UDK 697.7

TECHNICAL AND ECONOMIC COMPARISON HELIOSYSTEMS WITH TWO TYPES OF SOLAR COLLECTORS

V. Kozyrskyi, Doctor of Engineering
L. Martyniuk, PhD student
National University of Life and Environmental Sciences of Ukraine, Kiev
Joanna Aleksiejuk, PhD student
Warsaw University of Life Sciences, Poland

Paper presents results of the technical and economic comparison of solar systems with two types of solar collectors (flat plate and vacuum tube) according to that efficiency and payback period.

Heliosystem, solar collector, efficiency, payback period.

In Ukraine solar radiation is 3500-5200 MJ/m2/year, that is on par with the countries which actively use solar collectors (USA, Germany, Sweden, etc.).

Duration of solar radiation in Kyiv from April to October 130 - 300 hours / month and not inferior to other Central European cities, which are widely used in solar technologies for heating.

There are many variants of heliosystems, and thermal energy they can produce a particular day – is limited and depends on many factors: the configuration of the system and its design features, the degree of clarity of the day, the temperature of cold water tank volume, ambient temperature and so on. Therefore, the correct calculation of solar systems must use the appropriate calculations and complex software products. The efficiency of solar defined efficiency of solar collectors and their layout, orientation in space, angle, etc.

Known methods of calculation of economic efficiency of solar power plants have two main drawbacks: first, many of them based on the old economic models and not adapted to modern conditions; secondly, basically have the following characteristics that are difficult to determine at the preliminary stage design of solar power plants

The purpose of research – a comparison of two types of solar collectors (flat plate and vacuum tube) according to that efficiency in solar hot water (DHW) by using appropriate calculation algorithms.

Materials and methods of research. For example, the firm WATT S.A. selected two types of heliosystems for domestic hot water: flat-plate and evacuated-tube solar collectors. This systems differ only area of the aperture collectors and price (related to different type of collectors). All other parameters are identical.

Results of research. An important aspect in the design of solar systems is the choice of the appropriate of the aperture solar collector area as the size and design parameters of the latter substantially affect the value of solar as a whole, and hence in terms of payback. In addition, solar payback period also depends on the type previously used traditional sources of heat and energy tariffs. However, remember that the payback period exceeding the period of operation is not allowed.

The method of determining the economic payback of solar heating systems shows its dependence on key factors: the cost of solar, total solar radiation intensity in the plane of the collectors, the efficiency of solar collectors, the value substituted heat load and allows for the rapid assessment of feasibility of construction of solar power plants at the stage of deciding on implementation.

Payback period of solar power plants at the design stage can be defined:

$$T = \frac{K_Г}{\sum S_P k_2 C_3}$$

where: T - payback period (years); $K_Г$ - cost of solar systems, UAH; $\sum S_P$ - total intensity of solar radiation in the plane of the collector during the year, kW·h/year; k_2 - efficiency of solar collector, %; C_3 - value substituted heat load (green fee), UAH/kW·h.