

ENERGY EFFICIENCY OF HEATING AND COOLING OF A PUBLIC BUILDING IN THE CITY OF VINNYTSIA

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Abstract

The issue of increasing the energy efficiency of the heating and cooling system of a public building in the city of Vinnytsia by analyzing the energy demand and energy consumption of the building and developing measures to increase the economic, ecological and energy efficiency of this building is studied. A mathematical model was developed and numerical studies of the impact of energy-saving measures on energy consumption and energy consumption of the heating, cooling, ventilation, hot water supply system were carried out. The calculation of the technical and economic indicators of the operation of the heating and cooling system of the public building were carried out.

Keywords: heat and cooling supply, energy consumption, energy demand, energy efficiency, public building

Introduction

Due to military actions, environmental problems and the increase in the price of fossil fuels, the cost of energy will increase rapidly now and in the future.

The active development of renewable energy sources in parallel with the development of local fuels, the use of biomass and biogas from organic waste will allow reducing the man-made load from energy systems on the environment.

Heat pump technologies are one of the most energy-efficient, environmentally friendly and easy-to-use renewable energy technologies. Their additional advantage is the possibility of working in reversible mode to produce heat in the cold period and cold in the warm period of the year.

The goal of the work is to reduce the consumption of fossil fuels and man-made load on the environment by developing an energy-efficient heating and cooling system for a public building in Vinnytsia.

Results

The object of research was analyzed in terms of enclosing structures and installed equipment of heating, cooling, ventilation and hot water supply systems. It was found that the adopted design decisions require an energy audit, namely to determine the energy demand of the building and its energy consumption.

A mathematical model was developed to determine the energy consumption and energy consumption of a public building. The general characteristics of the mathematical model are given and the main equations of the mathematical description of the model are given.

This model makes it possible to carry out research on the effectiveness of implementing energy-saving measures to reduce the building's energy consumption, energy consumption of heating, cooling, lighting, ventilation and hot water supply systems and to increase the building's energy efficiency class.

It is shown that the enclosing constructions meet the requirements of the SBN in terms of thermal resistance. It was found that the specific energy consumption for heating, cooling and hot water supply is 42.8 kWh/m³, which exceeds the minimum requirements of the standards by 5.6%. But the energy consumption of the heating, cooling and hot water systems corresponds to the "A" class of the building.

A study of the influence of the thickness of the insulation of the external walls, the increase of the thickness of the insulation of the combined coating, the clarification of the consumption of hot water on the amount of energy consumption for heating, cooling and hot water supply of the building was also carried out.

It was found that in order to achieve the minimum requirements for energy consumption, it is necessary to reduce the specific consumption of hot water to 33% of the one proposed in the normateves, or to increase

the thickness of the insulation on the outer walls to 200 mm.

The work includes a local estimate for construction work on the creation of a heating and cooling system for a public building. It was found that the estimated cost is UAH 149 200, of which the cost of materials, structures, and equipment is UAH 122 700, and the estimated labor intensity of the works was 0.242 thousand man-hours.

Calculations of technical and economic indicators showed that the net cash receipts are UAH 5 070, the net present value is UAH 2 600, and the payback period according to the cumulative method is 1.41 years.

Conclusions

1. Heat pump technologies are one of the most energy-efficient, environmentally friendly and easy-to-use renewable energy technologies.
2. A mathematical model was developed to determine the energy consumption and energy consumption of a public building. This model makes it possible to carry out research on the effectiveness of implementing energy-saving measures to reduce the building's energy consumption, energy consumption of heating, cooling, lighting, ventilation and hot water supply systems and to increase the building's energy efficiency class.
3. It was found that the specific energy consumption for heating, cooling and hot water supply is 42.8 kWh/m³, which exceeds the minimum requirements of the standards by 5.6%. But the energy consumption of the heating, cooling and hot water systems corresponds to the "A" class of the building..

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