

NATIONAL GEOTHERMAL INFORMATION RESOURCE

Overview of GRID

The National Geothermal Information Resource (GRID) was established in 1974 as a focal point for the collection, evaluation and dissemination of information on geothermal energy. The project compiles and evaluates data in three general areas: (1) basic science, site independent data, principally the thermodynamic properties of aqueous electrolyte solutions, (2) utilization of the geothermal resource, including both site-specific data and information on technical, institutional and other factors affecting geothermal development, and (3) environmental effects of geothermal energy activities. These subject areas have been funded by three separate divisions of the Department of Energy.

The project disseminates information in the form of printed reports and as responses to specific requests. The project maintains computerized databases containing both bibliographic and numeric/fact data from which reports or responses to queries can be prepared. The users include representatives of industry, DOE and other government agencies, and researchers within universities.

GRID has been administered (since FY1979) by the Information and Data Analysis Department of Lawrence Berkeley Laboratory. Activities of the project are reviewed yearly by a committee representing both government and industry.

Activities Relevant to Utilization of Geothermal Energy

A major issue for DOE is whether (and how) private and local power authorities can be stimulated to convert geothermal energy resources to power production and to use the resource directly in manufacturing and heating applications. The objective of GRID is work in this area to provide a single, comprehensive database containing evaluated reference data useful in assessing geothermal areas for their potential to produce electrical power and for direct utilization. The present compilation and evaluation constitute a databook of current information for construction, modeling, research and development for conversion of geothermal energy to power on-line. The results of this work include identification of areas where data are lacking or are inadequate, and recommendations for providing the needed data. The need for site-specific data stems from two major concerns: (1) forecasts of power production related to local, state and national goals, for example the second report on geothermal energy by the Interagency Geothermal Coordinating Council which contains forecasts for power on-line to the year 2000 and beyond, and (2) data on the suitability of each site to produce power for a 20 to 30-year time period. Suitability may be dependent on such data as: (a) temperature of the fluids produced, (b) composition of the reservoir fluids, (c) composition of surface and near-surface fluids, (d) control of scaling and corrosion, (e) fluid flow rates sustainable by the reservoir, (f) cost of drilling within the area, (g) spent brine treatment and disposal, (h) process instrumentation,

and (i) hydrogen sulfide abatement. The need for sound data is obvious.

However, the currently available data for geothermal sites is widely scattered, is uneven in quantity and quality; while there are extensive data for The Geysers and East Mesa areas, the data are sparse for such areas as Alvord and Lassen. The data are especially poor for sites outside of California. It is the goal of GRID to compile accurate data if such data can be obtained, and to point out critical gaps in our state of knowledge where existing data (or necessary interpretations) are lacking. The best available sources are used by the project in their efforts to gather the data, and a major effort is made to assure that figures and facts quoted are based on information that is accurate, up-to-date, consistent and properly interpreted.

Another body of information relevant to commercialization is the extensive and increasing number of reports covering new regulatory processes and new techniques from research and development to make geothermal power production more economical than at present and to facilitate obtaining permits. Selected portions of this work are included in the GRID database to provide relevant information on such topics as resource assessment, drilling, materials development, and brine treatment to control scaling and corrosion.

Accomplishments to January 1979

1. Site-Specific Data for Energy Utilization

Site-specific data for over 21 geothermal prospects in the United States are presented in this interim report. Data include technical, economic and institutional information which is used mainly to evaluate a geothermal area for its potential to produce electrical power. A brief site description with a summary data table is provided to show the current status of each prospect with respect to power production, major impediments to its development, a map showing the location of each area, and recommendations for additional work where current data are either lacking or are inadequate.

These data are being organized into a computerized database (ENCON) with several hundred data elements. Extension to additional sites and the inclusion of new data as they become available are also in progress.

2. Geothermal Power: Progress Monitoring

- (a) Information is being obtained on key activities together with the date each activity was initiated or completed for each geothermal site for DGE staff. The activities include leasing, drilling, issuance of permits, plans for power plant construction and environmental assessments. Leasing and environmental assessment data were obtained from U.S. Geological Survey; drilling, permits and other data were obtained from publications and contacts.
- (b) Data in the form of tables were compiled for California to cover drilling, expected power plant construction, leasing and names of geothermal areas for the DGE staff.

