Raft River Colloquy

A series of papers on geothermal development at Raft River, Idaho

by
W.J. Toth
Idaho National Engineering Laboratory

(Editor's Note: Following are the first in a series of articles concerning the Raft River (Idaho) power plant and related subjects. These articles are being published in the BULLETIN to provide a case history of this type of development, particularly the various parameters that must be addressed to accomplish it. Future issues of the BULLETIN will contain the remaining articles in the series.)

The Idaho National Engineering Laboratory (INEL) has been involved in geothermal energy development since 1973. Since the technical feasibility and development of high-temperature geothermal resources had been demonstrated at The Geysers and elsewhere, the development and uses of the country's more numerous moderate-temperature resources posed many new challenges, especially in the generation of electricity. Successful demonstration of the technical viability of such resources could open a vast resource base to augment the nation's energy supplies. Thus, the Laboratory's objective has been to study the feasibility of using a moderate-temperature geothermal resource for both electrical production and direct-heat applications.

Earlier efforts by the U.S. Geological Survey (USGS) identified such a moderate-temperature resource near INEL in the Raft River area of southern Idaho (see Figure 1). This resource had an inferred reservoir temperature of 275°-295°F, too low

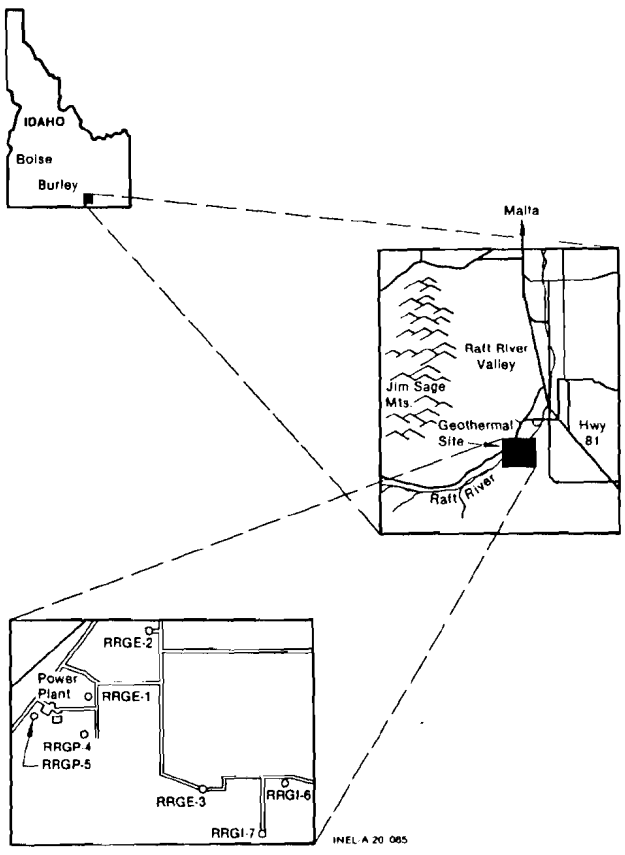

Figure 1. The Raft River Geothermal Site

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Table 1. Raft River Well Characteristics Summary

Well Number	Type	Depth	Down Hole Temperature***	Pumping/ Injection Rate
RRGE-1	Exploration/ Production	4989 ft	286°F	660 to 1230 gpm
RRGE-2	Exploration/ Production	6543 ft	297°F	630 gpm
RRGE-3	Exploration			625 gpm
LEG A	Production	5853 ft	252°F	
LEG B		5532 ft	288°F	
LEG C		5862 ft	252°F	
RRGP-4	Production			Presently
LEG A		5420 ft	288°F	Nonproductive
LEG B		5110 ft	252°F	
RRGP-5	Production		276°F	645 gpm**
LEG A		4911 ft		
LEG B		4925 ft		
RRGI-6	Injection	3844 ft	252°F	1463 gpm
RRGI-7	Injection	3844 ft	172°F	410 gpm*

*Injectivity has increased significantly; additional data is forthcoming in a paper to be published in Spring '82.

**Frac-sand remains in the wellbore and needs extraction prior to pumping the well for production.

***Temperature observed immediately after drilling.

for conventional flashed steam applications, but high enough for binary electrical production, as well as for a large number of direct applications. Thus, a joint effort between the Idaho Operations Office of the Energy Research and Development Administration (ERDA), the USGS, the State of Idaho, the Raft River Rural Electric Co-op, and INEL was undertaken to develop this resource.

After additional exploration work, a successful well was drilled in February 1975. A second successful well was drilled four months later. Additional exploration, production, and injection wells were drilled between 1975 and 1978, proving the existence of an adequate resource at Raft River. Table 1 summarizes the characteristics of these wells. Presently four of these wells can be operated as production wells, and two are used as injection wells. The seventh well, "RRGP-4," has poor flow characteristics and is used for reservoir monitoring only.

With an abundant supply of geothermal fluids available, a number (20) of experiments have been undertaken at Raft River. These have included direct applications for space heating, air conditioning, potato drying, fish farming, soil heating, and alcohol production, among others. In the area of electrical production, a 60 kW(e) electrical prototype power plant was constructed. Based on the successful operation of this facility, a 5 MW(e) (45 MW(t)) pilot plant was designed and built. This plant was successfully tested in late October and early November 1981. With the experience gained in these experiments and demonstrations, the technical feasibility of applying moderate-temperature geothermal resources has been shown.

This paper introduces a series of papers which describe the Raft River geothermal resource, the 5 MW(e) pilot plant, and fluid handling. The first three of these papers follow in this issue of the GRC BULLETIN. Additional papers will appear in future issues.

In the first of the three papers presented here, J.A. Tullis and M.R. Dolenc discuss the nature of the Raft River geothermal resource and history of the seven wells at the site. The second paper, by J.F. Whitbeck and R.R. Stiger, reviews the design of the 5 MW(e) power plant and provides a "quick look" at the startup results. The third paper, by D.F. Suciu, P.M. Wikoff, and R.D. Sanders, discusses the design and operation of the geothermal water treatment systems.

Future papers in this series will include one by B.F. Russell describing well field testing methods. Another paper by B.F. Russell, D. Allman, and T.L. Thurow will describe the injection and monitoring systems, and provide an initial analysis of the reservoir injection data. A related paper by L.C. Hull will discuss the geochemical changes of the resource fluids during use and injection. In the final paper planned in this series, T.L. Thurow, L.S. Cahn, and R. Breckenridge will discuss the use and benefits of surface disposal of geothermal fluids through the use of wetlands and crop irrigation.