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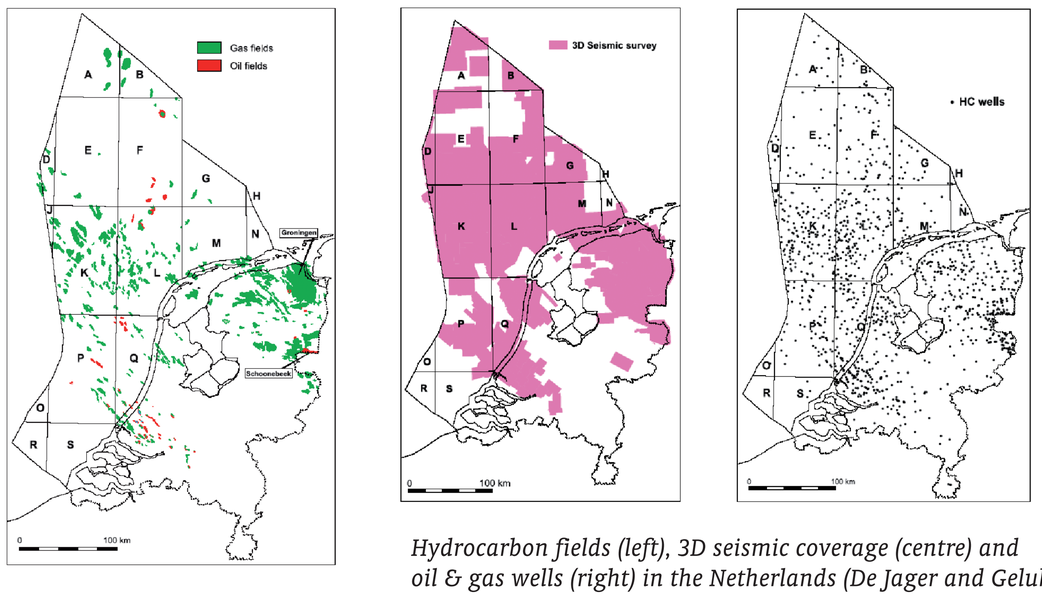
Geothermal Energy in the Netherlands

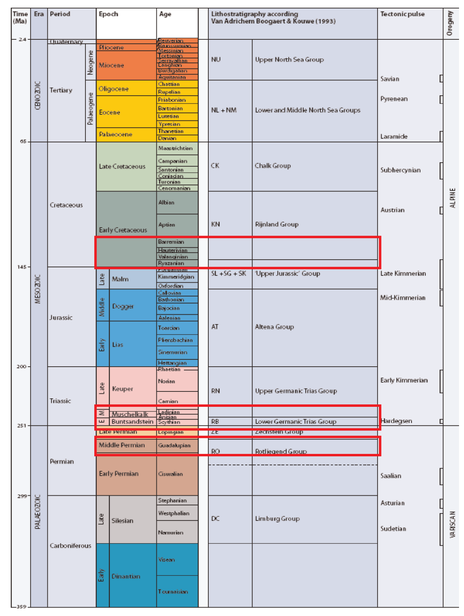
In the Netherlands, geothermal energy is a promising renewable source for district heating and for heating industrial greenhouses. Aquifers that are of potential interest for heating purposes occur at depths of less than 1000 m to more than 3000 m in Permian, Lower Triassic and Lower Cretaceous/Upper Jurassic sandstones. In the areas where the aquifers are located at depths below 3000 m, additional potential for electricity production (via ORC/Kalina cycle) is present. With a moderate geothermal gradient in the dutch subsurface, total estimated Heat in Place (HIP) of these aquifers more or less equals the the energy content of the huge Groningen gas field. Application of EGS could (in future) substantially increase the geothermal yield of individual projects.

