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## Principle of Geochanger Systems for Buildings Heating and Cooling

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Geothermal heat pumps (GSHPs), or direct expansion (DX) ground source heat pumps, are a highly efficient renewable energy technology, which uses the earth, groundwater, or surface water as a heat source when operating in heating mode or as a heat sink when operating in a cooling mode. It is receiving increasing interest because of its potential to reduce primary energy consumption and thus reduce emissions of greenhouse gases (GHGs). The main concept of this technology is that it utilizes the lower temperature of the ground (approximately  $<32^{\circ}\text{C}$ ), which remains relatively stable throughout the year, to provide space heating, cooling, and domestic hot water inside the building area. The main goal of this study is to stimulate the uptake of the GSHPs. Recent attempts to stimulate alternative energy sources for heating and cooling of buildings have emphasized the utilization of ambient energy from the ground source and other renewable energy sources. The purpose of this study, however, is to examine the means of reduction of energy consumption in buildings, identify GSHPs as an environmentally friendly technology able to provide efficient utilization of energy in the buildings sector, promote using GSHPs applications as an optimum means of heating and cooling, and to present typical applications and recent advances of the DX GSHPs. The study highlighted the potential energy saving that could be achieved through the use of ground energy sources. It also focuses on the optimization and improvement of the operation conditions of the heat cycle and the performance of the DX GSHP. It is concluded that the direct expansion of the GSHP, combined with the ground heat exchanger in foundation piles and the seasonal thermal energy storage from solar thermal collectors, is extendable to more comprehensive applications.

### Biography

Abdeen Mustafa Omer is an Associate Researcher at Energy Research Institute (ERI). He obtained both his Ph D degree in the Built Environment and Master of Philosophy degree in Renewable Energy Technologies from the University of Nottingham. He is a qualified Mechanical Engineer with a proven track record within the water industry and renewable energy technologies. He has been graduated from the University of El Menoufia, Egypt, BSc in Mechanical Engineering. His previous experience involved being a member of the research team at the National Council for Research/Energy Research Institute in Sudan and working as director of research and development for National Water Equipment Manufacturing Co. Ltd., Sudan. He has been listed in the book WHO'S WHO in the World 2005, 2006, 2007, and 2010. He has published over 300 papers in peer-reviewed journals, 200 review articles, 15 books, and 150 chapters in books.

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