3. Work for Sponsors Other Than DGE

- (a) Basic Energy Data: The result of this work is a database on the thermodynamic and transport properties of aqueous solutions to 350°C and 500 bars pressure. The work has been mainly a critical evaluation of data and development of correlation equations for enthalpy, solubility, viscosity, density, thermal conductivity of sodium chloride solutions.
- (b) Environmental Studies: This work has included studies of geothermal subsidence and hydrogen sulfide.

Output from GRID and its Impact on Geothermal Energy Utilization

The principal output from GRID has been a series of reports on various aspects of geothermal energy. (See the attached bibliography.) The objective of these reports is to provide a concise, authoritative source of information that may be used by someone who is not necessarily a specialist in the subject area. The reports (and, more generally, the database on which they are based) encompass expert analysis of the data, including such things as corrections for changes in the definitions of units or the values of comparison standards, judgement about discrepant values, and the analysis of independently measured quantities related by theories or models. Underlying bibliographic information is supplemented with technical annotation that defines clearly the relevance of a particular publication to a potential application.

The intended impact of this activity is:

- (1) To provide the results of past research and development needed in ongoing programs, both in R&D and in applications;
- (2) To avoid duplication of research or development activity, by providing a summary of what is already known;
- (3) To highlight critical gaps in the state of knowledge, where new research is needed.

The impact is economic, in that wasted effort to measure data or to search for existing measurements is avoided. Perhaps more significantly, the impact is the avoidance of delay in utilization of the resource resulting from the absence of needed data.

Past activities of GRID have been successful in achieving these goals. For example, the subsidence and brine treatment studies were important factors in the establishment of the need for more research on each of these subjects. GRID studies on electrolyte properties have highlighted the absence, in spite of much research on the subject, of adequate data for temperatures and pressures characteristic of geothermal systems.

GRID activities relevant to geothermal energy utilization are too recent to observe such obvious impacts. In view of the broad scope of information required and the scarcity of reliable data, compilation and evaluation activities should have a strong, positive impact on future utilization activities.

Value of the GRID Project and Application to Commercialization

As described above, GRID has served the function of a typical "information analysis center" in support of basic research and engineering necessary for the development of geothermal energy. As utilization of the resource on a significant scale approaches reality, the value of this type of activity should be enhanced. A larger scope of data and a higher degree of evaluation are characteristic of the information requirements for implementation, as contrasted with the needs for more basic research.

In addressing the new requirements, GRID draws on a database and a body of experience gained from its past activities in support of research and development. In addition to its own resources, the project has access to research experts in many aspects of geothermal energy within the laboratory's Earth Sciences Division, and the support of information processing experts within its own department.

In response to the new demands, GRID has started two new databases:

- (1) ENCON. The site-specific data contained in the energy conversion database supplies information required for the analysis of individual geothermal areas from discovery through power production. An important application is the identification of missing information, so that funding can be allocated to provide for additional research or marketing studies. The database includes such information as organizations involved, reservoir temperatures, expected plant size and cost, make-up water, drilling data, hydrogen sulfide content, existing land use, leaseholders, and exploration permits.
- (2) Progress Monitoring to Power Production. This database, developed in response to requests by members of the DGE staff, is designed to monitor the utilization of the resource. For each site, the database contains listings of key activities, with the date of completion or initiation, that are relevant to the forecasting of power on-line. Summary tables for the state of California cover drilling, leasing, expected power-plant construction, and names of the geothermal areas.

Additional subjects could be covered as the need becomes well defined. At the present time, funding of the project is insufficient to cover the ongoing work properly. Because of the value to utilization programs, an increase in the level of compilation/evaluation activity deserves consideration in spite of decreasing funding levels for basic research and development.

Expected Significant Accomplishments, FY 1979:

- (1) Site-Specific Survey for Geothermal Energy Conversion. This interim report covering 21 sites, based on the ENCON database, will be ready for review toward the end of January, 1979. A more extensive databook, containing information on the current status of over 40 sites, will be completed within the fiscal year if funding permits, as will a computerized version of the database.
- (2) An annotated and indexed bibliography printout, containing references to publications on the exploration and evaluation of geothermal areas for power production, was completed in December, 1978 (LBL-3220, Vol. I).
- (3) A Survey of Treatment Methods for Geothermal Brines. This report is a revision of a previous one, A Study of Brine Treatment, which was partially funded by EPRI.
- (4) A report based on the Progress Monitoring database, including activity indicators for 21 sites. This report should be completed toward the the end of the fiscal year. Information is being collected and evaluated, and the file updated, on a continuous basis.

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