

Paper Number: 3834

The South Africa geological suitability for underground source heat pump system (USHP)

Galgaro, A.¹, Greggio P.¹, Ninfo A.¹, Cultrera M.¹, Di Sipio E.², De Carli M.³, Emmi G.³, Fels W.⁴, Myron Sukha⁵ and Mantovan M.⁴

¹Dept. of Geoscience, University of Padova, Italy.

²GeoCentre of Northern Bavaria -Friedrich-Alexander University, Schlossgarten 5 Erlangen, Germany

³Dept. of Industrial Engineering, University of Padova, Italy

⁴Hiref S.p.a, Tribano (Padova), Italy

⁵Hiref SA, 4 Sederberg Rd, Alberton 1451. South Africa

In recent years, the environmental impacts caused by the energy production from fossil fuels represent a worldwide issues. Meanwhile the increase in energy requirements, along with a growing awareness in curbing gas emissions and pollutants, have promoted a growth of new technologies to save and produce energy from renewable sources.

Thermal use of the underground via borehole heat exchangers (closed loop systems) or groundwater (open loop systems) coupled with a heat pump (Ground Source Heat Pump) could be an efficient and environmentally friendly technique. Underground Source Heat Pumps systems (USHP), despite their economic and environmental advantages, are not widespread among many countries, such as South Africa.

This preliminary study aims to evaluate the South African suitability to USHP; in particular we focus on 3 key zone (Johannesburg, Durban and Cape Town), that could be considered representative of the geological and climatic national variability, moreover these areas are the most urbanized ones.

A Geographic Information System tool supports information regarding land suitability, in order to provide a regional evaluation and to support the territory geothermal planning and management.

The geological, hydrological, climatic and underground thermo-physical parameters were stored, combined and analysed inside a GIS system. Suitability maps (fig 1) could provide an instrument to individuate the suitability levels of open and close loop USHP systems.

Early results show a good suitability for use of geothermal solution, varying from place to place in relation to geological and hydrogeological conditions, while the local weather conditions affect the actual convenience and opportunity to use the geothermal solution for air conditioning of buildings. The exploitation of underground thermal assessment through systems of geo-exchange could be generally favored by its combining with a large range of technologies and available energy sources (as wind, solar, PV, etc.).

In conclusion this study, also if preliminary, could provide a useful support for the low enthalpy geothermal exploitation in South Africa.

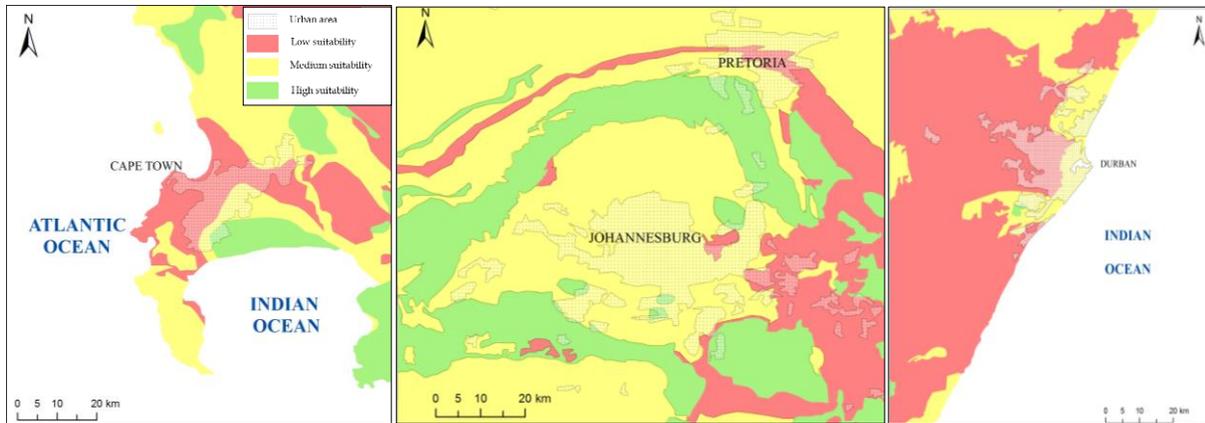


Figure 1: Closed loop USHP suitability map of Cape Town, Johannesburg and Durban municipalities

