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STUDY OF THE EFFECTIVENESS INNOVATIVE MEASURES FOR ENERGY SAVING IN EDUCATIONAL INSTITUTIONS

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In recent years, a significant number of cities in Ukraine, in particular, Kyiv, Kharkiv, Lviv, Ternopil, Chernivtsi and others. have joined the Covenant of Mayors on Climate and Energy [1], which provides for the holding municipal authorities measures to significantly reduce greenhouse gas emissions by 30% by 2030. Achieving this result requires a new strategy for the use and development of the municipal energy system, which envisages increasing the environmental safety of boiler plants and thermal power plants through the introduction of innovative high-efficiency energy-saving, environmental and economically sound technologies [2]. This strategy should take into account such problems of the Ukrainian economy as: outdated technologies and equipment for thermal energy production, high energy consumption and material costs exceeding 2-3 times the corresponding indicators of developed countries; lack of modern environmental protection systems, lack of appropriate legal and economic mechanisms that would encourage the development of environmentally friendly technologies, environ-mental protection techniques, etc. [3]. At the same time, stimulating the effective consumption of thermal energy by users will allow reduce the resource consumption of urban heating networks, which will reduce environmental pollution and reduce green-house gas emissions.

Actual scientific task that confronts the communal sector of the economy today is to increase the informative methods for assessing the effectiveness of measures energy

saving in the areas of heat supply and heat consumption. To solve this problem, the effectiveness of the measures under study should be considered as a complex value, which takes into account the energy, environmental and economic consequences of their implementation.

Recently, the interaction between energy and the environment has become dangerous character. Burning and heat energy installations carry out chemical pollution of the environment by emissions of harmful substances, first of all nitrogen and sulfur oxides, greenhouse gas emissions - CO_2, CO those others, ash and soot emissions, which are steadily exacerbating environmental problems due to in careased production. The growing technogenic burden on the environment and the exacerbation of these environmental security issues require an immediate change in environmental policy and the sustainable development of ecology in the future, energy and the economy. The solution to this problem is made possible by a clear optimization of the structure of the energy balance of the country, in which the largest share should be ecologically safe energy sources from renewable energy sources.

Traditional energy today accounts for at least 30% of all atmospheric emissions. Of the total emissions, about 30% are solids, more than 60% sulfuric anhydride, and about 55% nitrogen oxides. In these conditions, the integration of energy and ecology, close interrelation of ecological aspects of energy with energy aspects of ecology is important in the region [4]. The implementation of such integration is in accordance with the concept of sustainable development of society, whose main purpose is to ensure the high quality of life of present and future generations on the basis of a balanced solution to the problems of economic development, conservation of the natural environment, rational use and reproduction of the planet's natural resource potential.

An analysis of the development strategy of the EU energy sector shows that between 2020 and 2030, the relative shares in the energy balance of primary energy sources of fuels such as oil and solid fuels will decrease by 0.4% (from 35.7 to 35.3%) and 0.7% (from 17.4 to 16%), respectively, of natural gas - will not change - 25.7%, and the share of renewable energy sources will increase by 3.1% (from 9.9% to 12.0%). Thus, the contribution to the energy balance of traditional energy sources will be reduced over the years, which will lead to an in-crease in their cost, while, on the contrary, renewable energy sources will increase significantly [5].

One of the promising areas of energy resource conservation is the utilization of solar energy due to the depletion of world oil and gas reserves, as well as the problem of environmental pollution by solid fuel combustion products. The technology of utilization of solar energy, which is most prepared for the implementation of public utilities needs, is water heating by solar energy. Ukraine's National Energy Strategy for the period up to 2030 envisages a gradual increase in the production of equipment for solar hot water supply and heating systems, and it is also planned to install about 2 million m^2 of solar collectors, which will allow to obtain tangible savings. Experience in operating these systems has shown that 1 m^2 of solar collector under optimal operating conditions saves from 0.1 to 0.15 tons of conditional fuel during the summer season. Large-scale use of solar systems in Ukraine by 2030 will save up to 200

thousand within the adopted strategy of energy industry development Tons of conditional fuel [6].

