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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 the greenhouse gases (GHGs). The main concept of this technology is that it utilises the lower temperature of the ground (approximately <32°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 has emphasised the utilisation of the ambient energy from 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 environmental friendly technology able to provide efficient utilisation 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.With the improvement of people's living standards and the development of economies, heat pumps have become widely used for air conditioning. The driver to this was that environmental problems associated with the use of refrigeration equipment, the ozone layer depletion and global warming are increasingly becoming the main concerns in developed and developing countries alike. With development and enlargement of the cities in cold regions, the conventional heating methods can severely pollute the environment. In order to clean the cities, the governments drew many measures to restrict citizen heating by burning coal and oil and encourage them to use electric or gas-burning heating. New approaches are being studied and solar-assisted reversible absorption heat pump for small power applications using water-ammonia is under development

The outdoor piping system can be either an open system or closed loop. An open system takes advantage of the heat retained in an underground body of water. The water is drawn up through a well directly to the heat exchanger, where its heat is extracted. The water is discharged either to an aboveground body of water, such as a stream or pond, or back to the underground water body through a separate well. The direct expansion installed for this study was designed taking into account the local meteorological and geological conditions. The site was at the School of the Built Environment, University of Nottingham, where the demonstration and performance monitoring efforts were undertaken Figures (3-4). The heat pump has been fitted and monitored for one-year period. The study involved development of a design and simulation tool for modelling the performance of the cooling system, which acts a supplemental heat rejecting system using a closed-loop GSHP system. The water supply system consisted of water pump, boiler, water tank, expansion and valve flow metre. A thermostatically controlled water heater supplied warm water, which was circulated between the warm water supply tank and warm water storage tank using a pump to keep the surface temperature of the trenches at a desired level.

Biography

Abdeen Mustafa Omer is an Associate Researcher at Energy Research Institute (ERI). He obtained both his PhD degree in the Built Environment and Master of Philosophy degree in Renewable Energy Technologies from the University of Nottingham. He is qualified Mechanical Engineer with a proven track record within the water industry and renewable energy technologies. He has been graduated from 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 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, 7 books and 150 chapters in books

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The University of Nottingham

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