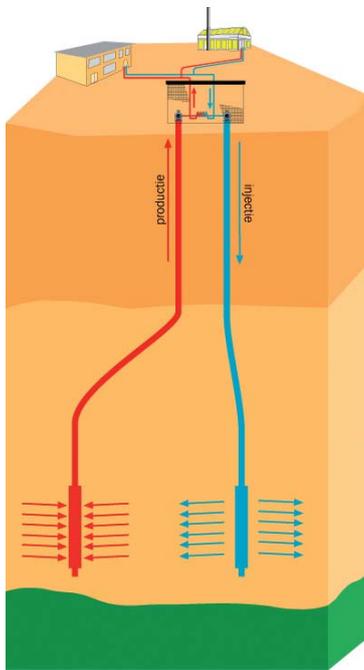


Renewed interest in geothermal energy



Driven by concerns about the sustainability of our environment and the security of our energy supply, interest in renewable energy is growing. Roughly 40% of Dutch energy demand is consumed in the form of 'low-temperature' power for heating homes and offices (at the municipal level) and industrial greenhouses. This demand for low-temperature power could easily be supplied by geothermal energy in its various forms. The Netherlands has considerable deep geothermal potential. Studies show that deep geothermal energy is highly competitive with other forms of energy. Moreover, with its low rates of greenhouse-gas emissions, geothermal energy would help reduce CO₂ emissions. Avoiding CO₂ emissions is usually much cheaper than other CO₂-control options. In addition, a substantial base load of local energy demand could be met with the shallow subsurface storage of seasonal heat and cold and waste heat.

The history

TNO has participated in some 40 geothermal studies and projects in recent decades, ranging from mapping and feasibility studies to the design, planning and supervision of two R&D geothermal exploration wells in the Netherlands. Whereas the implementation of seasonal heat and cold storage (including the use of shallow borehole heat exchangers) has become quite common on a local scale (roughly 600 installations), the number of deep low-enthalpy geothermal applications stands at zero. Many factors are holding back development in this area: namely, the wealth of Dutch gas resources, the tariff structure imposed on gas for agricultural application and the lack of a subsidiary instrument for the use of green heat.

Renewed interest

There has been a resurgence of interest in the use of deep geothermal heat in the Netherlands in recent years. The causes of this are multifold. Besides the Kyoto Protocol, which encourages governments to explore the use of renewables, the sharp rise in gas and oil prices is forcing private enterprises to consider the use of alternative energy sources. In 2003 large quantities of geological information on the subsurface became available under the new Dutch Mining Act. This is enabling a proper assessment of the subsurface conditions for geothermal applications. Moreover, this law regulates the production of geothermal energy, giving it a firm base in the Dutch legal system. Earlier, in 2002, Senter-Novem

initiated the founding of a Dutch Geothermal Platform, in which several actors, such as governmental bodies, energy companies, R&D institutes (inc. TNO) and consultancies, are participating to promote the use of geothermal energy and to lobby for a subsidiary programme for green heat.

Recent TNO studies

As a consequence of all this renewed interest, several studies have been undertaken since 2000. TNO's expertise has been used in most of these, partly ongoing, studies:

- **2001-2003** An advisory and pilot study of the implications of the new Mining Act for geothermal energy, in terms of such things as the mutual interference of

Geo energy and Geo information

TNO Built Environment and Geosciences *Geological Survey of the Netherlands* is the central geoscience centre in the Netherlands for information and research to promote the sustainable management and use of the subsurface and its natural resources.

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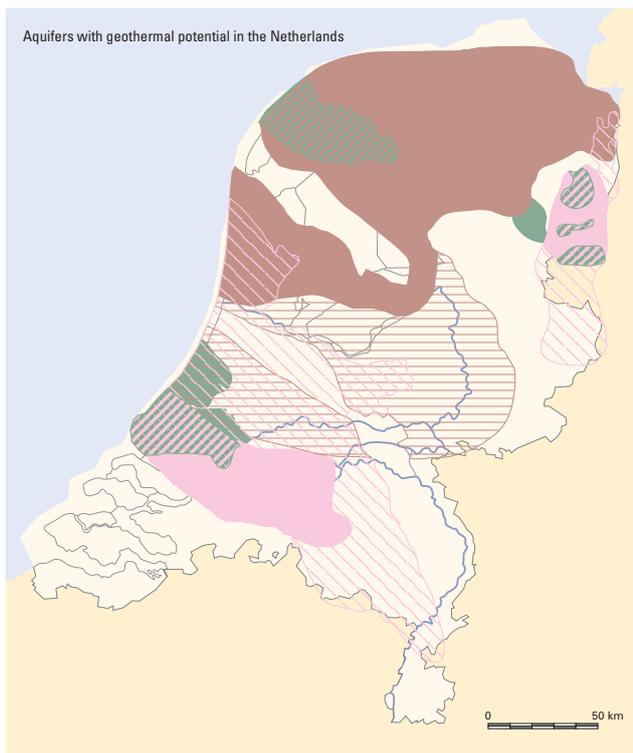
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different subsurface applications, risk analysis, modelling of geothermal systems and cost analysis for a planned binary geothermal power plant. These studies were carried out for the Netherlands Ministry of Economic Affairs.

- **2002** A modelling study of the subsurface thermal and flow behaviour of a planned binary geothermal plant in the western Netherlands for the NAM.
- **2004-2007** A feasibility study for the use of geothermal heat in homes was carried out in 2004 for the city of The Hague (together with IF Technology, DWA, The Hague City Council, Eneco, E.ON Benelux and the Geothermal Platform). This resulted in a covenant between six principal parties in 2006. The consortium recently approved the development of an extensive business case and a full technical implementation plan. TNO carried out a detailed geological risk assessment study for this phase.
- **2005** A site specific geological risk assessment study of a binary geothermal plant for heating a greenhouse, for a private horticultural enterprise in the western Netherlands. At the end of 2006, a start was made with drilling the first well to a depth of 1700 m. If this well proves successful, the second well for the binary geothermal plant will be drilled in 2007.
- **2005-2006** An inventory study of geothermal potential in the province of Drenthe, followed by an economic pre-feasibility study on application within the cities of Assen and Emmen and the Roden/Leek municipality.

- **2006-2008** Participation in the Enhanced Geothermal Innovative Network for Europe (ENGINE), an EU project. Development of a risk assessment and decision support system for deep geothermal application.
- **2007** An inventory study of geothermal potential in the province of Flevoland, carried out together with Ecofys Netherlands.
- **2006-2007** TNO participates as subsurface expert in a study funded by SenterNovem, which is evaluating interdependencies between spatial planning and the use of renewable energy sources (among which geothermal energy) in a future sustainable society.



 Rotliegend sandstones	 Rotliegend sandstones, potential uncertain
 Triassic sandstones	 Triassic sandstones, potential uncertain
 Lower Cretaceous sandstones	

