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MONTANA HYDROTHERMAL COMERCIALIZATION BASELINE

PREPARED FOR

DEPARTMENT OF ENERGY - IDAHO OPERATIONS OFFICE

DEPARTMENT OF ENERGY - RESOURCE APPLICATIONS,
GEOTHERMAL RESOURCE OFFICE

BY

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ACKNOWLEDGEMENTS

A number of people from EG&G Idaho and the Earth Science Laboratory of the University of Utah Research Institute contributed to this draft document. Input was also provided by Western Energy Planners Ltd., Stafco Inc., and G. A. Freund (consultant). Keith E. Brown of the Montana Department of Natural Resources and Conservation has been contributing on behalf of the Montana state geothermal team.

I. INTRODUCTION

Geochemical indicators and observed well and spring temperatures in Montana suggest mainly low- or moderate-temperature reservoirs best suited for direct applications. In the eastern portion of the state, the Madison aquifer contains hot water whose potential for direct uses has not been determined. Utilization of resources for direct applications has been modest, as has been leasing and development activity.

This handbook (draft) provides a synopsis of various aspects of the geothermal program in Montana. The section on Basic State Data lists government personnel (both legislative and executive branches) most directly involved with geothermal development. Some basic demographic data are also included. The various hydrothermal resources and the pertinent geology are summarized in Section 3. Activities (ranging from leases to operational systems) that lead to commercialization are described in Section 4. Plans for various developments are summarized in Section 5, while government assistance to Montana projects is listed in Section 6. The section on energy use patterns summarizes existing energy use and identifies counties and industries likely to be impacted most by geothermal energy. The section on leasing and permitting policies deals with legal and institutional considerations and includes a time table of institutional procedures for a typical resource to show the interrelationships among various organizations involved in development and regulation of the resource.

2. BASIC STATE DATA (MONTANA)

A. Government Contacts

Governor - Thomas Judge (D).

Lt. Governor - Ted Schwinden (D) (Energy policy matters reside with office of Lt. Governor).

Legislature

Senate Natural Resources Committee: Senator George F. Roski (R), Chairman.

Senate President ProTem: Sen. Williams Mathers (R).

Assembly Natural Resources Committee: Rep. Arthur H. Sheldon (D), Chairman.

Speaker of the Assembly: Rep. Harold Gerke (D).

State Geothermal Team

Operations Research: Randy Moy, Ray Brueninger, Keith E. Brown, Montana Department of Natural Resources.

Resource Assessment: John Sonderreger, Montana Bureau of Mines.

State Agencies

Department of Natural Resources and Conservation: Ted Doney, Director.

Oil and Gas Conservation Division: Donald Chisholm, Administrator.

Energy Planning Division: Randy Moy, Administrator.

Department of State Lands: Leo Barry, Commissioner of State Lands.

Department of Public Service Regulation: Win J. Opity, Executive Director; Gordon Bollinger, Chairman.

Department of Health and Environmental Services: Arthur C. Knight, MD, Director.

Montana Bureau of Mines: SID GROFF, DIRECTOR

Department of Highways:

Department of Fish and Game:

B. Statistical Data

Demographic

Population (1975 estimate): 742,500

Area: 147,138 sq. mi.

Population Density: 5.0 people/sq. mi.

Geothermal Resources

Confirmed Reservoirs > 150°C: None

Prospects < 150°C: 5

Confirmed Reservoirs - 20°C < T < 150°C: 8

Prospects - 20°C < T < 150°C: Many

Identified Warm Springs & Wells T > 40°C: 30-40

Geothermal Leases

Federal: 10,687 acres

State: None

Private: N. A.

Test Wells: ∿ 5

Operational Hydrothermal Systems

Spas: Three

Space Heating: Three

Others: None

Major Active Developments

Direct Use: Warm Springs State Hospital

Electric: None

Government Assisted Activities

PON's: Warm Springs State Hospital

PRDA: Fort Peck Indian Reservation

Loan Guarantees: None

Energy

Supply (1975): 710 x 10^{12} Btu; 60% Exported; 5% Imported.

Use (1975): 280 x 10^{12} Btu.

Potential Conversion to geothermal (1975): 20 x 10^{12} Btu.

is this all?

3. HYDROTHERMAL RESOURCES

A. Geologic Setting[1]

Three physiographic provinces occur in Montana: the Northern Rocky Mountains, the Middle Rocky Mountains, and the Great Plains. The Rocky Mountains Provinces are composed of faulted and folded sedimentary rocks and intrusive rocks which form mountain blocks and intermontane basins. The Boulder Bathalith in southwestern Montana is a large intrusion which has been dated at 68 to 74 million years before present. Southwestern Montana contains a broad area with higher-than-normal heat flow and with numerous hot springs. Geochemical indicators and observed well and spring temperatures suggest mainly low- or moderate-temperature reservoirs best suited for direct heat applications. In the eastern portion of the state, the Madison aquifer contains hot water whose potential for direct-heat uses has not been determined. Ref Sonderegger ?

B. High Temperature Resources (>150°C)[2] (see Figure 3.2)

Confirmed Reservoirs: None.

? based on what

Prospects: Barkell-Biltmore area, West Yellowstone KGRA, Corwin KGRA, Hunters Hot Springs, Marysville KGRA. pg 6-4

C. Low- and Moderate-Temperature Resources (<150°C)[2] (see Figure 3.2)

Confirmed Reservoirs: Hunter's Spring, White Sulphur Springs, Warm Springs, Fairmont, Silver Star, Bozeman Hot Springs, Boulder, Broadwater, Ennis.

Prospects: Madison Aquifer in eastern Montana., other H.S.

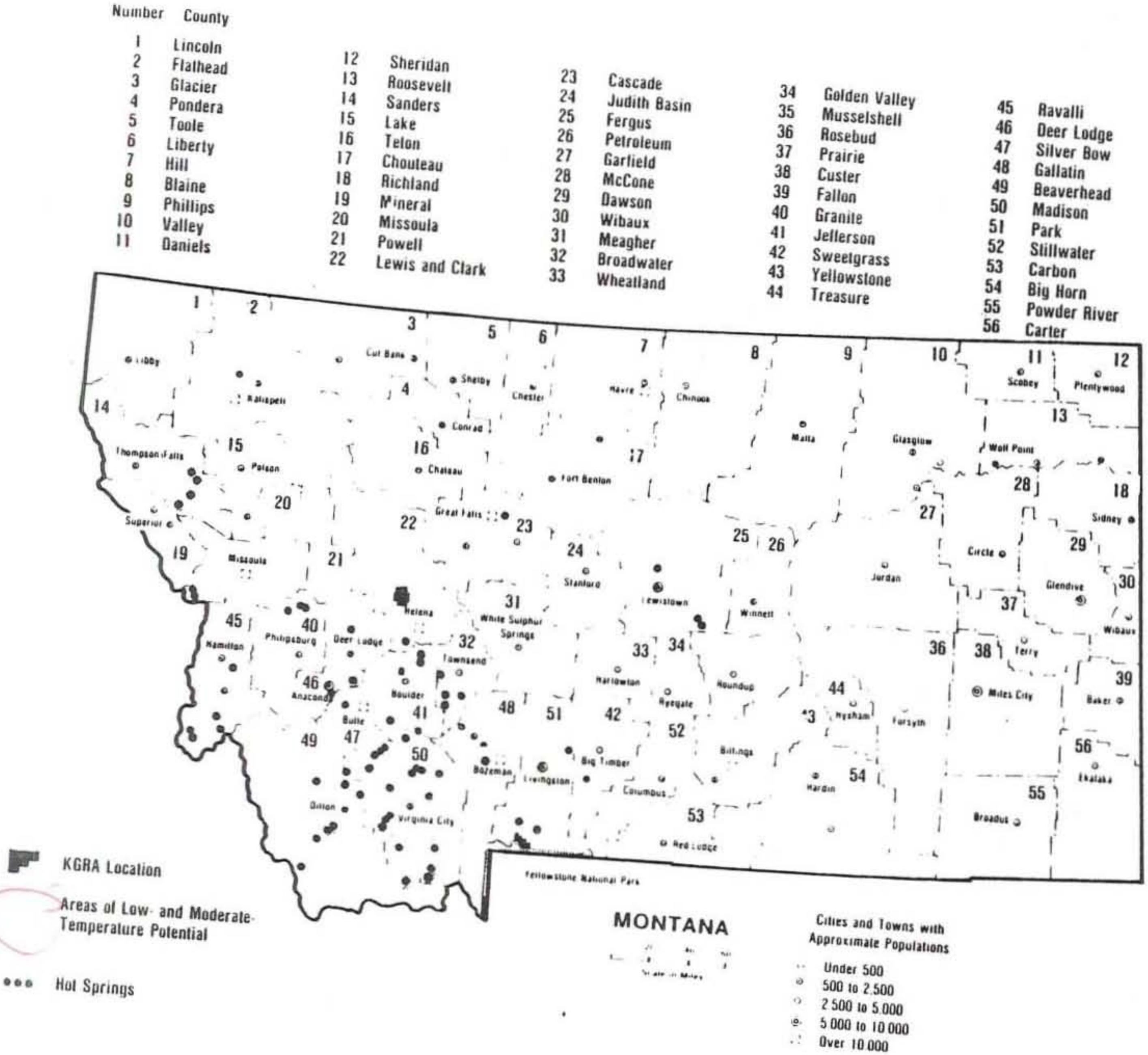


Fig. 3.2 Montana counties and geothermal springs and resource areas [37]