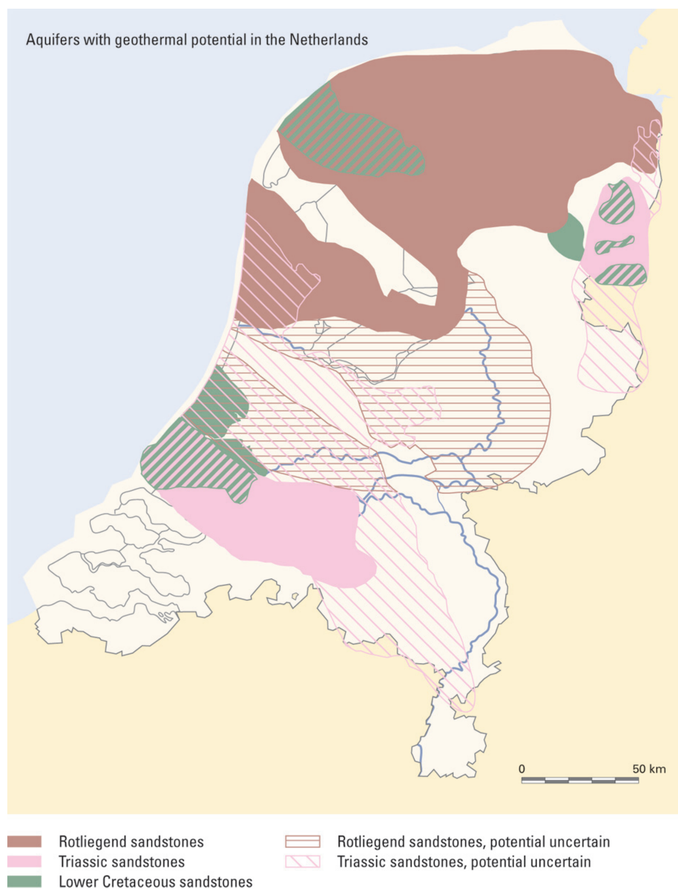
Since 2000, a resurgence of interest for geothermal energy has emerged in the Netherlands due to :

- The sharp rise in gas and oil price, forcing private enterprises to consider the use of alternative energy sources;
- The release of a wealth of Oil&Gas related well and seismic data of the dutch subsurface, based on the new Dutch mining law-2003; implementation of the legal framework for geothermal energy, within the new mining law;
- Foundation of the Dutch Geothermal Energy Platform in 2002, which acts as knowledge disseminator and lobby centre towards the variuos dutch stakeholders.



Hydrocarbon fields (left), 3D seismic coverage (centre) and oil & gas wells (right) in the Netherlands (De Jager and Geluk, 2007)





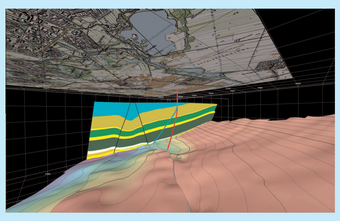
Current geothermal projects

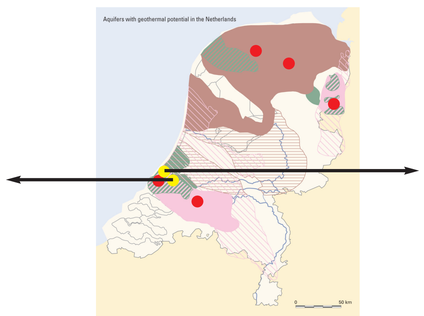
Greenhouse Heating- Bleiswijk

In 2007, the first dutch geothermal doublet has been drilled in Early Cretaceous sandstones at 1750 m depth.

Temperature 60° C; Flow rate 160 m³/hr
Capacity 4-5 MWth

The doublet currently heats 7 ha of tomato green house, avoiding the use of 3 million m³ of gas per year. Investment costs were about 6 MEUR.





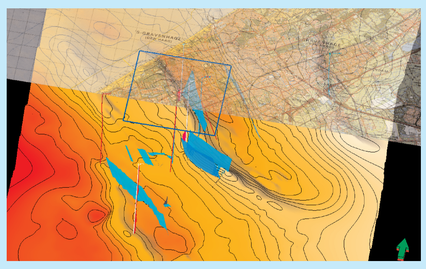
Various other geothermal heating projects are under way (red dots), mainly in the northern and western part of the Netherlands. In some of these projects, the target depth is more than 3000 m, hence opening up the opportunity to produce geothermal electricity. These options are currently being considered.

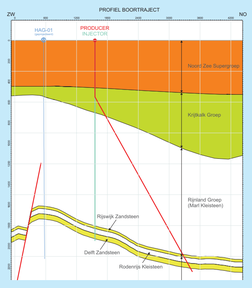
District Heating - The Hague

A 2nd doublet will be drilled in 2008 and is also targeted to Early Cretaceous sandstones, here at 2200 m depth.

