services Corporation of New Mexico
PON	Program Opportunity Notice
PRDA	Program Research and Development Announcement
RA	Resource Applications
RD&D	Research, Development and Demonstration
REA	Rural Electrification Administration
SCE	Southern California Edison
SDG&E	San Diego Gas and Electric
SMUD	Sacramento Municipal Utility District
SPPC	Sierra Pacific Power Company
TIC	Technical Information Center
UP&L	Utah Power and Light
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USGS	U.S. Geological Survey