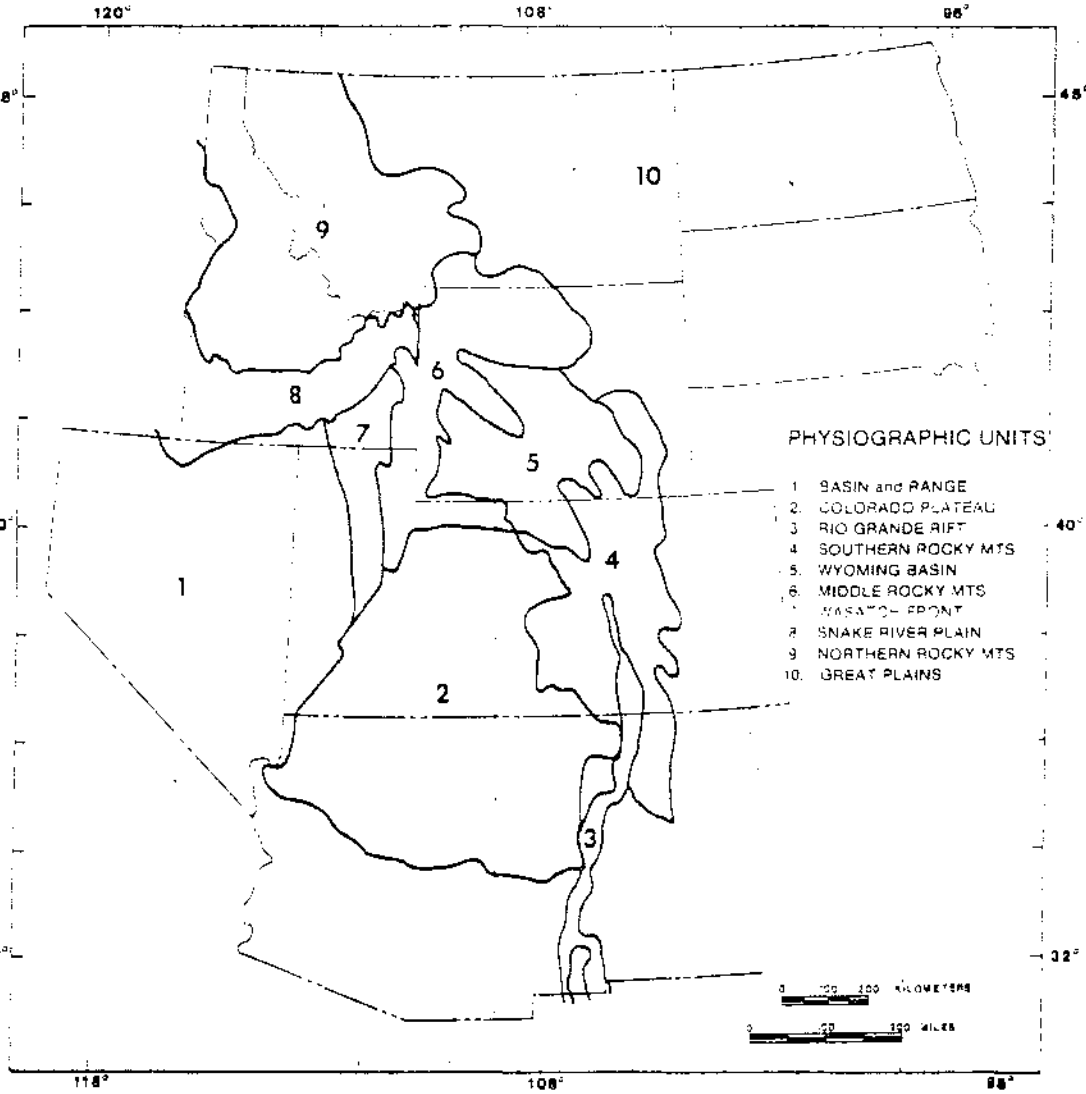


Fig. 3.1 Physiographic Provinces[1]

D. Comments

The West Yellowstone and Gardiner areas have attracted some industry interest, but no exploratory drilling has occurred to date.

Moderate discovery potential exists for high-temperature systems in the Yellowstone area. Blind potential systems (lacking ~~in~~ surface manifestations) may exist, as indicated by the discovery of moderate-temperature water at Marysville.

Deep irrigation wells in the Madison aquifer in eastern and southeastern Montana produce warm water suitable for direct-heat applications.

Because of the numerous hot springs, potential for yet undiscovered low- and moderate-temperature hydrothermal resources appears to be good.

E. Hydrothermal Springs and Wells

A listing of hydrothermal springs and wells with measured temperatures in excess of 40°C is given in Table 3.1 for Montana[4].

TABLE 3.1

HYDROTHERMAL SPRINGS AND WELLS - MONTANA
(Source: USGS File GEOTHERM) (date aquired

(S) Surface
(W) Well

COUNTY, NAME AND TYPE	LOCATION	TEMP °C	FLOW L/min	TOTAL DISSOLVED SOLIDS, ppm
BEAVERHEAD				
(S)	T5S, R15W	58.0	1000	
(S)	T4S, R12W	48.5	400	
Elkhorn Hot Springs (S)	T4S, R12W	48.5	379	
Jackson Hot Springs (S)	T5S, R15W	58.0	1003	670
Lucas Flowing Well (W)		42.2	375	3092
Madison County? Norris Hot Springs (S)	T3S, R1W	52.5	397	646
DEER LODGE				
(S)	T5N, R10W	77.0	600	
Gregson Hot Springs (S)	T3N, R10W	70.0	1000	478
Warm Springs (State Hospital) (S)	T5N, R10W	77.0		1250
GALLATIN				
(S)	T2S, R4E	50.0		
Bozeman Hot Springs (W)	T2S, R4E	50.0		433
JEFFERSON				
(S)	T5N, R4W	62.0		
Pipestone (S)	T2N, R5W	57.0	300	
Alhambra Hot Spring (S)	T8N, R3W	55.0	189	953
Alhambra Hot Springs (S)	T8N, R3w	56.5	42	660
Boulder Hot Springs (S)	T5N, R4W	76.0	2233	420

TABLE 3.1 (contd)

COUNTY, NAME AND TYPE	LOCATION	TEMP °C	FLOW L/min	TOTAL DISSOLVED SOLIDS, ppm
LAKE				
Campaqua Hot Springs (S)	T22N, R23W	50.8	1249	
LEWIS AND CLARK				
(S)	T10N, R4W	62.0	50	
Broadwater (Helena) (S)	T10N, R4W	62.0		593
Marysville Test Well (W)	T12N, R6W	96.5		675
MADISON				
(S)	T3S, R2W	49.5		
(S)	T2S, R6W	71.5	150	
(S)	T4S, R7W	53.0	100	
Ennis Hot Springs (Thexton) (S)	T5S, R1W	83.2		801
Norris Hot Springs (S)	T3S, R1W	52.5	400	
Potosi Hot Springs (S)	T3S, R2W	49.5	197	333
Pullers (S)	T8S, R5W	42.2	580	
Renova Hot Springs (S)	T1N, R4W	50.0	151	652
Barkell - Biltmore Silver Star Hot Springs (S)	T2S, R6W	71.5		610
Wolf Creek Hot Springs (S)	T10S, R1E	68.0	201	363
MEAGHER				
(S)	T9N, R6E	46.0	1750	
Ringling Flowing Well (W)	T7N, R7E	48.0	3028	1351
White Sulphur Springs (S)	T9N, R7E	46.0		1512

see pg. 4-11

TABLE 3.1 (contd)

COUNTY, NAME AND TYPE	LOCATION	TEMP °C	FLOW L/min	TOTAL DISSOLVED SOLIDS, ppm
MISSOULA				
(S)	T11N, R23W	44.0	100	
Granite Hot Springs (S)	T11N, R23W	50.6	371	
LoLo Hot Springs (S)	T11N, R23W	46.4	681.	
LoLo Hot Springs (S)	T11N, R23W	44.0	98	196
PARK				
(S)	T6S, R8E	42.0	500	
(S)	T8S, R8E	65.0	500	
(S)	T8S, R8E	65.0	500	
(S)	T1S, R12E	60.0	5000	
(S)	T1S, R12E	60.0	5000	
(S)	T1S, R12E	57.0	5000	
Chico Hot Springs (S)	T6S, R9E	48.0	500	255
Hunter Hot Springs (S)	T1S, R12E	60.0		289
La Duke Hot Springs (S)	T8S, R8E	65.0	500	2077
RAVALLI				
(S)	T1N, R20W	45.0	400	
(S)		52.0	2000	
Gallaogly Warm Springs (S)	T1S, R19W	48.9	454	190
Medicine Warm Springs (S)	T1N, R20W	45.0		257
Sleeping Child Warm Spring (S)	T4N, R19W	52.0	800	390

TABLE 3.1 (contd)

COUNTY, NAME AND TYPE	LOCATION	TEMP °C	FLOW L/min	TOTAL DISSOLVED SOLIDS, ppm
SANDERS				
(S)	T21N, R24W	45.0		
Camas Hot Springs (S)	T21N, R24W	45.0	379	
Quinn's Hot Springs (S)	T18N, R25W	42.8	76	227
Symes Hot Springs (W)	T21N, R24W	46.1		367
SILVER BOW				
(S)	T3N, R10W	70.0	1000	

F. References

[1] Regional Hydrothermal Commercialization Plan, Department of Energy-Division of Geothermal Energy and Idaho Operations Office, EG&G, Idaho, Inc., and the University of Utah Research Institute Earth Science laboratory.