Description of the object of research. As a full-scale object for research was chosen the building of the Communal Institution «Kharkov Palace of Children and Youth Creativity» (CI KhPCYC) 1993 of the building, which consists of two buildings and has a multi-level complex T-shape. According to the project documentation for the building: its construction volume is 80 375 m^3, the total area of the building is 15 159 m^2; usable area 13 712 m^2; the projected consumption of thermal energy for heating 1 m^2 of the total area is 183 W/m^2. For full-scale object, the use of 2 energy-saving measures is recommended: controlling the thermal conditions of the building's premises with the HERZ Smart Comfort system [7] (Fig. 1) and using an alternative source of heat supply - heliosystems.

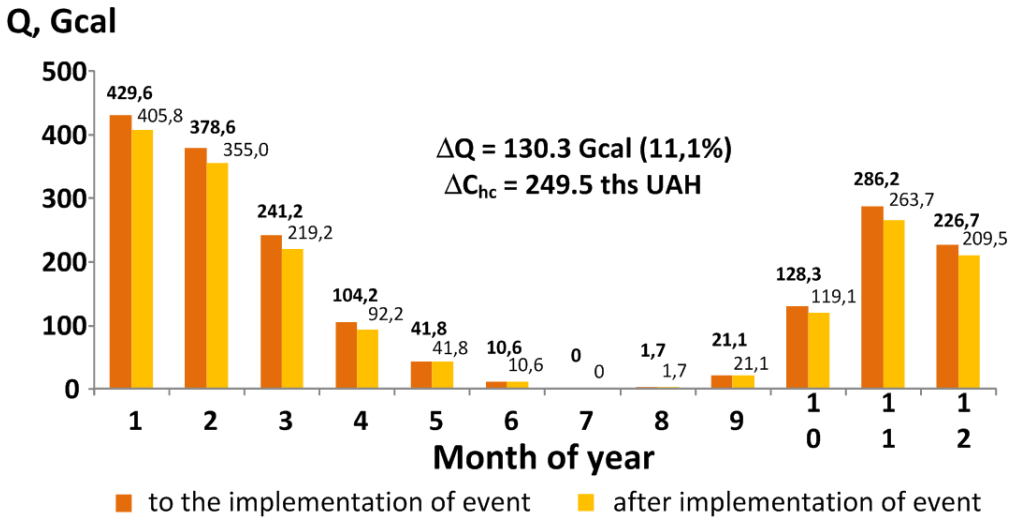

Fig. 1. The results of evaluating the efficiency of use HERZ Smart Comfort system

The shape of the possible location of the heliosystems with a total area of 1080 m^2 is located on the south side of one of the buildings of the CI KhPCYC. On the recommended site in accordance with established requirements 180 flat-type solar collectors of the recommended type– Buderus SKT 1.0 [8] can be placed.

Evaluation of the energy-saving measures effectiveness at full-scale object. Based on the above ratios estimated the level of saved heat energy in all rooms of the CI KhPCYC building, which require optimization of the temperature regime. The calculation results (see Fig. 1) indicate that the use of optimizing the temperature mode of the building by lowering the temperature during the absence of staff and visitors can save 130.3 Gcal or 11.1% of heat energy during the heating season. Moreover, the relevant indicators of environmental and economic effects are: reduction of natural gas consumption – 16.5 thousand m^3, reduction of CO_2 and NO_x emissions into the atmosphere – 32.0 tons and 0.035 tons, respectively [9]; reduction in heating charges – 249.5 thousand UAH.

A multicriteria assessment of the efficiency of use of the heliosystem shows that this measure allows you to additionally obtain such an annual effect: energy – an additional amount of thermal energy – 376.7 Gcal or 20.2%, of which it can be used: the building of

the communal enterprises CI KhPCYC – 212.3 Gcal or 11.4 %, in other buildings (from May to September) – 164.4 Gcal or 8.8%; In this case, the demand of communal enterprises CI KhPCYC in thermal energy is provided: in the period from May to September – by 100%, in the heating period – by 2.8 ... 35.6%; ecological - reduction of natural gas consumption – 47.7 thousand m^3, reduction of CO_2 and NO_x emissions – 92.6 tons and 0.101 tons, respectively; economic: reduction of payment for thermal energy – 721.3 thousand UAH; The payback period of the event is 5 years.

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