- Temperature 75° C; Flow rate 150 m³/hr
- Capacity 6 MWth

The doublet will be used to heat 3800 dwellings and 20000 m² office space between 2008 and 2011. Investments costs are about 45 MEUR (including heating grid)



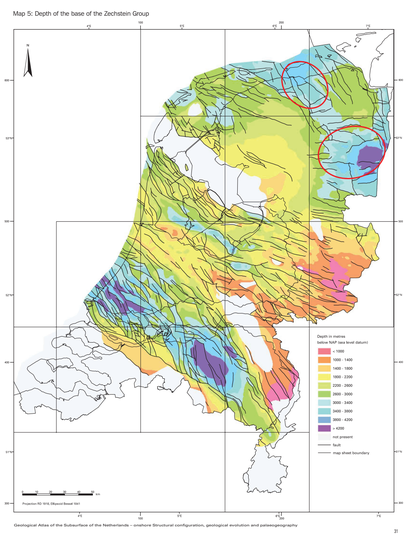


Potential for Enhanced Geothermal Systems

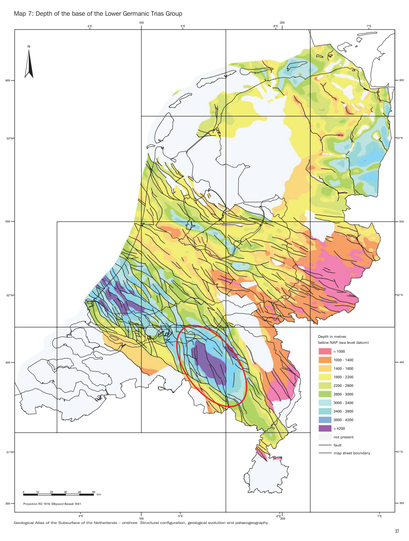
Within the European geothermal resource portfolio for EGS that has been initiated recently within ENGINE, 2 areas in the Netherlands have been identified.

In the northern part of the Netherlands, Rotliegend Slochteren sandstones locally have depths of more than 3500m, with temperatures over 120°C. In the Roer Valley Graben (southern Netherlands), Triassic bunt-sandstones also are present at depths below 3500 m.

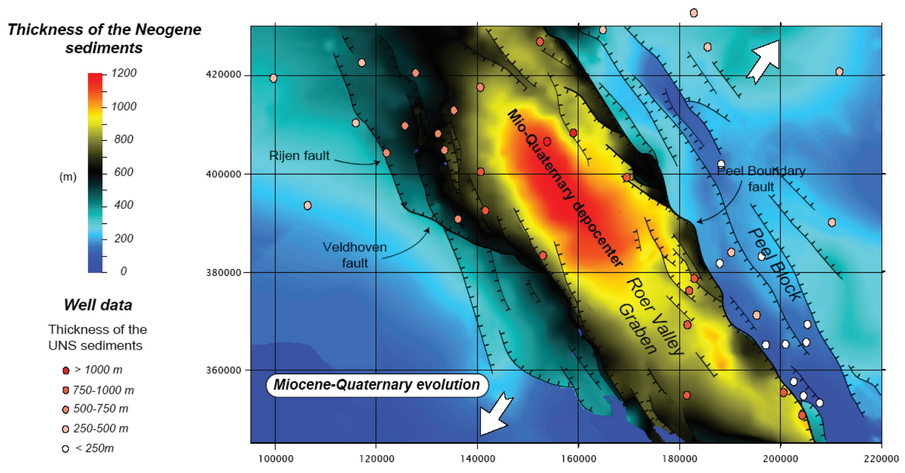
In both areas, large fault systems have been active within the Late Tertiary and Quarternary stage. The combination of natural permeability at large depths and presence of active fault systems gives favourable conditions for potential application of EGS. This opportunity will be adressed in the near-future geothermal R&D focus within the Netherlands.



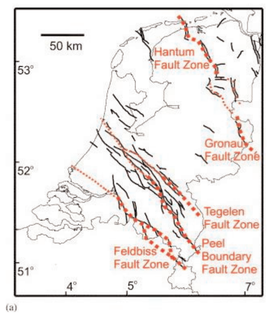
Depth of the Base Zechstein Group, indicating the top of the Rotliegend Slochteren Formation (TNO, 2004). Encircled are potential areas for EGS.



Depth of the Base of the Germanic Trias groupe, indicating the depth the Triassic Buntsandstein Group (TNO, 2004). Encircled are potential areas for EGS.



Miocene-Quaternary evolution of the Roer Valley Graben, inferred from the distribution of the Neogene sediments, the subsidence analysis and the distribution of the active faults. White arrows indicate the extension direction (after Michon et al, 2003)



Late Tertiary Faults in the Netherlands (after van Balen et al, 2005)

References
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