[2] K. E. Brown, Montana Department of Natural Resources, Private Communication, May 1979.

[3] L. J. P. Muffler, Ed., Assessment of Geothermal Resources of the United States - 1978, Geological Survey Circular 790, 1979.

[4] USGS File GEOTHERM.

4. COMMERCIALIZATION ACTIVITIES

A. Highlights

Surface manifestations of geothermal energy in Montana have been evident from earliest recorded times of our country. The most widely known area was described by the Indians as a "supernatural place" involved in the "production of the Evil Spirit". Later it became known as "Colter's Hell" from tales John Colter brought back from trading and trapping expeditions. It is now known as Yellowstone National Park. Another widely known area was discovered by Dr. Andrew Jackson Hunter. He settled Hunter's Hot Springs in 1870 because of the attractive qualities of a continuous hot water supply[1].

Over 100 thermal springs are known in Montana. Temperatures of the hotter springs are known and a number of the cooler springs have also been tested.

The partial breakdown according to temperature is as follows:

149°F or greater - 7 springs
130°F to 149°F - 6 springs
110°F to 129°F - 13 springs
90°F to 109°F - 7 springs

The remaining springs are either less than 90°F or temperatures have not been recorded.

Reservoir temperatures up to 183°C have been predicted for the major springs. The geothermometry gives many reservoir temperatures in excess of 100°C. Surface geology provides good indications that many unknown geothermal reservoirs may exist in Montana. Development of better geophysical techniques will aid in locating these resources.

Many of the states hottest springs have been analyzed for subsurface reservoir potential. Some spring sites have had geological mapping with hydrothermal modeling. A few small drilling projects have occurred at sites such as White Sulphur Springs, Broadwater Hot Springs, Ennis Hot Springs, and the Centennial Valley.

A major drill hole for the purpose of hot dry rock resource assessment in the Maryville area was funded by the National Science Foundation in 1974[2,3]. The site for the Maryville geothermal project was based primarily upon the results of 15 relatively shallow heat flow boreholes that had been investigated by D. D. Blackwell. Apparent heat flow determinations obtain in these shallow holes ranges from 3.1 to 19.5 HFU, indicating a significant thermal anomaly. Based upon these and other geological and geophysical data, a deep production well was drilled to a depth of 2070 m. The well penetrated an extensive hydrothermal zone of about 93°C water that was essentially isothermal from 610 m to 2070 m. Hence, the hypothesis that molten magma (and abundant hot dry rock) existed at shallow depth proved to be incorrect.

The DOE awarded a geothermal PON in 1978 for the Warm Springs district heating project. The project is being conducted by the Montana Energy Research and Development and MHD Institute.

The Montana Major Facilities Siting Act, which includes geothermal energy productions, was amended by the 1979 State Legislature to provide for a lower limit on energy production covered by provisions of the Act. The lower limit for electrical production remains at 50 MW, but the amendment provides a lower limit of 25×10^6 Btu/hr for geothermal energy production (apparently referring to direct use, but "direct use" is not specifically stated)[4].

B. Leases

Little leasing activity has taken place in Montana on federal lands. Tables 4.1 - 4.5 and Figure 4.1 present information about these leases in various levels of detail. Table 4.1 provides latest totals of Federal and State acreages leased to private organizations for geothermal development. Figure 4.1 provides for federal lands in Montana a synopsis of various leasing summaries produced by Automatic Data Processing (ADP) of USGS' Conservation Division. It traces the three types of federal leases (noncompetitive, competitive, and Indian Land) from inception to production. For noncompetitive leases it summarizes: (1) applications, (2) withdrawals, (3) rejections, (4) pending actions, (5) total leases, (6) terminations, (7) active leases, (8) production status and, (9) unitization. For competitive leases it summarizes offerings and the same items (5) - (9) as for the noncompetitive leases. For Indian land leases, it shows the same items (5) - (9). Some entries appear in more than one ADP format and minor discrepancies exist for these entries, possibly because the summaries are run on different dates. These discrepancies should be correctible in updates of the baseline document. Table 4.2 gives a county-by-county listing of the various holders of active noncompetitive Federal leases and the extent and location of their holdings.

Table 4.3 summarizes by KGRA the bidding history for competitive geothermal lease sales on federal lands in Montana. It lists the KGRA, the county, number of sale dates, number of tracts and acreage offered, number of offerings culminating in leases, acreage leased, and average cost per acre in successful bids.

Table 4.4 gives a county-by-county listing of the various holders of active competitive Federal leases, the extent and location of their holdings, the effective date and cost per acre of the lease.

Table 4.5 is provided for a listing of holders of active state leases in Montana and the extent of their holdings. No state leases have been issued by the Department of State Lands; no lease sales have been held; one application is pending.

TABLE 4.1

TOTAL ACREAGES OF GEOTHERMAL LEASES - MONTANA

(as of March 1979)

Federal Leases:	
Total Acreages of Competitive Leases in KGRA's:	None
Total Acreages of Non-Competitive Leases:	10,687
(Six leases)	
State Leases:	
Total Acreages of State Leases:	None
TOTAL OF ALL ACREAGES LEASED	10,687

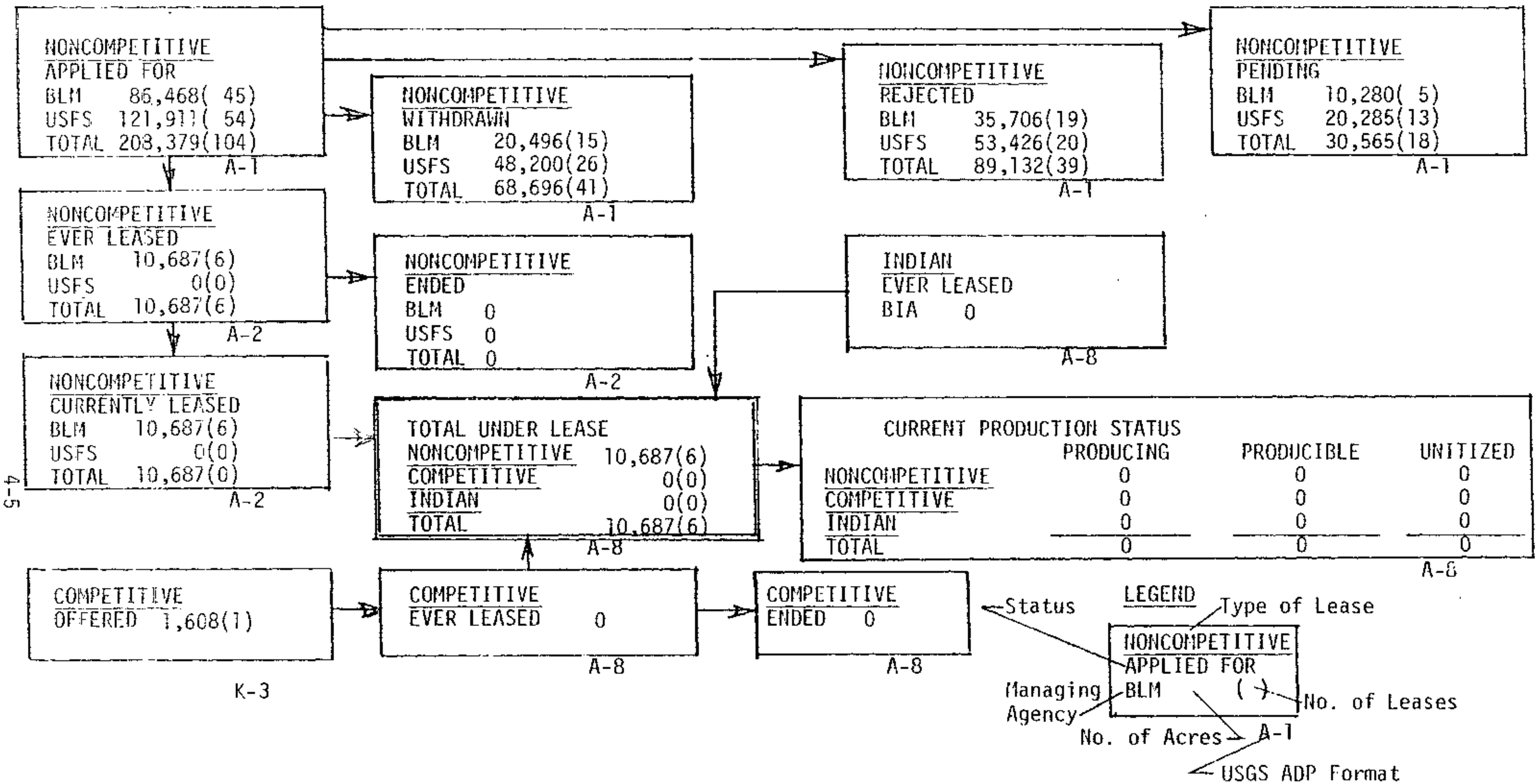


Figure 4.1. Summary of Federal Leasing Activity - Montana

(Source - USGS ADP File)[1]

TABLE 4.2

FEDERAL ACTIVE NON-COMPETITIVE GEOTHERMAL LEASES - MONTANA

(as of 3/14/79)

COUNTY & LESSEE	SIZE, ACRES & (NO. OF LEASES)	LOCATION
MADISON		
Phillips Petroleum Co.	10,687.42(6)	T1, 2, &4S, R6 & 7W, One lease partly in Silverbow County.

