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USER-COUPLED CONFIRMATION DRILLING PROGRAM

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ABSTRACT

The U.S. Department of Energy, Division of Geothermal Energy, is sponsoring the User-Coupled Confirmation Drilling Program (UCCDP) to absorb a portion of the high front-end risk and cost of geothermal development by providing cost-sharing of hydrothermal reservoir confirmation for direct heat applications. The development scenario to achieve the hydrothermal direct heat goal of 1.0 Quad (33,400 Mwt-yr) by the year 2000 is reviewed and a summary of the program is presented. The UCCDP will share the cost for exploration, drilling, flow testing, reservoir engineering, and injection well drilling (if required) for projects selected through a competitive process. The federal percentage of cost-share will be determined by a negotiated formula based upon usability of the thermal fluids intersected by the production well. This program is expected to act as a major catalyst to promote the development of hydrothermal direct heat utilization in the United States.

INTRODUCTION

Most geothermal geoscientists agree that there are many more low- and moderate-temperature (30°C to 150°C) hydrothermal resources than there are high-temperature (>150°C) hydrothermal resources. The U.S. Geological Survey Circular 790¹ documents the distribution of hydrothermal resources, as presently known, as a function of temperature down to 90°C. The conclusion is there is an exponential increase in the number of known resource occurrences as temperature decreases. This implies that the geographic distribution of resources is wider and that the possibility of co-location with a user is increased as temperature decreases. The above exponential relationship seems to be a property of many natural resources for it has also been documented for a number of other cases.

Considering the relationship stated above, it is possible that direct heat utilization of low- and moderate-temperature hydrothermal resources will ultimately contribute more heat-on-line than will electrical generation from high-temperature resources simply because lower temperature resources are more plentiful and widespread.

However, development of this low- and moderate-temperature resource is presently hampered by lack of resource knowledge and by the high risks and costs of reservoir confirmation. In addition, there is presently no experienced private sector infrastructure for direct heat development of the magnitude indicated as possible by the predicted large size and widespread occurrence of the resource. After consideration of the above factors, the User-Coupled Confirmation Drilling Program (UCCDP) was initiated by the U.S. Department of Energy, Division of Geothermal Energy.

The objective of the program is to foster the economic use of the low- to moderate-temperature hydrothermal resource by the private sector by:

- a) reducing the risk and cost of reservoir confirmation, and
- b) developing an experienced infrastructure in the private sector which will reduce reservoir confirmation risks in the future.

The strategy developed to achieve this objective requires that DOE fund the private sector on a variable cost-share basis to carry out confirmation of hydrothermal reservoirs. The size of the DOE program must be consistent with developing a self-sustaining private sector infrastructure and achieving DOE's direct heat utilization goals. The scenario developed below addresses the scope of the UCCDP.

PROGRAM SCENARIO

In order to make a desirable impact on the Nation's energy supply by the year 2000, direct heat utilization of hydrothermal resources is projected to be 1.0 Quad (33,400 Mwt-yr). It is assumed that ninety percent of this amount will be developed by private industry between 1986 and the year 2000. This will require private development of an average of .07 Quads (2225 Mwt-yr) per year. The average yearly distribution of utilization system sizes* brought on-line is projected as follows:

*see footnote at end of paper.

Utilization System Size	Number	Contribution**
100 Mwt	3	300 Mwt
50	10	500
25	30	750
10	50	500
5	35	175
	128	2225 Mwt

This means that private users would be required to bring 128 reservoir confirmation projects to a successful conclusion each year between 1986 and the year 2000. Assuming an average 25 percent success rate for reservoir confirmation projects, about 500 projects would have to be initiated per year.

The infrastructure needed for industry to perform this task will be large, but there is no need for federal support for its entire development. Instead, it is projected that the total infrastructure will develop along the lines shown in Figure 1 if the impetus of the UCCDP is placed at the beginning of the period. This figure shows one possible schedule for reservoir confirmation projects to the year 2000. Obviously, the required infrastructure is approximately proportional to the number of projects per year. Figure 1 shows that the UCCDP will peak in 1983-84, when about 160 DOE-funded reservoir confirmation projects will be initiated. Assuming Figure 1 to be a viable scenario for the DOE program, the following project schedule is indicated:²

Year	FY80	FY81	FY82	FY83	FY84	FY85	FY86	FY87
Number of UCCDP Projects Initiated	1	20	140	160	160	140	90	60

Thus, the UCCDP will initiate a total of 771 projects over 8 years and will support the development of about 25 percent of the total infrastructure needed to reach the year 2000 direct heat utilization goals. The remaining 75 percent of infrastructure development will be completed by the private sector. Infrastructure development beyond 1988 will, of course, depend upon the overall economics of direct heat utilization at that time. The economics cannot now be fully evaluated but should be favorably improved as a result of this program. In addition, an extensive data base will be available in 1988 to allow the private sector to evaluate the economics of direct heat systems.

