

A comprehensive review of the application of solar assisted ground source heat pump (SAGSHP) systems in Canada

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ABSTRACT

Ground source heat pump systems (GSHP) are globally recognized as efficient green systems to reduce energy consumption and mitigate fossil fuel emissions. However, in severe cold regions, such as Canada, the application of GSHP is confined due to the soil thermal imbalance and higher required drilling depth. Hybridization of GSHP with solar energy as solar-assisted ground source heat pumps (SAGSHP) is one of the innovative methods which can address the issues of application of GSHP in extremely cold climates. Due to the promising of SAGSHP in cold regions, numerous studies have recently assessed the efficiency of these systems. This critical review will be carried out with the aims to examine the state-of-the-art of SAGSHP in the cold regions and its application prospects in Canada. In this study, the potential of different SAGSHP configurations and operating strategies to provide the required heating demand of the residential sector in cold climates will be reviewed based on various parameters encompassing coefficient of performance (COP), energy efficiency, solar efficiency, solar fraction (SF), seasonal performance factor (SPF) and operating costs. Furthermore, for the sake of identifying the more favorable regions for developing SAGSHP in Canada, geothermal potential (i.e., soil properties and underground heat flow) and solar thermal potential (solar intensity and hours of sunlight) of different regions will be thoroughly reviewed. Finally, this study would provide insight into applying more feasible configurations and operating modes of SAGSHP in the regions with a higher favorability index in Canada.

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