CHAPTER 16
INDUSTRIAL APPLICATIONS

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16.1 INTRODUCTION

Geothermal energy may be used in a number of ways in the industrial field. Potential applications could include drying, process heating, evaporation, distillation, washing, desalination, and chemical extraction.

The most important energy considerations for an industrial complex are the cost, quality, and reliability. Geothermal energy may be attractive to an industry providing: (a) the cost of energy/lb of product is lower than that presently used, (b) the quality of geothermal energy is as good or better than the present supply, and (c) the reliability of geothermal energy is available for the life of the plant. Reliability and availability can only be proven by long-term use or testing.

In some situations where available geothermal fluid temperatures are lower than those required by the industrial application, the temperatures can be raised by means of integrating thermal systems (boilers, upgrading systems, heat pumps, etc.). In designing geothermal energy recovery and utilization systems, alternate possibilities could be considered for various applications. The usual approach for utilization of geothermal fluid by proposed industries is to fit the industry to the available fluids. An alternate approach is to fit the available fluids to proposed industries. This alternate approach requires developing ways to economically upgrade the quality of existing geothermal fluids or the fluids derived from them. Figure 16.1 shows application temperature ranges for some industrial and agricultural applications.

While there are many potential industrial uses of geothermal energy, the number of worldwide applications is relatively small. However, a fairly wide range of uses are represented, including heap leaching of precious metals, vegetable dehydration, grain and lumber drying, pulp and paper processing, diatomaceous earth processing, fish processing and drying, chemical recovery, and waste water treatment. See Steingrimsson, et al. (1992) for a special issue of Geothermics on industrial uses. Industrial applications largely require the use of steam, or superheated water, while agricultural users may use lower temperature geothermal fluids. The largest industrial applications are a pulp, paper, and wood processing plant in New Zealand, a diatomaceous earth plant in Iceland and vegetable dehydration plants in the United States. These systems provide the best present example of industrial geothermal energy use.

16.1.1 Pulp, Paper, and Wood Processing

The site for the integrated newsprint, pulp and timber mills of the Tasman Pulp and Paper Company Ltd., located in Kawerau, New Zealand, is the largest industrial development to utilize geothermal energy. The plant site was selected because of the availability of geothermal energy. Geothermal exploration at Kawerau started in 1952 with the main purpose of locating and developing the geothermal resource for use in a projected pulp and paper mill. The mill produces approximately 200,000 tons of kraft pulp and 400,000 tons of newsprint each year (Carter and Hotson, 1992; Hotson, 1995).

In 1995, the Tasman Pulp and Paper Company was using a total flow of 0.60 million lb/hr from six wells to supply steam at two pressures, 200 and 100 psi. The geothermal steam, which is generated by separate flash plants in the bore field, is used:

1. For directly operating log kickers in the wood room, for timber drying for shatter sprays, and for combustion air heaters in the recovery boilers.

2. To generate clean steam in shell-and-tube boilers for use in the paper making equipment. Clean steam is necessary as the small percentage of noncondensible gases in the geothermal steam can cause intolerable temperature fluctuations in paper-making equipment. These heat exchangers are the most important users of geothermal steam at Tasman.

3. For a 10 MW turbo-alternator installed in 1960, designed to exhaust to atmosphere. In 1968, a single effect evaporator was installed to use exhaust steam to provide additional black liquor evaporation capacity.

Geothermal supplies approximately 26% of the total process steam requirement and up to 6% of the electricity demand at Tasman.

16.1.2 Diatomite Plant

The production of diatomaceous earth at Namafjall, Iceland, utilizing geothermal energy, is an important development for geothermal energy because it serves as an example of the way in which cheap geothermal energy can make a process economic when, with conventional energy resources, the process could not be justified. The