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## OVERVIEW OF THE D.O.E. DIRECT USE PROGRAM FOR GEOTHERMAL ENERGY

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Although higher temperature geothermal resources will most likely be used for electric power generation, they may also be quite suitable for direct applications. In addition, the lower temperature resources, believed to be much more extensive, also offer a great potential for direct uses of this abundant natural resource in the United States.

We have repeatedly heard how geothermal energy is being used in many countries throughout the world for space heating and for some industrial uses. We have also heard of similar but rather limited applications in some sectors of our own nation. There is still, however, a great untapped potential, and correspondingly, there are still many areas within our country where geothermal resources could be directly and profitably used.

What then, must be done to stimulate industry and to promote the development and use of geothermal energy for direct applications? We recognize that only the private sector as lease holders, developers of the resources, and ultimately users of the resource, can make the increased utilization of this great energy potential a reality. We in the government sector can only aid. As a protagonist in the undertaking before us, we can certainly play a role in helping to solve some of the problems that lie in the path to creating an economically viable geothermal industry.

Before taking a look at this role, let's review Government involvement to date.

Government Involvement

Up until 1973, the U.S. Geological Survey had taken the lead Federal role in geothermal energy by carrying out assessments, reservoir engineering and fluid analysis of geothermal resources. With the addition of the National Science Foundation and the Atomic Energy Commission to the team in 1973, a more concerted effort toward actual utilization of these fluids was possible, and the interest toward electric power generation became the key theme in the Federal program. Although nonelectric or direct uses potential was recognized, only a

minor role was delegated to such applications at that time.

Some of us may recall the contributions of the Lawrence Livermore Laboratory and the Idaho National Engineering Laboratory during these early phases, as well as the role of the Committee on Challenges of Modern Society, a NATO-sponsored activity, in fostering the development of geothermal energy for direct uses. Interest in this country was generated as a result of the activities of these organizations. This interest helped to promote greater understanding of direct application of this unique energy resource, already so aptly displayed in such places as Klamath Falls, Oregon and Boise, Idaho. Increased government involvement was accompanied by corresponding increases year by year of funds applied to direct uses. Although several years have now passed, we still fail to see a more rapid expansion of the use of geothermal energy in other areas of this country where suitable resources are believed to exist.

What then are the reasons for this apparent lack of development?

Factors Impeding Development

We can consider the problems impeding development of geothermal resources in four categories: economic consideration, environmental concerns, institutional barriers and resource uncertainty.

The lack of definitive economic data at particular locations associated with specific applications pose certain risks to prospective developers or users. Economic considerations are also important for projects which utilize geothermal energy since in addition to high capital costs they are restricted to rather limited distances from the source of the hot fluids due to the heat losses during transport of the fluids through pipes. Thus, site-specific installations carry obvious risks. And for insurance, back-up systems, supplied with conventional fuels are usually necessary. Such cost considerations obviously tend to dissuade newcomers into areas of yet unproven resources.

Environmental concerns, too, sometimes act as stumbling blocks to development, especially when one has to consider such vital concerns as subsidence, noxious emissions or noise problems. Of course any industrial endeavor faces similar problems, but those associated with utilization of geothermal fluids, are especially important due to the potential effect over a wide area.

Concerning institutional barriers, it is sufficient to mention here that policy concerns - leasing, taxation, regulations, and interfaces with state and local governments - are certainly recognized as important for nonelectric utilization just as they are for geothermal applications on the broadest scale.

Associated with the economic risk, we also have to consider resource uncertainty as an impediment to development of geothermal resources. We simply need to know more about the size and extent of a resource at any particular location. Once a resource has been located and the size and extent has been established, we still need to know a great deal about reservoir behavior in order to give us an idea about reservoir life. Having to be assured of an adequate reservoir of fluids is perhaps the most fundamental barrier to development of geothermal resources.

#### Factors Favoring Development

Now, having considered some of the reasons why direct uses of geothermal energy is progressing so slowly, let's examine some of the positive reasons, those factors which favor development:

First, we know that there are many reservoirs, especially in the lower usable temperature range; and we have a fairly good notion of the geographical range and extent of these resource areas. The U.S. Geological Survey has been instrumental in compiling significant resource data and making it available to the public. In many areas, we have some first-hand knowledge of reservoir characteristics through information obtained from well bore logs and production data. Thus, a workable resource base is available.