TABLE 4.3

SUMMARY OF BIDDING HISTORY FOR COMPETITIVE GEOTHERMAL LEASE SALES ON FEDERAL LANDS - MONTANA
(Source USGS ADP File - Format K-4)

COUNTY	KGRA	OFFERED SALES	(INC. REOFFERS) TRACTS	ACREAGE	LEASES ISSUED NUMBER	ACREAGE	AVG. $/ ACRE
Jefferson	Boulder Hot Springs	1	1	1,608	0	0	N. A.
TOTAL		1	1	1,608	0	0	N. A.

TABLE 4.4

FEDERAL ACTIVE COMPETITIVE GEOTHERMAL LEASES - MONTANA

(as of 3/14/79)

COUNTY & LESSEE	SIZE, ACRES & (NO. OF LEASES)	KGRA/LOCATION	DATE ISSUED & (COST/ACRE)
NONE			

TABLE 4.5

STATE LEASES - MONTANA

COUNTY & LESSEE	SIZE, ACRES & (NO. OF LEASES)	LOCATION
None		

C. Test Wells

Test wells in Montana are listed in Table 4.6.

TABLE 4.6

TEST WELLS - MONTANA

COUNTY & LOCATION	COMMENTS
GALLATIN	
Bozeman	One 450 ft deep hole has been drilled.
LEWIS AND CLARK	
Broadwater	Several 200 ft deep holes have been drilled.
Marysville	One 6,600 ft deep exploration hole has been drilled.
MEAGHER	
White Sulphur Springs	One 1,000 ft deep exploration hole has been drilled.
SANDERS	
Camas	One well, depth unknown, has been drilled.

Cent. valley?

D. Other Exploratory Activity

Other exploratory activity in Montana for geothermal resources is given in Table 4.7.

TABLE 4.7

OTHER EXPLORATORY ACTIVITY - MONTANA

COUNTY & LOCATION	COMMENTS
DEER LODGE	
Warm Spring	Gravity, geology, resistivity and seismic surveys have been performed.
GALLATIN	
Bozeman Hot Springs	Resistivity and soil temperatures, and hammer seismic surveys have been performed.
West Yellowstone KGRA	Earthquake, aeromagnetic and heat flow surveys have been performed.
GRANITE	
Bearmouth Area	Geochemistry, age dating of volcanic rock, microearthquake, magnetic, and gravity surveys have been performed.
LEWIS AND CLARK	
Broadwater Hot Springs	Resistivity and hydrogeologic modeling surveys have been performed.
Marysville KGRA	Magnetic, electrical, seismic ground noise, microearthquake, infrared gravity surveys and heat flows have been performed.
MADISON	
Barkells-Biltmore	Phillips Petroleum has leases in this area, test wells are to be drilled.
Barkells Hot Springs	Regional gravity, soil temperatures, hammer seismic, resistivity, and broad resistivity surveys have been performed.
Ennis	Several temperature gradient holes have been drilled to 3000 ft.

Two Different sites?

COUNTY & LOCATION	COMMENTS
Ennis Hot Springs	Temperature gradient, resistivity, gravity, infrared, magnetic, and seismic surveys have been performed.
Norris Hot Springs	Resistivity and hammer seismic surveys by USGS.
MEAGHER	
White Sulphur Springs	Soil temperature, resistivity and magnetometer surveys have been performed.
PARK	
Corwin	Hydrogeologic mapping and modeling have been performed.
Hunter's Hot Springs	Geology and geophysical work short of drilling has been performed by private concerns interested in electrical production. DC resistivity and hammer seismic surveys have also been performed by MSU. A wildcat electrical exploration was discontinued because of difficulty in obtaining state land leases. No holes were drilled.
POWELL	
Deer Lodge Warm Springs	Gravimetric, geology, seismic, resistivity, and gravity surveys have been performed.
VARIOUS IN EASTERN MONTANA	
Madison Formation	Ideal flow and formation mapping was performed by the USGS from 1977 to 1979.

E. Operational Systems

Table 4.8 provides a summary of operational systems using geothermal energy in Montana.

F. References

[1] K. E. Brown, Montana Geothermal Planning and Resource Inventory - 1978 Report, OIT and Montana Department of Natural Resources and Conservation, ______, 1979 (Draft).

[2] Hot Dry Rock Geothermal Energy: Status of Exploration and Assessment, ERDA Division of Geothermal Energy, ERDA 77-74, June 1977.

[3] D. D. Blackwell, Heat Flow Determinations in the Northwestern United States, J. Geophys. Res., 74, 992-1007 (1969).

[4] K. E. Brown, Montana Department of Natural Resources and Conservation, Private Communication, April 1979.

[5] USGS Conservation Division, Office of Geothermal Supervisor, Automatic Data Processing File.

TABLE 4.8

OPERATIONAL HYDROTHERMAL SYSTEMS - MONTANA

COUNTY & USE	LOCATION	COMMENTS
DEER LODGE		
Space heating	Warm Springs	The hospital complex will be geothermally heated (Department of Institutions, State of Montana).
GALLATIN		
Swimming Pools & Baths	Bozeman Hot Springs	Swimming pool, Charles Page, Operator.
Space heating	Bozeman Hot Springs	3 houses, 1 very large warehouse, and shop area. Owner recently received a state grant to expand resource base.
LEWIS AND CLARK		
Swimming Pools & Baths	Broadwater Hot Springs	Spa, Frank Gruber, Operator.
Space heating	Broadwater Hot Springs	Spa and sports club. The owner is preparing to build a 100-300 unit subdivision to be heated from the hot springs, if sewage disposal problems can be resolved.
MEAGHER		
Space heating	White Sulphur Springs	A bank to be heated from a recent well; (First National Bank of White Sulphur Springs, Mike Grove).

5. DEVELOPMENT PLANS

A. Description

The State of Montana through the Oregon Institute of Technology and the Department of Natural Resources and Conservation has participated since October 1977 in the DOE Operations Research Geothermal Planning Project. One major objective of this DOE/State geothermal planning process has been to generate specific plans for the prospective development and commercialization of geothermal energy from current time through the year 2020.

The present planning process for Montana and other states of the Rocky Mountain Basin and Range Region consists of three categories of plans for prospective and actual geothermal developments. The three plans are called Area Development Plans (ADP), Site Specific Development Plans (SSDP), and Time Phased Project Plans (TPPP).

Area Development Plans are plans for prospective development of geothermal resources and utilization of the geothermal energy for a multi-county, sub-state area. The plan encompasses several geothermal resource sites and all potential residential, commercial, industrial and agricultural uses of geothermal energy. The geothermal resource sites for an ADP include confirmed (proven) reservoirs and reservoir prospects (potential and inferred resources). In most cases no private sector action toward development or commercialization has taken place. The time table for an ADP is a best guess of when increments of geothermal energy will come on line from the several geothermal prospects for the several applications of the multi-county area.

Site Specific Development Plans are plans for development of specific geothermal single or integrated applications of the geothermal energy. The plans are restricted to confirmed (proven) reservoirs and potential reservoirs. Applications may be for any electric and/or direct thermal use of geothermal energy which is compatible with the quality of the confirmed (proven) or potential resource. In most cases, either some level of development or commercialization activity is already underway or is deserving of consideration by the community of geothermal energy developers and users. The time schedule of events in a SSDP represents a possible sequence of technological and institutional achievements under an atmosphere generally favorable for geothermal development of the specific site and application.

Time Phased Project Plans are plans for geothermal developments that are now at a commercialization level of activity or are in advanced stages of planning by the public and private sectors. The plans are confined to site-specific confirmed reservoirs or high potential geothermal prospects and to specific energy consumptive applications, either electric or direct thermal. The TPPP portrays or reproduces as closely as possible the actual planning and construction array of events and the associated time schedule of the commercial developer and user of the geothermal energy. The TPPP reveals actions by both the private and government sectors that must be accomplished on time in order to achieve successful geothermal energy production and utilization of a specific site for a committed application.

Table 5.1 identifies for Montana the geothermal resource sites and applications for which development plans have been prepared or which are candidates (designated by asterisk) for the preparation of development plans by the State Planning Teams in 1979[1].

B. References

TABLE 5.1

DEVELOPMENT PLANS - MONTANA

TIME PHASED PROJECT PLANS	SITE SPECIFIC DEVELOPMENT PLANS	AREA DEVELOPMENT PLANS
Warm Springs (Space heating of State Mental Hospital Complex)*	Barkells Hot Springs (District hating, electrical, greenhouses)	Madison Aquifer
	Boulder Hot Springs KGRA (Aquaculture, district heating, greenhouses)	Lewis & Clark, Jefferson & Broadwater Counties*
	Bozeman Hot Springs (Space heating, greenhouses)	Madison County
	Broadwater Hot Springs (Space heating, greenhouses)	Powder River Area*
	Corwin Springs KGRA (Electrical, space heating, recreational, greenhouses)	Meagher, Gallatin, and Park Counties*
	Deer Lodge Warm Springs (Greenhouses, space heating, agricultural)	Powell, Granite, Deer Lodge & Silver Bow Counties*
	Ennis Hot Springs (Space heating, greenhouses)	Northeastern Montana*
	Hunter's Hot Springs (Aquaculture, greenhouse)	Flathead, Lincoln Sanders & Lake Counties*
	Marysville KGRA (Electrical, district heating)	
	New Biltmore Hot Springs (Greenhouses, recreational)	
	Warm Springs (Space and water heating, agricultural, greenhouses)	
	West Yellowstone KGRA (Electrical, district heating, lumber drying)	
	White Sulphur Springs (District heating, wood processing, agricultural)	

* Candidates for development plans in 1979.

