

## Study of Heat Transfer through the Ground and its Accumulation Properties to Increase the Energy Efficiency of Underground Buildings

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**Abstract :** To maintain a comfortable indoor temperature for its residents in the colder season, heating a building is necessary. Due to the expansion in the construction sectors, the consumption of heating energy is increasing. According to Eurostat data, in the European Union, the share of energy consumption of heating energy for space and cooling in residential buildings was around 63% in 2019. These figures indicate that heating energy still accounts for a significant portion of total energy consumption in Europe. Innovation is crucial to reduce energy consumption in buildings and achieve greater energy efficiency and sustainability. It can bring about new solutions that are smarter and more natural energy generation to reduce greenhouse gas emissions. The ground can serve as an effective and sustainable heat accumulator for heating and cooling. The temperature of the ground is higher than that of the ambient air in the colder period and lower in the warmer period. The building deep in the soil could use less thermal energy compared to the above-ground buildings that provide the same amount of thermal comfort. The temperature difference between the soil and the air inside the building decreases as the temperature of the soil increases. In progress, this process generates the condition that acts against heat loss. However, heat dissipates further to the consecutive layers and reaches thermal equilibrium. The charging of the ground by heat and its dissipation through the adjacent soil layers was investigated experimentally. The results of this research showed that 9% of the energy savings in partially underground buildings and 44.4% in completely underground buildings were derived from heating the space. Heat loss to the ground is treated as a charge of the soil by thermal energy. The dependence of the intensity of the charge on time was analysed and presented.

**Keywords :** heat transfer, accumulation of heat, underground building, soil charge

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