Implementing the GEOPEAK Project in Greece towards the achievement of Europe 20-20-20 targets: Development and Evaluation of a Geothermal Heat Pump of High Efficiency

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Geothermal energy is a renewable, low carbon energy source that can be used to condition building environments or converted to electricity. Resources of geothermal energy range from the shallow ground to hot water and hot rock found a few kilometers beneath the Earth's surface, and down even deeper to the extremely high temperatures of molten rock called magma. The shallow geothermal energy is indirectly defined as the ground heat originated by the ground temperature less than 25 ^{o}C. Geothermal heat pumps can tap into this resource to heat and cool buildings. A geothermal heat pump system consists of a heat pump, an air delivery system, and a heat exchanger, a system of pipes buried in the shallow ground near the building. In the winter, the heat pump removes heat from the heat exchanger and pumps it into the indoor air delivery system. In the summer, the process is reversed, and the heat pump moves heat from the indoor air into the heat exchanger. The heat removed from the indoor air during the summer can also be used to provide a free source of hot water. Geothermal heat pumps are already used in Southern Europe, however, further R&D and practical experience is crucial to fully exploit the advantages of geothermal heat pumps in warmer climates in supplying heat and cold from one single installation. Greece is a country located in the Southern Europe and its target is to meet the EU heating and cooling RES targets ~580 GWh by 2020, through the installation of new geothermal heat pump systems.

In view of the above, in “GEOPEAK” project ongoing work on the development of the first Greek geothermal heat pump is currently being carried out. Under the auspices of this project the development of six geothermal heat pumps (capacity 15, 20, 30, 40, 60 and 80 kW) with a high coefficient of performance (COP) has been accomplished. Experimental evaluation has been performed on those prototypes at the INTERKLIMA company’s test lab. Furthermore, three borehole heat exchangers have been developed at Central Greece University of Applied Sciences campus in Evia island and during the next period they will be connected with one of the prototypes. This system will cover cooling and heating needs in one of the university buildings and by this way it will operate in real conditions and environment. The final design of the six (6) geothermal heat pumps will be completed after the evaluation of the results in laboratory and real operation. Finally, numerical modeling work has been conducted to simulate the system’s performance and will support the development of the necessary charts and diagrams that will accompany the geothermal heat pumps when they will be introduced in the market.