6. GOVERNMENT ASSISTED ACTIVITIES

A. Geothermal Direct Use PON Program

Background: In September 1977 and April 1978, the Department of Energy (DOE), Division of Geothermal Energy, in conjunction with the San Francisco Operations Office, issued a document which indicated DOE's desire to receive and consider for partial support proposals for direct heat utilization or combined electric/direct heat utilization field experiments demonstrating single or multiple usages of geothermal energy. These documents were issued under the title, "Program Opportunity Notice - Direct Utilization of Geothermal Energy Resources - Field Experiments". The Program Opportunity Notice (PON) is the name of this offering document, but it has become common practice to call any program which results from these notices a PON.

These solicitations are part of DOE's national geothermal energy program plan, which has as its goal the near-term commercialization by the private sector of hydrothermal resources for direct use purposes. Encouragement is being given to the private sector by DOE cost sharing a significant portion of the front-end financial risk in a limited number of field experiments.

DOE's primary interest under these PONs is to encourage field experiments in space/water heating and cooling for residential and commercial buildings, agricultural and aquacultural uses, and industrial processing application.

Current Status: Fifteen proposals from PON No. EG-78-N-03-2047, with closing date July 18, 1978, are in the contract negotiation stage, per an October 1978 announcement by DOE. One of these is in Montana:

Montana Energy and MHD Research and Development Institute, Inc., Butte, Montana: to design, construct, and operate a geothermal conversion system for space heating of the Warm Springs State Hospital, Montana.

B. Program Research and Development Announcement

Background: This program, commonly referred to as the PRDA program, is to provide funding for engineering and economic studies for direct applications of geothermal energy. The last announcement had a closing date for applications of January 16, 1979. Studies are up to $125,000 each, and cover a study period of six to twelve months.

Current Status: Under the latest PRDA solicitation, one proposal from Montana has been selected by DOE, as of May 1979, as the basis for a contract negotiation: to the Fort Peck Indian Reservation for a heating system at Poplar.

C. Demonstration Projects and Experiments

None

D. Geothermal Loan Guaranty Program (GLGP)

Background: Congress authorized $300,000,000 for loan guaranties. Each loan can be up to 75% of the total development cost. Nationally, DOE has received eleven applications to date, totalling $150,000,000 in loan guaranties. Of those eleven, three have been approved (two electric and one direct application); two turned down; one withdrawn; one is obtaining more information, and four are in the review process.

Current Status: No activity thus far in Montana.

E. National Conference of State Legislatures (NCSL)

Background: After a preliminary study on geothermal energy in 1976, the National Conference of State Legislatures (NCSL) launched the Geothermal Policy Project in January 1978. The objective of the project is to stimulate and assist the review of state policies that affect the development of geothermal resources. Successful completion of the project is to facilitate state statutory and regulatory environments that are consistent with efficient development of geothermal resources.

Current Status: The project selected six states in which to concentrate its efforts in 1978. Montana is not one of these states so there has been no activity on this project in the state.

F. State Coupled Program

Background: The objectives of the State Coupled Program are: (1) to assist the U. S. Geological Survey in its ongoing geothermal resource assessment effort, and (2) to stimulate confirmation of low- and intermediate-temperature reservoirs at sites with an apparent but unquantified potential for direct heat application development. Major energy companies have generally shown little interest in lower grade resources because of a national and industrial focus on electrical power generation.

The State Coupled Program consists of cooperative effort among: (1) DOE, (2) an agency or institution in each state, (3) the U.S. Geological Survey, (4) the National Atmospheric and Oceanic Administration (NOAA), and (5) the Earth Science Laboratory of the University of Utah Research Institute. DOE provides overall program management and direction. The State Agency manages and performs the project within the state. The U.S. Geological Survey interfaces with the program through the local Water Resources Division Offices, through the U.S. Geological Survey Geothermal Program Office, and by providing the use of computer file GEOTHERM. NOAA will publish the state map. The Earth Science Laboratory provides management assistance to DOE.

In order to accomplish this work contracts are written between DOE and each participating state. A separate contract for overall management assistance and program coordination is negotiated between DOE and the University of Utah/University of Utah Research Institute.

Each state project consists of: (1) Phase I, geothermal data compilation, with emphasis on low- and intermediate-temperature systems, culminating in publication of state maps and reports on the location and possible viability of geothermal resources, and (2) Phase II, investigation of specific geothermal sites, with drilling to demonstrate reservoir characteristics.

Current Status: Sixty-eight records from thermal springs and wells have been submitted by the Montana Bureau of Mines and Geology to USGS file GEOTHERM. Fourteen areas ~~of moderately restricted areal extent~~ were selected for inclusion on the Circular 790 map.

The Phase I data base now contains a fairly complete listing of thermal springs in Montana; more compilation of thermal wells is needed to better identify abnormally warm areas. A study of mine waters has indicated a few potential resource areas. Montana, unlike most other states in the Rocky Mountains, contains no sites where temperature measurements or geochemical thermometers indicate high temperature resources (>150°C).

see pages 3-1, 4-1 !!

Phase II studies are being concentrated in the Ennis area where interest for greenhouse and space heating exists and where the USGS has a complementary program, in the West Yellowstone area where space heating utilization might be made, and in the Deer Lodge Valley where prison and hospital heating is being considered. Geothermal energy is being used for heating a bank in White Sulphur Springs.

G. Industry Coupled Program

Background: The purpose of DOE's Industry Coupled Program is to foster a viable geothermal electrical power generation industry in the United States. Development by industry has been seriously lagging due to a number of problems. Front end costs are high in geothermal development due to leasing costs, regulatory costs, and the high cost of exploration, particularly for drilling. In addition, geothermal electrical power generation is a high-risk venture given the uncertainties of reservoir longevity. As a result of these factors, industry has made only a limited commitment to the development of high-temperature resources.

The Industry Coupled Program addresses some of the above problems through: (1) cost sharing with industry for exploration, reservoir assessment and reservoir confirmation, (2) release to the public of geoscience data which will improve our understanding of the geothermal resource. Improved understanding will decrease reservoir uncertainty and lower exploration and assessment costs.

The Program is a cooperative effort between DOE and an industrial organization engaged in geothermal exploration. Industry responds with proposals to DOE procurement initiatives. Succcessful proposers then negotiate contracts with DOE. The contracts specify: (1) an exploration and/or reservoir confirmation program which industry will manage and perform, (2) a data package which industry agrees to make public, and (3) a certain percentage of total costs (generally in the range of 20% to 50%) which DOE will contribute toward funding the work.

The Earth Science Laboratory of the University of Utah Research Institute provides assistance to DOE on the Industry Coupled Program by: (1) assisting in management of the Program, (2) releasing geoscience data generated by the program to public open file, and (3) interpreting and supplementing the above data for the purpose of developing and publishing reservoir case studies.

Current Status: There has been no activity in the Industry Coupled Program in Montana.

H. Technical Assistance

Background: Technical assistance is provided to potential geothermal users as an on-call service by EG&G Idaho's geothermal program Office and by the Earth Sciences Laboratory of UURI. The strategy of this program is to provide a catalytic agent in fostering geothermal energy use, particularly for direct applications. The amount of assistance given is limited so as to protect the interest of private engineering organizations and others working in the field. Generally, enough information is provided so that a potential user can make an evaluation of how or where to proceed. The technical assistance activity is extensive: 115 separate requests were handled for the ten-state Rocky Mountain Basin and Range Region during the first half of FY-79.

Current Status: Assistance has been given to the following organizations and individuals in Montana:

(1) MERDI, Butte, Montana - assistance given in developing resources at Warm Springs Hospital for greenhousing, heating, and process heat use.

(2) Lolo Hot Springs - assistance in developing the resource for heating the resort and possible 'snow making' machines.

(3) Ray Bosley, Deer Lodge, Montana - assistance given for a 33,000 acre cattle ranch for greenhousing, methane production.

(4) Sun Ranch, Cameron, Montana - assistance to develop the Wolf Creek Hot Springs for greenhousing, also hydropower and geothermal electric with 140°F.

(5) First National Bank, White Sulphur Springs, Montana - assistance in preparation of proposal for a Montana Natural Resources Grant to heat the bank.

(6) Frank Gruber, Helena, Montana - assistance to this residential developer ended in heating a house and now doing a spa complex.

I. State Assisted Activities

Montana has an Alternative Renewable Energy Sources Program funded by some of the receipts from the coal severance tax. Specifically, 2-1/2 percent of the tax receipts not held in trust fund this program. (Effective July 1, 1979 the percentage is increased to 5%.) Since 1975, $1.7 million in grants have been awarded through this program; estimated receipts to the program from the tax are $750-850,000 for fiscal year 1979.

Five geothermal grants have been awarded under this program:

(1) Montana Tech - $10,265 for geophysical work at Warm Springs State Hospital.
(2) Montana Energy and MHD Research Institute - $9,000 for feasibility study at Warm Springs State Hospital.
(3) First National Bank, White Sulphur Springs - $43,500 to drill 890 ft well and provide space heating for bank building.

(4) Memorial Hospital, White Sulphur Springs - $2,000 to support drilling test well.

(5) Private residence in Broadwater area of Helena - $15,000 for well and home heating system.

J. <u>References</u>

7. ENERGY USE PATTERNS

A. Energy Use Summary - Montana[1,2]

Montana's large deposits of coal make it a net exporter of energy (Figure 7.1). The state also exports a small amount of oil and an almost insignificant portion of its hydroelectricity. About 40% of Montana'a natural gas is imported; this is the second largest energy source used by industry and the largest used in the residential sector. Figure 7.2 is the energy-use map for Montana.

