CHAPTER 5

USE OF GEOTHERMAL ENERGY

INTRODUCTION

- Heat from thermal aquifers are presently used at numerous locations world-wide. With respect to technical applications one may differentiate between geothermal aquifers containing
  - low temperature waters (25 to 40 °C),
  - warm waters in the range between 40 and 100 °C,
  - hot water above 100 °C
- Depending on the aquifer temperature, geothermal energy can be used in several areas.

AREAS OF UTILIZATION

- Low and intermediate temperature waters are directly used in a number of sectors (Table 5.1) including

- domestic water supply
- industrial processes (process heating in several chemical industries, e.g. plastics, synthetic rubber, soaps and detergents)
- space heating including domestic heating (in houses etc.) and heating in municipal sector (schools, hospitals, towns, cities)
- agricultural purposes (principally to heat greenhouses and for irrigation)
- balneology (in baths – Kaplica)

although some of these sectors also utilize hot waters with temperatures between 100 and 150 °C
AREAS OF UTILIZATION

- Hot waters (especially those above 150 °C) are used in electric power generation (Table 5.1)

PROBLEMS RELATED TO UTILIZATION OF GEOTHERMAL ENERGY

The problems related to the utilization of geothermal energy derive from the inherent nature of the fluids, i.e. their physical and chemical properties. The most important of these properties are:

- High concentrations of certain compounds, especially carbonates and silica, which cause scale formation (especially in the event of changes in P-T conditions) in the drilling casings and/or distribution pipes.

- High concentration of Boron (B) in some geothermal waters which is harmful to agricultural products (High-B geothermal water becomes part of a surface water cycle, via mixing with meteoric water, which is used for irrigation purposes. Especially in fields developed for electric power generation, the steam –rather than the liquid- phase of the geothermal fluid is used and the residual water, which becomes increasingly enriched in B, is discharged into rivers, streams etc. making part of the surface water).
PROBLEMS RELATED TO UTILIZATION OF GEOTHERMAL ENERGY

- Presence of dissolved gases in the geothermal fluids.
- Corrosive effects

SOLUTIONS TO PROBLEMS RELATED TO UTILIZATION OF GEOTHERMAL ENERGY

The extent to which these problems can be solved largely determines the economic profitability of the commercial exploitation of each particular geothermal field. In general, the following alternatives are proposed for the solution of the above stated problems:

- Keeping the pressure inside the well at a high level so that any scaling due to pressure release can be prevented (water extraction from drilling wells may cause a sudden drop in the well pressure which in turn facilitates boiling (adiabatic boiling). As a result, a steam phase is separated from the geothermal fluid, and the residual liquid becomes oversaturated with respect to certain compounds which do not go into the steam phase. Oversaturation results in the precipitation of that compound, i.e. scaling). High pressure inside the well also prevents the emission of dangerous dissolved gases.

- Installing down-hole or up-hole heat-exchangers (the geothermal fluid is not directly utilized. Instead, cold water is sent through pipes to the well and heated there (via exchange of heat with the geothermal fluid); the water heated in this way is then brought-through pipes to the distributor to be utilized in the selected area of application). Use of heat-exchangers eliminates the effects of scaling or the corrosive effects of the geothermal fluid.
SOLUTIONS TO PROBLEMS RELATED TO UTILIZATION OF GEOTHERMAL ENERGY

- Injection of special inhibitors (to the geothermal fluid) to prevent scaling.
- Re-injection of the high-B geothermal fluid to the aquifer to prevent its mixing with the surface run-off.