Secondly, there are few technological barriers to utilization of the fluids in the temperature ranges generally of interest to the developer. Corrosion and scaling problems can be troublesome, especially when we deal with geothermal fluids of high salinity in the higher temperature ranges. But in the lower temperature ranges where much of the direct-uses potential is, such problems will be of lesser concern. And quite important, too, is the fact that direct utilization of geothermal fluids is inherently more efficient than conversion to electricity since less of the heat is lost in the conversion process.

Thirdly, we have confidence that there are viable private sectors in our country where geothermal

energy can be adapted to existing industrial and process needs, as well as in space heating and other applications. We know this from the many successful applications in other countries.

#### Industry Sectors

Four convenient categories for classifying use sectors are: Industrial process heat, agribusiness, commercial building complexes and residential applications.

Industrial processes generally require large quantities of fuel to provide the heat needed for a wide variety of applications. From a conservation point of view alone, there is an obvious interest to have an alternate source for heat, such as geothermal energy.

Agricultural uses include greenhouses, fish farming, animal husbandry, all of which are more or less amenable to remote locations. Thus, relocation of certain facilities might also be possible in many instances, since the location would not be as critical as for most industrial processes.

Commercial buildings and complexes include business districts, shopping centers, schools and hospitals, when heating systems may be readily convertible to using geothermal fluids. The very best example in this category is found in Klamath Falls, Oregon, where an entire college campus, a hospital, a church and various commercial establishments use geothermally-supplied heat.

In individual residences, geothermal energy can be used for space heating, where the temperature needs are in the lower range of most geothermal reservoirs. In Boise, Idaho, many houses are heated, and have been for almost 100 years, by geothermal heat. Of course, here too, siting of homes near geothermal resources is a very limiting factor.

#### The Federal Role

Having thus surveyed various areas where we feel geothermal energy can play a role, what can the government do to help foster the use of this energy source? Specifically, our plans are as follows:

We shall continue to support an accelerated assessment of geothermal resources through several programs: state-cooperative, pre-commercial and industry-coupled. You will hear more about those programs later. Working with the U.S. Geological Survey and through laboratory and university programs, we shall continue geological, geophysical and hydrological studies, and we shall support evaluation drilling, logging and reservoir analysis at resource areas suitable for direct uses.

We shall continue our studies on legal and institutional barriers to commercialization of geothermal energy; and, recognizing our responsibilities to comply with all the environmental requirements of both Federal and state agencies, we shall support the preparation of environmental reports, environmental assessments and environmental statements wherever needed.

Although the present approach to planning the program for direct uses is on a national scale, we recognize the regional orientation of various types of geothermal resources. Accordingly, we plan to reorient the direct uses program to reflect regional needs as much as possible and to incorporate the planning for direct-uses programs into the overall planning for geothermal energy development on a regional basis. The geographical distribution of government supported projects will be guided by regional development plans, and to the extent possible, by the resource assessment projects.

Of particular interest to many of you attending this symposium, we shall continue the Engineering and Economic studies, as appropriate, to provide more technical and marketing data to determine the feasibility of increasing the utilization of hydrothermal fluids for direct uses in the four categories of concern to us here.

A corollary effort of which many of you may be aware is the Field Experiment program, whereby individuals, corporations, companies, educational institutions and others, individually or as project teams, may have hydrothermal direct utilization projects considered for support. As part of the Department of Energy geothermal energy program, such projects provide an opportunity for interested parties to propose direct heat utilization field experiments. These demonstration type projects, which will be joint efforts by the participants and the government, will provide visible evidence of the wide potential for application of geothermal energy to many of our nation's energy consuming sectors.

An initial solicitation for proposals was issued in 1977 and the first batch of candidate projects are currently being evaluated.

Working with industry, state and local governments, the academic community and other concerned groups, we want to provide the Nation with an economically and environmentally acceptable energy resource to substitute for and supplement present energy uses. An integral part of this program is to develop a viable geothermal industry.

Thus, a comprehensive program to aid and promote the development of geothermal energy for uses in direct applications is consistent with our Nation's effort to use all of our domestic energy sources to greatest advantage, while conserving fuels, especially those that we import.