Montana's industries are average energy consumers for the region. Oil is the primary source of energy for industry, and natural gas is second. The stone, clay, and glass-products industry uses about 15% of the industrial total, followed by petroleum and coal products (∿13%), and food and kindred products (∿8%).

The residential and commercial sectors account for approximately one-third of Montana's energy consumption. Due to its geographic location and its cold climate, its space conditioning requirements should be the same or a little greater than Idaho's, about 80% of the energy used by the residential sector.

Based upon the Energy Information Administration's projections, energy consumption in the northcentral region, which includes Montana, will experience a 2.8% increase per year from 1975 to 1985. Extrapolating this rate to the year 2000 will almost double the 1975 energy consumption as shown in Figure 7.3.

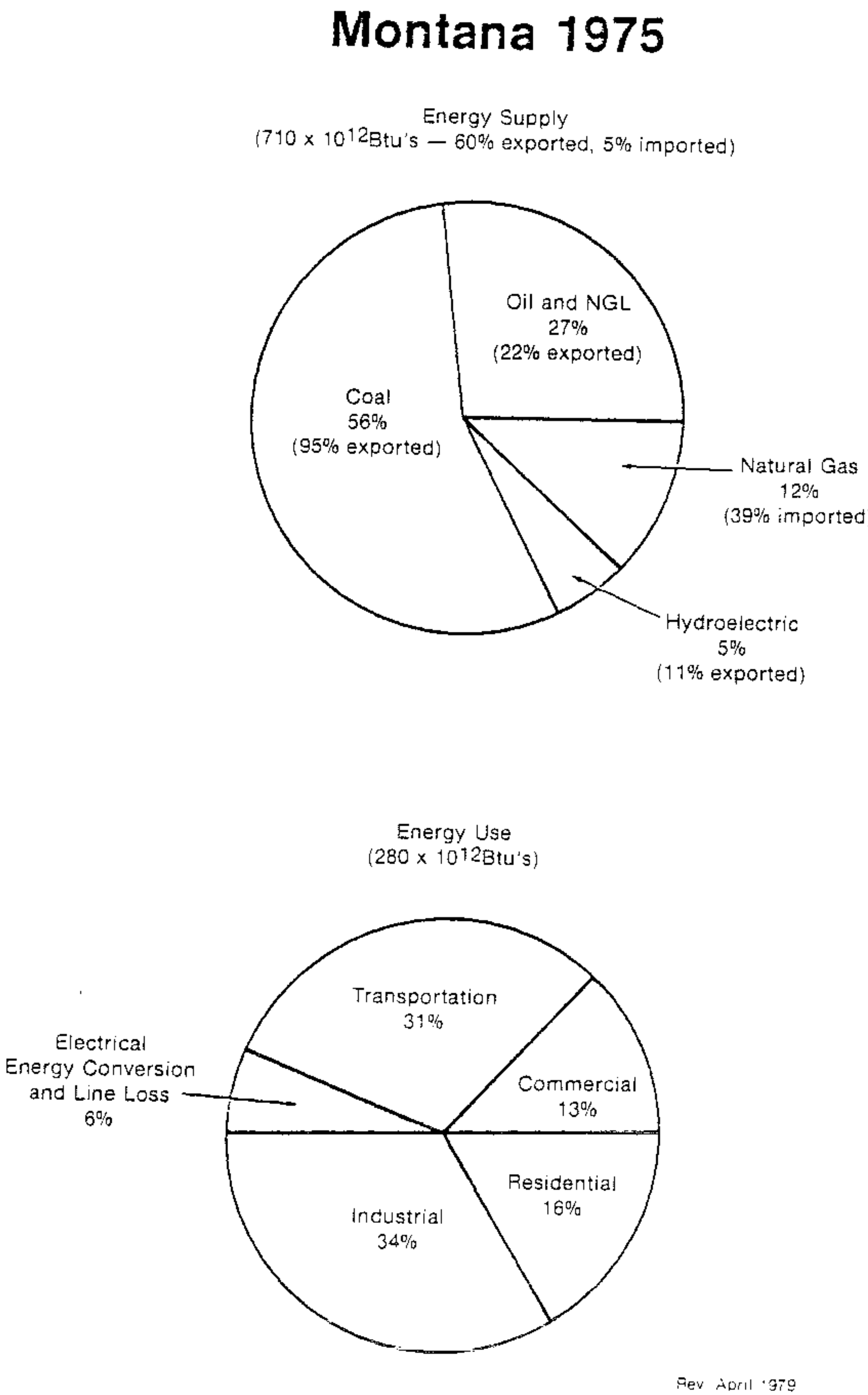
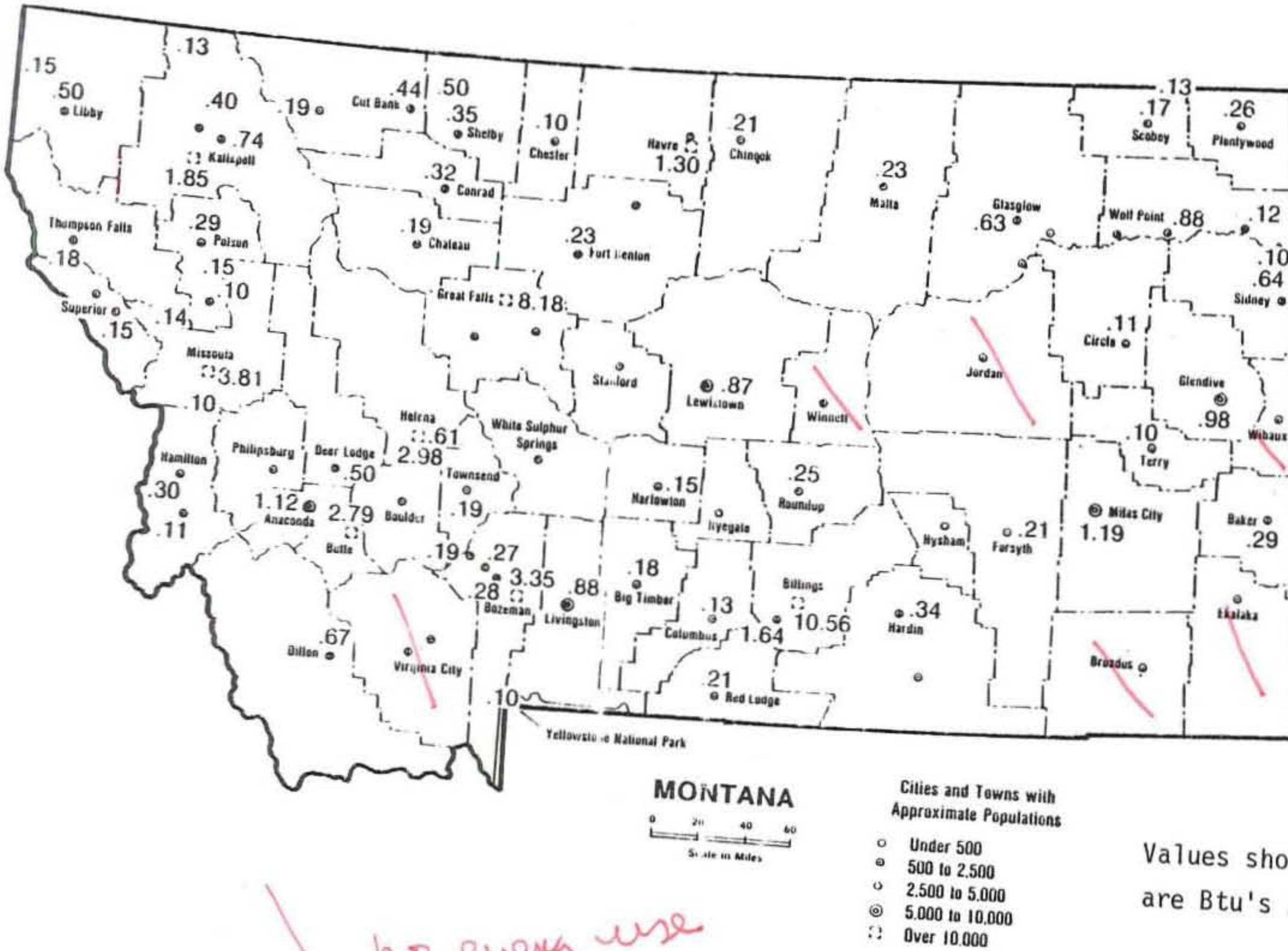


Fig. 7.1 Montana energy supply and use[1]

Fig. 7.2 Montana energy usage map[1]



