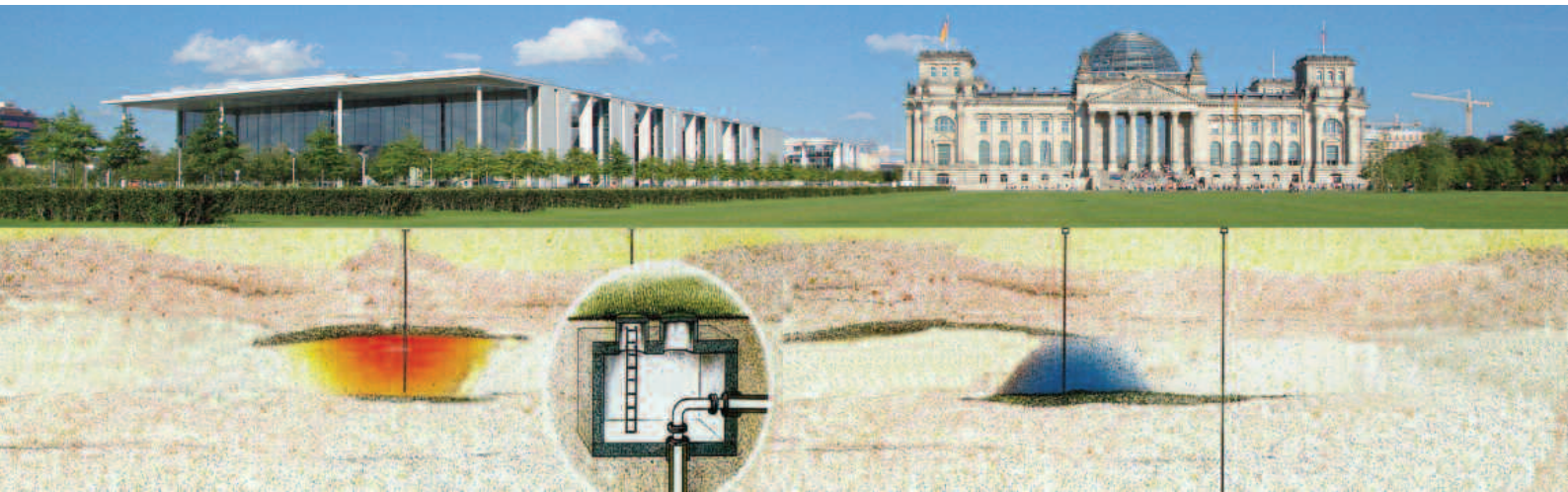


Heating and cooling with geothermal energy



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The use of geothermal energy for heating purposes and the use of water saturated rock formations below ground for cold water storage in connection with seasonal air-conditioning and cooling is already established on a commercial basis. Particularly, heating by means of geothermal energy is presently experiencing a period of considerable growth in Germany. Shallow geothermics is used for heating and/or cooling in connection with vertical heat exchangers and heat pumps. But the enormous technical potential of geothermal energy sources is still far from being fully exploited in Germany.

Research and development requirements

The main R&D task consists of providing this technology dependably and predictably. For geothermal energy to become economically competitive, the efficiency of geothermal systems has to be increased which is indicated by seasonal performance factor (SPF) that describes the ratio of useful energy output (heat generated) to the energy input (electricity), averaged over an entire heating season.

Depending on the heat source SPF of 3 to more than 4 are attained for ambient air and water (in vertical heat exchangers), respectively. Larger supply systems should be improved by a cost effective seasonal storage of heat or cold

below ground. Additionally, deep heat sources have to be exploited more economically. Research can be divided into two main categories:

1. Shallow geothermics

- An optimization of systems above ground will profit from an improved knowledge of the geological and geothermal situation below ground.
- Higher energy efficiency additionally requires a program for SPF increase to > 5 . The competitiveness of absorption heat pumps needs to be improved.
- The integration of underground heat and cold reservoirs in local energy supply systems must be developed.

2. Deep geothermics

- Exploration technologies have to be developed to increase the accuracy of expensive drillings and to enable forecasts on the behaviour of the subsurface during long-term operation.
- Geothermal technology development requires the systematic continuation of research aiming at the exploration and exploitation of productive sources at low costs and lower risk so that various locations with different geological settings can be used as energy sources.