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GEOTHERMAL MARKET PENETRATION ASSESSMENT

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NMEI, under contract with The Idaho Operations Office of The Department of Energy, The Four Corners Regional Commission, and The Energy and Minerals Department of New Mexico, is performing geothermal market penetration assessments of the potential in the Rocky Mountain Basin and Range. This paper presents a brief summary of the full briefing presented at the Salt Lake City Geothermal Conference, January 22-24, 1980.

AREA DIRECT HEAT APPLICATIONS

An analysis has been completed for each of the ten states, using a methodology devised and implemented by the NMEI team. The geothermal resources considered are based on formal and informal data provided by State Resource Assessment and Commercialization Planning Teams, and from USGS and UURI data. The analytical approach required compiling data on more than 11,000 industries, 2200 cities, and 1800 possible geothermal sites in the ten states. In addition, data was collected on fuel consumption by type of fuel, consuming sector, and price for as many cities and industries as possible. The analytical process is depicted as follows in Figure 1:

Figure 1

GEOTHERMAL MARKET PENETRATION
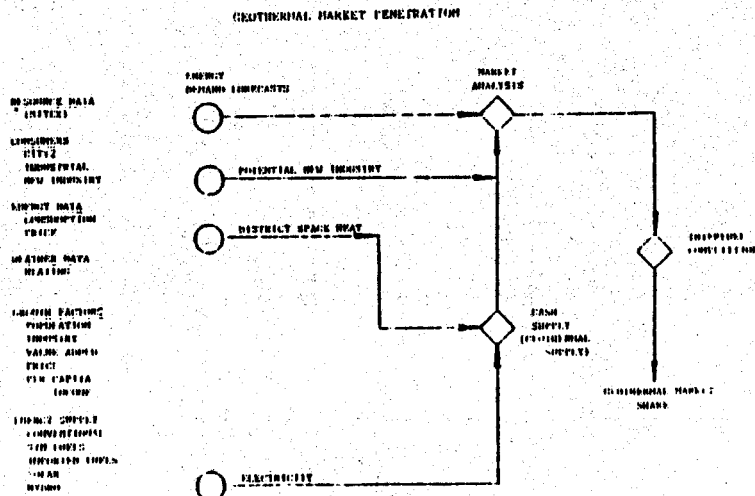
Concerning Geothermal electricity, Figure 1 shows an estimate of geothermal electricity, using NMEI and USGS reservoir temperatures and volumes, with methodology consistent with USGS Circulars 726 and 790. A range of potential is shown, governed by institutional factors and geologic uncertainties.

Figure 2

GEOTHERMAL ELECTRICITY POTENTIAL

(10 States)

	MW Potential
12 Sites, Temperature Higher than 200° C	4,950 - 5,500
94 Sites, Temperature between 149-199° C	4,100 - 11,150
TOTAL POTENTIAL	9,050 - 16,650

By reviewing available data on installed and planned electrical capacity, for export and retained use, and NMEI developed energy demand forecasts, Figure 2 depicts a comparison of possible future demand versus installed and planned capacity. The accepted rule of thumb is that installed capacity should be twice average demand; hence Figure 3 illustrates that planned capacity by 1995 provides no need for geothermal electricity if the price constrained demand occurs. If actual demand is close to unconstrained, a net expansion of capacity would be necessary, or increased imports. Accordingly, geothermal electricity will compete with existing oil and gas-fired plants, as possible replacement, or with planned new nuclear, coal, or non-coal fossil plants. These two categories account for almost 41,000 MW of the depicted 1995 capacity.

Figure 3

Rocky Mountain Basin and Range
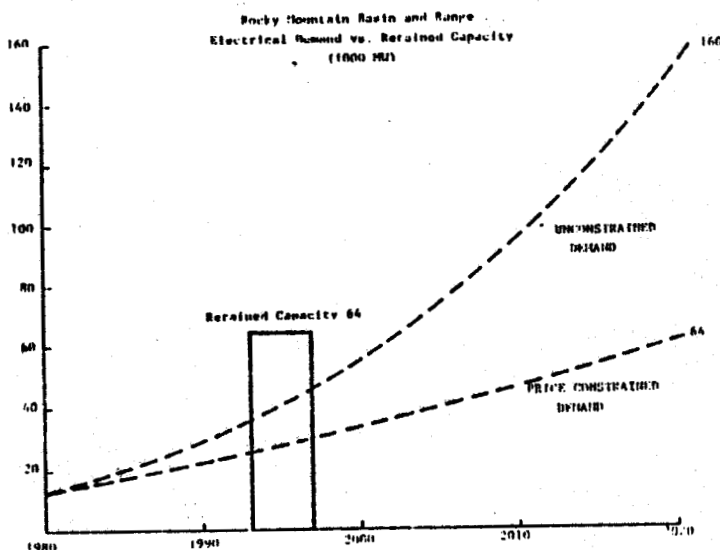Electrical Demand vs. Retained Capacity
(1000 MW)

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Figure 4 evidences four scenarios of Geothermal direct-use potential for the
ten intermountain states. The high case represents the most stimulative and
depends on two fundamental government initiatives. The first assumption is a
government-funded reservoir confirmation program of direct grants and funded
research to minimize the risk associated with dry holes. The second assump-
tion is governmental direct funding on a one dollar of federal money for three
dollars of private or city funds matching basis.

The mid case of Figure 4 includes only the reservoir confirmation program.
The low case assumes a 50% federal reservoir confirmation program and a higher
rate of return (25%) for the investor to compensate for the higher risks. The
low-low case assumes no federal stimulus at all and a required rate of return
of 35%.

