

UDC 624.1:644.1

## THE USE OF GEOTHERMAL ENERGY WITH THE HELP OF ENERGY PILES

Author – Kseniia Vedkal<sup>1</sup>, Stud. of gr. PCB 22-4pm

Scientific supervisor – Kostiantin Dikarev<sup>2</sup>, Cand. Sc. (Tech.), Assoc. Prof.

Language consultant – Liliia Druzhinina<sup>3</sup>, Assoc. Prof.

<sup>1</sup>[ksvedkal@gmail.com](mailto:ksvedkal@gmail.com), <sup>2</sup>[kdikarev@ukr.net](mailto:kdikarev@ukr.net), <sup>3</sup>[druzhinina.liliya@pdaba.edu.ua](mailto:druzhinina.liliya@pdaba.edu.ua)

Prydniprovska State Academy of Civil Engineering and Architecture

Today, there is a problem of energy supply from nuclear power plants and hydroelectric power plants, that is why the search for alternative energy supply solutions in Ukraine is becoming more actual. According to Oleksiy Chernyshov, the Minister of Ukraine, the priority for the Government is to achieve the energy independence of the state.

In connection with numerous studies scientists have come to the conclusion that geothermal energy, as one of the renewable energies released by the inner zones of the Earth, can serve as an alternative power source and provide heat and electricity to buildings.

Geothermal energy is heat energy released from the outer zones of the Earth over hundreds of millions of years. It is divided into high-potential energy and low-potential energy.

Advantages of geothermal energy are as follows:

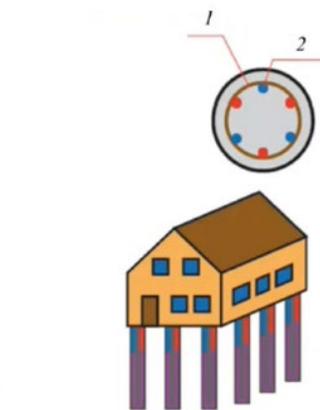
- it is always available regardless of the day time and season or climatic conditions;
- there is no need to create expensive transport systems since geothermal energy can be found directly on site;
- there are no direct emissions of carbon dioxide (insignificant emissions are possible only due to the use of electric units).

In addition, humanity has already had the technology that makes it possible to use available resources almost everywhere.

In global construction practice it is common to obtain the low-potential soil heat from the near-surface zone by using horizontal collectors and from the depth of soil layers using vertical collectors of heat pumps. The most effective method is the use of combined foundations (in the case of the location of the heat pump collector in the body of the foundation), this is especially relevant when using deep collectors. Piles, which are installed at the same time, are called energy piles.

The use of heat pump collectors combined with underground parts of buildings and structures, in particular, piles, is of great interest in this regard [2; 3].

Such foundation is called a “double” foundation. Its main function is to transfer the load from the building to the soil foundation, and its secondary function is to use it as soil heat exchanger [5].



*Fig. 1. Scheme of an energy-efficient pile: 1 – steel pile frame; 2 – heat exchanger pipes*

The scheme of the location of energy piles under the building is presented in figure 2.



*Fig. 2. The general layout of the building's elements heated with the use of energy piles:  
1 – heated building; 2 – technical basement with heat pumps;  
3 – energy piles with heat pump collectors*

The main advantages of energy piles are:

1. Low additional investment costs;
2. The possibility of simultaneous use of energy piles not only for transferring the load from the weight of the buildings and structures located on them to the base, but also for heating [4].

However, compliance of the soil with certain conditions or the location of building near a reservoir is necessary.

To understand the processes of distribution of temperature fields in the body of the pile, the currently accepted wiring diagrams of plastic collectors of heat pumps in the head of energy piles and the location of heat collectors in the body of the pile are of great interest (Fig. 3).

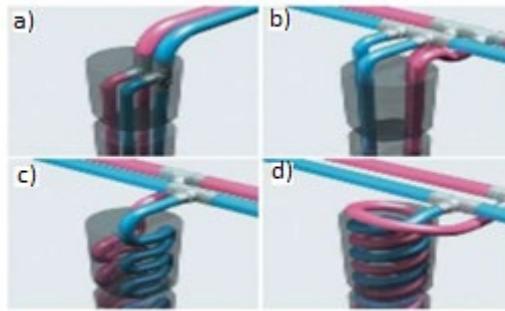


Fig. 3. Wiring diagrams and location in the body of energy piles of heat pumps plastic collectors: a, b – parallel location of collectors with cold and heated water; c, d – helical location of collectors with cold and heated water

As indicated in the wiring diagram and in the location of plastic collectors, the most uniform distribution of temperature in the body of the pile is achieved with the dilution presented in figure 3, d. At the same time, to ensure the strength of the pile, the plastic pipes of the heat pump collector should be placed inside the reinforcing frame. This allows to perceive axial and radial stresses caused by temperature deformations of the plastic collector.

Therefore, the main source of geothermal energy is a constant flow of heat from the red-hot subsoil, directed to the surface of the earth. The use of this energy, even in small volumes, can significantly change and improve the energy balance of any region. If humanity use only geothermal energy, it will take 41 million years before the temperature of the Earth bosom will decrease by at least half a degree [1].

### References

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