Using a number of assumptions, it has been determined that the UCCDP should consist of approximately 771 reservoir confirmation projects to be conducted from FY81 to FY87. To determine program costs, a project success rate and project mix over the life of the program was estimated. Figure 2 shows a decreasing success rate for UCCDP projects from 60 percent in early phases of the program to 25 percent in later phases.³ The success rate decreases with time because projects funded early will most likely be those where good resource data exist, where there are favorable surface geothermal manifestations, or where there are other factors which increase odds of success. Later projects may be more "wildcat" in nature, and the success rate could be even lower than 25 percent. However, it is expected that the development of exploration technology and experience as the program progresses

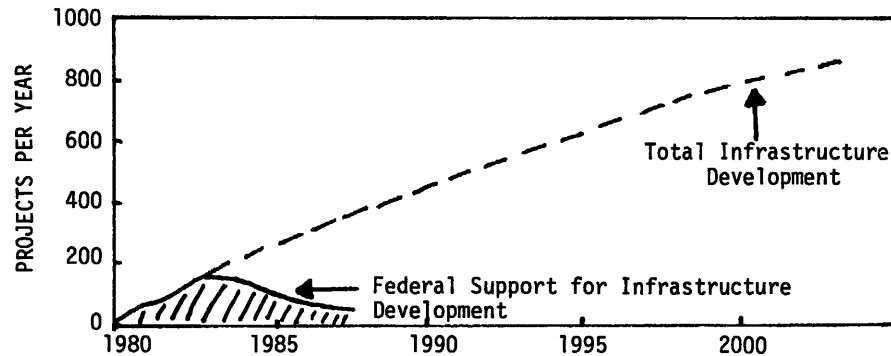


Figure 1. Postulated Infrastructure Development

**see footnote at end of paper.

will increase the success rate. An average success rate of 40-45% is projected over the life of the entire program.

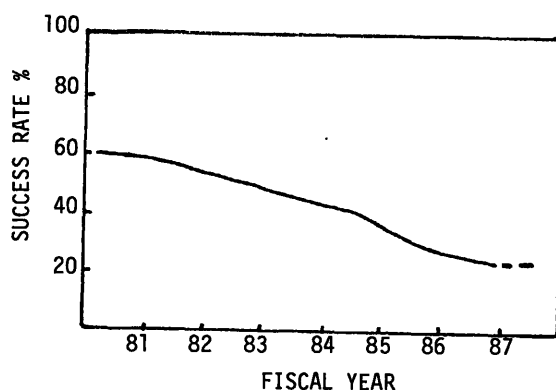


Figure 2. Postulated Success Rate

The mix of projects within the program was also projected. In practice, there will be great diversity. Some projects will require deep drilling in complex geologic environments where exploration problems are difficult, whereas others will consist of shallow holes in simple environments. Four confirmation project sizes were estimated as being typical.³ The development costs of these projects varied by a factor of 5-6 dependent upon the complexity of the projects.

Based upon the program objectives, the development scenario necessary to achieve these objectives, the likely success rate, and the project mix, it is estimated that the DOE support necessary to develop this program will be about \$250 million (1980 dollars) spread over the years FY81 to FY87. Thus, the UCCDP is a major new effort by DOE to absorb a portion of the high front-end risk and cost of reservoir confirmation, and stimulate the development of hydrothermal direct heat utilization in the United States.

PROGRAM SUMMARY

The new program was initiated by a DOE Solicitation for Cooperative Agreement Proposal (SCAP), issued in June 1980. Approximately 90 days were available thereafter for preparation and submission of proposals. The submitted proposals detailed, 1) the geologic evidence that a resource exists at the site of interest, 2) the direct heat use to be made of geothermal fluids if discovered and confirmed, 3) an adequate exploration, drilling, flow testing and data analysis program, and 4) an acceptable cost-share plan based on degree of success of the project. Proposals are being reviewed and awards will be made in accordance with applicable federal regulations. Successful proposers will negotiate a cooperative agreement with DOE. The participants funds can be used to perform the project, or alternatively a loan can be obtained from a commercial financial institution, using the DOE agreement as

evidence that project risk has been substantially reduced. The project will then proceed under participant management. After flow testing, the degree of success will be determined through analysis of flow testing results and by application of other requirements that are conditions of the cooperative agreement. The DOE cost-share is then determined, and DOE pays this amount to the participant, completing the agreement.

ANTICIPATED PROGRAM RESULTS

It is anticipated that this program will result in an increased utilization of direct heat hydrothermal energy that will decrease our dependence on foreign petroleum and aid in mitigating the energy crisis. The extent to which this will be possible will depend critically on the amount of funding that Congress authorizes for this program. It is estimated that for a seven-year federal expenditure of \$250 million in 1980 dollars, that direct heat uses as a result of this program would result in an annual petroleum savings of about 28 million barrels per year by the year 1987. For an oil price of \$26 bbl, this represents an annual savings in payments for foreign petroleum of over \$700 million per year.

FOOTNOTES

*This distribution assumes a decreasing number of larger systems because of the fall-off in number of occurrences as temperature and size increase. The number of uses under 10 Mwt drops off because economics of very small utilization systems will probably not be favorable.

**1 Quad = 10^{15} Btu = 33,400 thermal megawatt-year (Mwt-yr).

REFERENCES

- 1 United States Department of the Interior, Geological Survey, 1979, Assessment of Geothermal Resources of the United States - 1978, Geological Survey Circular 790.
- 2 Department of Energy, Division of Geothermal Resource Management, Draft National Hydrothermal Direct Applications Program Plan, April 16, 1980.
- 3 Wright, Phillip M., User Coupled Confirmation Drilling Program, prepared for the Idaho Operations Office, U.S. DOE, October 1979.