Figure 4

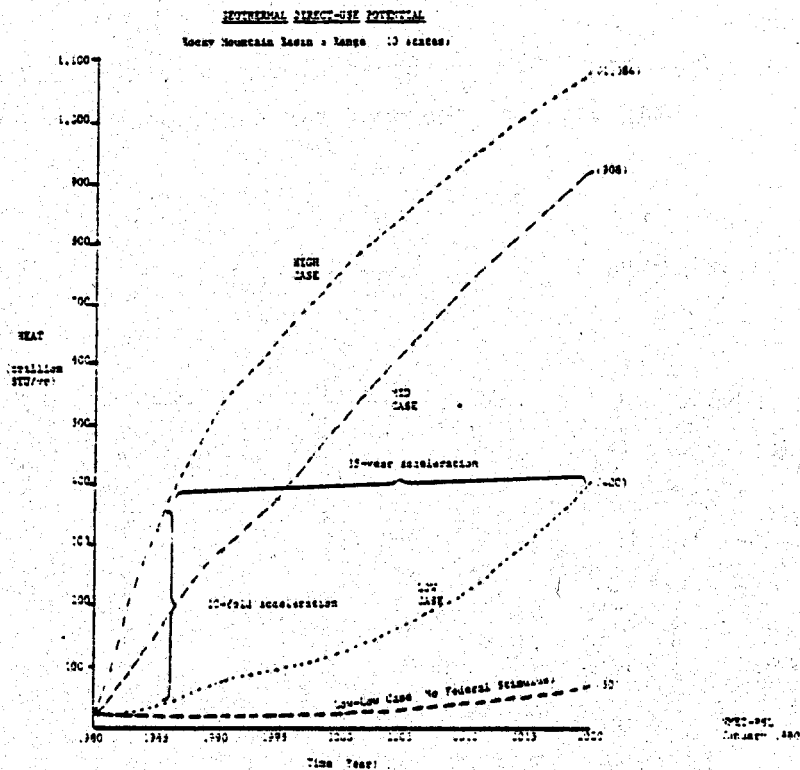Figure 5 lists the results of the four cases or policy options for the ten
states. Net Federal Outlays are the summation of reservoir confirmation,
direct construction grants, and investment tax credits, with federal income
tax and royalty payments as offsets. The high case portrays approximately
one-half quad on line by 1990, and represents a 35-year acceleration in geo-
thermal usage compared to the low stimulus case.

Figure 5

POLICY OPTIONS
VS
PAYBACK BY 1990

CASE	NET FEDERAL OUTLAY $ BILLIONS (NOMINAL)	CONSUMER SAVINGS $ BILLIONS (DISCOUNTED)	CITIES SERVED	HEAT ON LINE QUADS	FOREIGN OIL DISPLACEMENT (MBBL/YEAR)
HIGH	5.86	36.3	961	0.55 - 0.94	305**
MID	1.70	9.9	465	0.27	172
LOW	0.28	0.2	87	0.15	70
LOW-LOW	N/A	0.06	20	0.015	20

* Includes 0.35 Quad for New Industrial Parks in Oregon, Washington, Idaho
** Assumes 2 to 1 ratio of oil imports to final end-use consumption

Figure 6 is a breakdown of the accelerated or high case by state showing the level of investments and consumer savings along with heat on line by the year 2020.

Figure 6

HIGH CASE
ROCKY MOUNTAIN BASIN AND RANGE
DISCOUNTED COSTS AND BENEFITS THRU 2020
($ BILLIONS)

	INVESTMENTS	TAXES & ROYALTIES	CONSUMER SAVINGS	TRILLION BTU/YEAR HEAT ON LINE
ARIZONA	2.3	0.35	18.6	176
COLORADO	1.5	0.28	14.0	244
IDAHO	1.2	0.24	14.7	178
MONTANA	0.9	0.07	3.2	51
NEVADA	0.2	0.04	1.6	75
NEW MEXICO	0.6	0.11	5.6	99
NORTH DAKOTA	0.4	0.14	3.6	51
SOUTH DAKOTA	0.2	0.03	1.6	15
UTAH	0.8	0.17	8.5	145
WYOMING	0.5	0.08	3.7	56
	8.6	1.51	77.1	1,090

● Requires $5.86 Billion Federal Outlay
● Provides up to 305 million barrels/year Foreign Oil Displacement by 1990
● Requires 660 Reservoir Confirmation wells next two years
● Requires 3000 - 4000 Production wells by 1990

The actual percent of the market which geothermal will displace depends on two major factors. The definition of the market and the extent of geothermal supply. Figure 7 shows the possible market share given two definitions of the market (co-located and total state demand) and the supply stimulus scenarios developed in Figure 4.

Figure 7

ROCKY MOUNTAIN BASIN & RANGE

Geothermal Economical Market Shares (%)

		HIGH	MID	LOW	LOW-LOW
Total Demand					
	1990	28.65	14.43	2.81	.70
	2020	24.91	26.05	11.43	1.12
Co-Located Market					
	1990	41.67	21.04	4.16	1.12
	2020	47.24	39.6	17.44	2.2

From NMEI review, more than 7 million people in these ten states live in 1639 cities within 50 miles of a prospective geothermal resource. These cities, with their residential, commercial and industrial use, require more than 1.2 Quads of energy in a form which geothermal energy direct use can supply. Of this total co-located market, some 961 cities and 5.75 million people could be economically served by geothermal direct use by 1990 under the high case. Based on economic factors, fossil fuel savings, foreign oil displacement, and cost savings, this NMEI report displays the potential of geothermal, and the positive contribution federal incentives can provide to the partial solution of the nation's energy crisis.