Values shown are Btu's x 10^{12}

\ no energy use

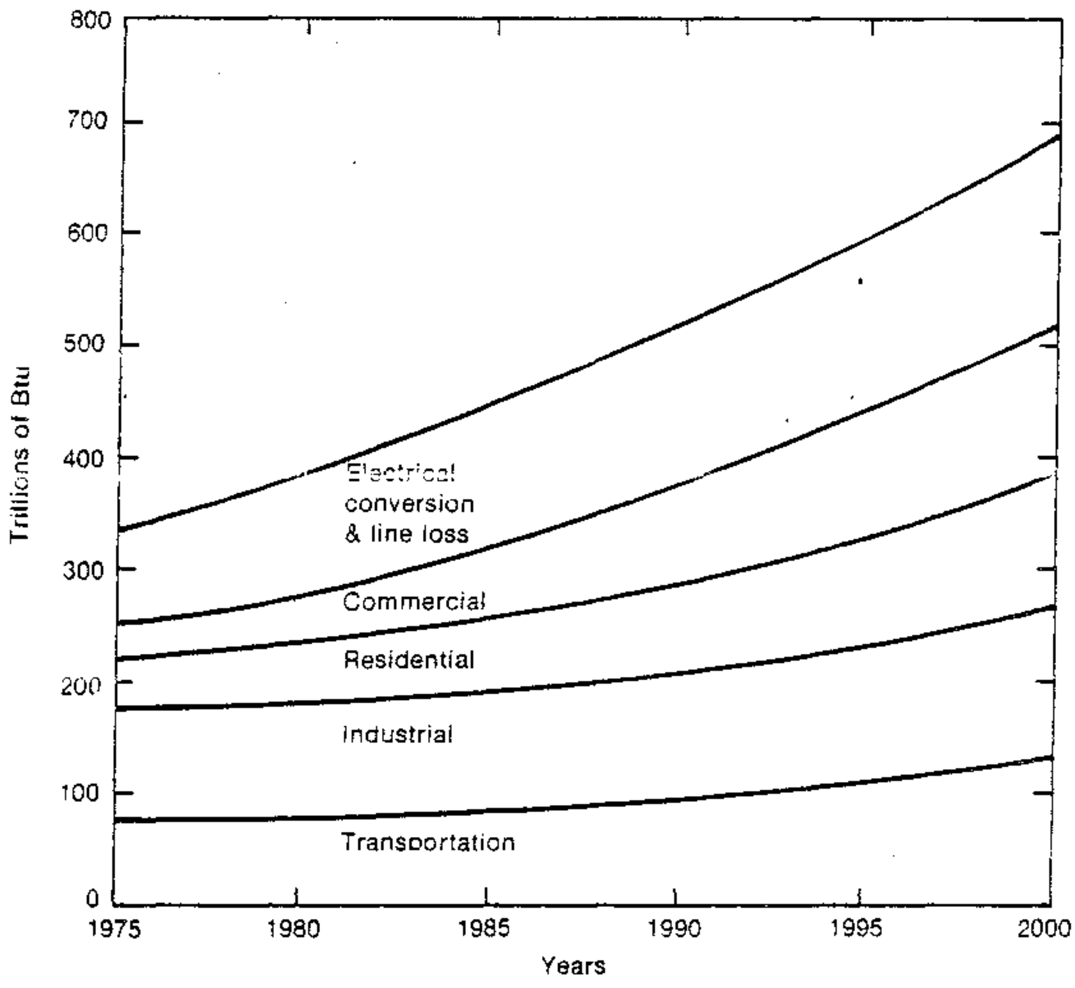


Fig. 7.3 Montana total energy use projection[1]

Counties overlying hydrothermal resources in the state (Figure 3.2) have been assessed to determine how many manufacturers could use the available hydrothermal energy as industrial process heat. Average resource temperatures are estimated for these counties. A list of potential hydrothermal use industries is compiled from the manufacturer's directory for the state. The number of employees per manufacturer is taken to be the midpoint of the employee range listed for the manufacturer. Each Standard Industrial Classification (SIC) category is aggregated within the county. A BTU use value for each manufacturer was determined by use of energy intensity coefficients (BTU/employee). Industrial, as well as residential/commercial, data for each such county is given in Table 7.1. These data show the potential for conversion to hydrothermal energy based on 1975 usage in these counties.

Table 7.2 lists the industry, the SIC number, and the percent of the process heat used in various temperature ranges from 40°C to 275°C. By use of this temperature breakdown, industries are considered as candidates for hydrothermal energy applications, even if total energy requirements cannot be met by hydrothermal energy.

B. References

[1] Regional Hydrothermal Commercialization Plan, Department of Energy Division of Geothermal Energy and Idaho Operations Office, EG&G Idaho, Inc., and University of Utah Research Institute Earth Science Laboratory, July 14, 1978.

[2] Draft Regional Hydrothermal Market Penetration Analysis, Appendix B, EG&G Idaho, Inc., and Utah University Research Institute Earth Science Laboratory, October 31, 1978.

TABLE 7.1

1975 MONTANA ENERGY USE BY COUNTY

County	Assumed Average Reservoir Temperature (°C)	INDUSTRIAL		RESIDENTIAL/COMMERCIAL	
		Standard Industrial Code (SIC)	Energy Use ($Btu/yr \times 10^{12}$)	Total Energy Used ($Btu/yr \times 10^{12}$)	Energy Used For Space Conditioning And Water Heating ($Btu/yr \times 10^{12}$)
BEAVER HEAD	68°	2011	0.003		
		2048	0.005		
		3273	0.002		
		Subtotal	0.010	0.50	0.45
BLAINE	90°			0.21	0.20
BROADWATER	115°			0.15	0.13
CASCADE	90°	2011	0.018		
		2021	0.005		
		2048	0.080		
		2086	0.020		
		3271	0.065		
		3273	0.005		
		Subtotal	0.193	6.50	5.80
DEER LODGE	90°	2013	0.003		
		2021	0.005		
		3273	0.002		
		Subtotal	0.010	1.10	1.00
FERGUS	90°	2021	0.005		
		2048	0.025		
		2086	0.005		
		3273	0.015		
		Subtotal	0.050	0.64	0.58
GALLATIN	90°	2011	0.003		
		2026	0.005		
		2048	0.020		
		2086	0.020		
		Subtotal	0.048	3.20	2.90

TABLE 7.1 (CONT'D)

1975 MONTANA ENERGY USE BY COUNTY

County	Assumed Average Reservoir Temperature (°C)	INDUSTRIAL Standard Industrial Code (SIC)	INDUSTRIAL Energy Use (Btu/yr x 10^{12})	RESIDENTIAL/COMMERCIAL Total Energy Used (Btu/yr x 10^{12})	RESIDENTIAL/COMMERCIAL Energy Used For Space Conditioning And Water Heating (Btu/yr x 10^{12})
GRANITE	90°				
JEFFERSON	136°	2021	0.005		
		2411	0.005		
		Subtotal	0.010	0.20	0.18
LAKE	90°	3273	0.002	0.50	0.54
LEWIS & CLARK	119°	2024	0.005		
		2026	0.015		
		2086	0.005		
		2411	0.020		
		2421	0.005		
		2434	0.015		
		2819	0.150		
		2841	0.010		
		3273	0.043		
		Subtotal	0.268	2.70	2.40
MADISON	129°				
MEAGHER	68°				
MISSOULA	90°	2011	0.044		
		2026	0.030		
		2048	0.020		
		2086	0.035		
		3271	0.095		
		Subtotal	0.224	3.40	3.10
PARK	90°	2011	0.003		
		2024	0.015		
		Subtotal	0.018	0.75	0.68

TABLE 7.1 (CONT'D)

1975 MONTANA ENERGY USE BY COUNTY

County	Assumed Average Reservoir Temperature (°C)	INDUSTRIAL		RESIDENTIAL/COMMERCIAL	
		Standard Industrial Code (SIC)	Energy Use (Btu/yr x 10^{12})	Total Energy Used (Btu/yr x 10^{12})	Energy Used For Space Conditioning And Water Heating (Btu/yr x 10^{12})
PHILLIPS	90°				
POWELL	90°	2048 3273	0.005 0.002		
		Subtotal	0.007	0.50	0.45
RAVALLI	77°	2021 2033 2048 3273	0.005 0.005 0.005 0.002		
		Subtotal	0.017	0.33	0.30
SANDERS	90°	No Match		0.26	0.23
SWEETGRASS	90°	2011 2021	0.003 0.003		
		Subtotal	0.006	0.17	0.15
STATE TOTAL			0.863		19.09

TABLE 7.2

INDUSTRIAL PROCESS HEAT REQUIREMENTS - MONTANA

INDUSTRY	SIC Number	40°C-60°C	60°C-80°C	80°C-100°C	100°C-120°C	120°C-140°C	140°C-160°C	160°C-180°C	180°C - 200°C	200°C	275°C
Meat packing	2011	NA	99%	100%							
Prepared meats	2013	NA	46.2%	61.5%	100%						
Fluid milk	2026	NA	NA	100%							
Prepared feeds	2048										
pellet condition.		NA	NA	100%							
alfalfa drying		NA	NA	NA	NA	NA	NA	NA	NA	100%	
Soft drinks	2086	60.9%	100%								
Sawmills and planing mills	2421	NA	NA	NA	NA	NA	100%				
Alumina	2819	NA	NA	NA	NA	76.2%					100%
Soaps	2841	NA	NA	0.6%						100%	
Detergents	2841	NA	NA	52.2%				99.9%		100%	
Concrete block	3271										
low pressure		NA	100%								
autoclaving		NA	NA	NA	NA	NA	NA	NA	100%		
Ready mix	3273	100%									

8. LEASING AND PERMITTING POLICIES

A. General[1]

No generally applicable regulatory scheme in Montana is designed to address the specific problems raised by geothermal development. Fundamentally, geothermal developments are subject to the water appropriation procedures of the Water Use Act. Any geothermal well which produces water (hot, briny, etc.) will require a water use permit and will be subject to the rights of prior water users.

Geothermal developments (of any size) are also subject to the requirements of the Major Facility Siting Act. All exploratory activity must be reported to the Department of Natural Resources and Conservation, and field reports, geological measurements, etc. must be submitted. Geophysical seismic exploration activity must be reported to the Secretary of State and the county clerk, and shot holes must be restored as required by the Board of Oil and Gas Conservation.

The Board of Natural Resources and Conservation must issue a certificate of public need and environmental compatibility (following extensive environmental studies and public hearings) before development may commence.

A geothermal lease must be obtained from the Board of Land Commissioners before any geothermal activity, even casual exploration, may be conducted on state lands. Leases are awarded after competitive bidding, and lease sales are announced at the discretion of the Commissioner of State Lands. Lease provisions establish rental, royalty and other conditions, including requirements for reclamation of disturbed lands.

Reinjection of geothermal water is subject to permit requirements of the Department of Health and Environmental Sciences under the Montana Water Pollution Control Act. Air pollution control regulations may also be applicable for the control of hydrogen sulfide and other emissions.

Approval of geothermal activities by the Departments of State Lands, Natural Resources and Conservation, and Health and Environmental Sciences may require preparation of environmental impact statements pursuant to the Montana Environmental Policy Act.

Leasing of Geothermal Resources on State Lands: Chapter 26 of Title 81 of the Montana Statutory Code was enacted in 1974 to authorize the State Board of Land Commissioners (BLC) to grant leases on state-owned land "for prospecting, exploration, well construction, and the production of geothermal resources". The law applies to all lands under the jurisdiction of the Land Board, including school trust lands, beds of navigable bodies of water, and other acquired lands, but does not apply to lands owned and used by state institutions for public building sites, campus grounds or experimental purposes. Regulations adopted to implement the law are administered by the Department of State Lands (DSL), and the director of the Department (the Commissioner of State Lands) reports to the Board.

The law provides that the Board may exercise "business discretion" in entering into lease agreements, but initial discretion lies with the Commissioner. A person wishing to obtain a lease for geothermal exploration or development on state lands must file an application with DSL describing the tract which is being applied for and the proposed activities. According to the regulations, even "casual exploration" is prohibited until a lease is applied for and approved. The Commissioner will announce a public lease sale when sufficient applications are received for a given tract, or "at the Commissioner's discretion". Sealed bids are then invited.

Bids must be accompanied by one-fifth of the bid amount, to be returned if the bid is unsuccessful. If there is only one applicant for the tract and no competing bids are received, the applicant may negotiate a lease with the Department, but the Board may choose to reject all bids and applications. If a lease is granted, a $25 fee is assessed and the remaining four-fifths of the first year's rental is collected.

Lease Terms: The law limits the primary term of the lease to ten years "and for so long thereafter as geothermal resources in paying quantities are produced". If, at the end of the primary term, production has not begun but the lessee is actively engaged in drilling, the lease will be extended while drilling continues and thereafter as long as resources are produced. The regulations impose a 640-acre limit per lease, but there is no limit to the number of leases which may be held by a person. Leased lands are to be in contiguous and compact tracts in so far as possible.

Lease terms must provide for a royalty of at least 10 percent of the gross revenue from the sale of heat energy, steam, brines, and associated gases. (If the lessee also owns and operates an energy generating facility utilizing the geothermal energy produced from the leased property, the royalty is based on the fair market value of such heat energy or steam.) The lease must also set a royalty of no less than two percent and no more than five percent of gross revenue from the sale of mineral by-products recovered from geothermal fluids, and no more than 10 percent of the revenue from operation of a geothermal spring for health or recreation purposes. A rental of at least one dollar per acre per year is also assessed. Once geothermal sources are discovered in commercial quantities, total yearly payments must total at least two dollars per acre. If "diligent exploration" has not commenced or it is not continuing by the end of the third year of the lease, a delayed exploration penalty of at least two dollars per acre is assessed at the end of each year until such exploration begins.

The lessee is required to utilize "best practices and engineering principles" in his operations, and the regulations set minimum requirements for well casings, plugging and abandonment procedures, and waste disposal. The regulations also call for reclamation of lands disturbed by exploration, development, operation, and utilization activities: restoration of original contours, topsoil stockpiling, reseeding, and revegetation. A plan of operations, including descriptions of environmental protection measures, must be filed and approved before drilling of deep wells (1,000 feet or more) commences. On entering the lease agreement, the lessee must post a bond of at least $2,000 conditioned on compliance with lease terms. The bond may be increased to $10,000 prior to deep well drilling.

Lease terms allow for pooling and unit operation agreements with other operators, but such agreements must be approved by the Board. The Board may also enter such pooling agreements directly on behalf of the state, and subsequent leases would then be issued in accordance with such agreements. Leases also recognize the rights of prior surface lessees. The geothermal lessee is entitled to such access as is necessary to develop the resource, but the surface lessee must be compensated for any damage to the surface leasehold interest caused by the geothermal activities. Furthermore, the state reserves the right to sell or lease non-conflicting surface interests notwithstanding the existence of a geothermal lease. In case of conflicts between lessees, the earliest lease has priority of rights.

If development of the geothermal resource requires the acquisition of water rights, the lessee may apply to the Board for permission to secure such rights. If permission is granted, the lessee may file an application in the name of the state of Montana in accordance with the Water Use Act.

Major Facility Siting Act: This law, originally enacted in 1973, provides for the comprehensive review of the siting and construction of major facilities engaged in the generation, distribution and conversion of energy. The law (70-801 et seq. R.C.M. 1947) is administered by the Energy Planning Division of the Department of Natural Resources and Conservation (DNRC), under the policy direction of the Board of Natural Resources and Conservation.

Before commencing construction of any such facility, an application must be filed for a certificate of environmental compatibility and public need. The applicant may be required to submit extensive information including alternative siting studies, projections of supply and demand, environmental impact assessments, and detailed descriptions of proposed operations. An application fee is assessed, based on the estimated cost of the facility. When the application is complete and all required information has been supplied, the DNRC conducts a detailed study of the proposal (up to two years are allowed) and reports to the Board. Studies and reports are also received from the Departments of Health and Environmental Sciences, Fish and Game, Highways, and Public Service Regulation.

The Board then holds a public hearing and issues written findings with respect to the need for the facility, environmental impacts, public convenience and necessity, etc. Among the factors to be considered by the Board which are particularly relevant to geothermal activities are opportunities for waste heat utilization, and availability of an impact on surface and subsurface water quantity and quality. All facilities must be certified by the Board and Department of Health as being in compliance with air and water quality standards and implementation plans. If the Board issues a certificate, construction may commence.

Additional procedural requirements may apply to a facility which will be operated by a "public utility". For the purposes of the Siting Act, a public utility is any individual or entity engaged in any aspect of the production, storage, sale, delivery or furnishing of heat, electricity, gas, hydrocarbon products or energy in any form for ultimate public use. (70-803, R.C.M. 1947)

The Major Facility Siting Act applies, generally, only to large facilities (e.g., those capable of producing 50 megawatts of electricity, or 25 million cubic feet of gas per day). However, the law also applies to:

> "any use of geothermal resources, including the use of underground space in existence or to be created, for the creation, use or conversion of energy." (70-803, R.C.M. 1947)

The above cited provision of the Major Facility Siting Act was amended by the 1979 State Legislature to provide a lower limit upon uses of geothermal resources covered by the Act: "any use of geothermal resources, designed for, or capable of, delivery of geothermally-delivered power equivalent to 25 million Btu per hour or more, or any addition thereto having an estimated cost in excess of $250,000.

Exploration Activities: A certificate from the Board is not required for preliminary acquisition of geological date or for boring test holes but the law and regulations require that such activities be reported to the DNRC. (A certificate is required for fracturing of underground formations related to possible future development of geothermal resources.) Any person who anticipates engaging in geological exploration activities related to potential future development of geothermal resources during the ensuing ten years must file a long-range plan with the Department describing the location, nature, and approximate dates of exploration activities. Starting sixty days before the commencement of test-hole drilling or other underground activities, and at sixty-day intervals thereafter, field reports are to be filed with the DNRC describing the area of exploration; number, location, and depth of holes; methods of drilling, casing, and closing; sampling reports; summaries of environmental impacts and mitigating measures, etc. Within nine months after commencement of exploration activities and at six month intervals thereafter during the investigations, geological reports are to be filed including well logs, geological measurements, rock structures, temperatures, rock and soil composition, etc. These data will be for the use of state agencies and will remain confidential for two years following commencement of test-well drilling, or for six months following completion of a commercially productive well.

B. Time Table of Institutional Procedures

The detailed steps and specific times associated with state institutional processes for geothermal development are still being compiled and evaluated by the State Geothermal Planning Team. Some of the major features are itemized below:

(1) Process EIA/EIS - Pre-Lease. A cursory EAR is required on state land which is to be leased. Should not take over six months prior to lease sale.

(2) Issue exploration permit - The Department of State Lands will not allow exploration or access to an up-leased parcel. After permit is granted it takes from 3-12 months to process.

(3) Lease Land - Assume that a geothermal lease sale can occur at any one of four quarters during the year, 3 months after Step 2.

(4) Water Rights Permit - Takes 9-18 months with an average of 12. Must begin process before production drilling to guarantee the right to use water.

(5) Issue Drilling Permits - Permit issued 60 days after the development plan is submitted to the Department of State Lands.

(6) Exploration - Permit covers both exploration and production.

(7) Production - covers both exploration and production.

(8) Certify Thermal Facility - This step is controlled by Montana's Major Facility Siting Act. An average of 3 years is required for larger (750 MW) installations. Allow 1 year for smaller operations. New 1979 legislation exempts all installations of 25 million Btu per hour or less.

(9) Issue Utility Charter - Most cases do not acquire state level participation other than for setting rate structure. The rate structure has to be approved by the utility commission. This step could take 1-6 months. A utility charter is necessary within city limits and approval time varies, but usually takes 3 to 6 months.

C. References

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TABLE 8.1

TIME TABLE OF INSTITUTIONAL PROCEDURES FOR A GEOTHERMAL PROJECT - MONTANA

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