

Modern design of energy efficient buildings

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ABSTRACT

At the present time, after the energy crisis in the early 1970s, humanity began to strive for a reduction in energy consumption, and a new direction was developed in architecture aimed at designing buildings with an "intelligent system" of energy supply. A similar project was realized for the first time by architects Andrew and Nicholas Isaac in Manchester in 1972. The projected building has a total area of 16350 m². There are office spaces on seven floors, not counting the technical floor.

Soon methods for achieving energy efficiency of buildings began to have their own systematized classification, which help to distinguish them in their kind. They are divided into passive and active.

A geothermal heat pump is a central heating and cooling system that uses ground heat as a warm pump. Thus, the earth can become a radiator in the summer and, accordingly, a source of heat in the winter. At the same time, the operating costs of the heating and cooling system are reduced and the effectiveness of this method is increased due to the difference in ground temperatures. It can also be supplemented by solar heating. As you know, the temperature of the earth below 6 meters is approximately equal to the average annual air temperature in a given area and undergoes minor changes throughout the year.

Another method of energy supply works with the help of solar collectors, that is, devices for collecting the thermal energy of the Sun (solar installation), carried by visible light and near infrared radiation. They work on the principle of the heater of the coolant material and are usually used for hot water supply and space heating.

Also, the use of an inversion roof, which means a flat roof covered with materials resistant to physical impact and erasure, provides high heat resistance. The device of a traditional flat roof includes a base, heat and waterproofing, drainage and external coating. However, in the inversion roof, the protective layers are arranged in the opposite order, which allows you to get rid of the "weak spots" of the flat roof due to the insulation over the waterproofing. Due to its reliability and durability (the operational term of the inversion roof is 50-60 years), it is widely used for a large area of the roof surface: schools and preschools, factories and plants, as well as all kinds of warehouses and production buildings. Moreover, the multifunction of the cover of the inversion roof allows the roof to be used as a park area, a terrace, a parking lot, a tennis court, a swimming pool and other types of sites where a large number of people can be at the same time.

There are several types of alternative energy sources. To this date, mankind has sought to use the energy of the sun, wind, earth, water, and the biosphere. In Kazakhstan today, this problem has not gone to a dangerous level, but scientific progress is slowly transforming the architectural appearance of many cities, especially the capital of Astana.

Keywords: energy efficiency, geothermal energy, solar panels, heat collectors.

1 INTRODUCTION

In today's world, many countries are switching to the use of alternative energy sources because in many of them a critical level of the ecological environment is entering. To date, the technological process has improved and created many methods and technologies to achieve energy efficiency in buildings. Many of them remain inaccessible to the majority of the population, due to the high cost and complexity in operation, but some have been upgraded to the limit and represent a worthy replacement for many traditional sources of

energy. This article presents some technologies and methods that help achieve maximum energy savings and reduce emissions in the surrounding urban environment. Illustrative examples of the use of these technologies in facade building solutions are presented and a detailed analysis of the most suitable and economical energy carriers in buildings from around the world is carried out.

2 FORMATTING

A geothermal heat pump is a central heating or cooling system that uses ground heat as a warm pump.

Thus, the earth can become a radiator in the summer and, accordingly, a source of heat in the winter. At the same time, the operating costs of the heating and cooling system are reduced and the effectiveness of this method is increased due to the difference in ground temperatures. It can also be supplemented by solar heating. As you know, the temperature of the earth below 6 meters is approximately equal to the average annual air temperature in a given area and undergoes minor changes throughout the year. This phenomenon of thermal inertia and use geothermal heat pumps.

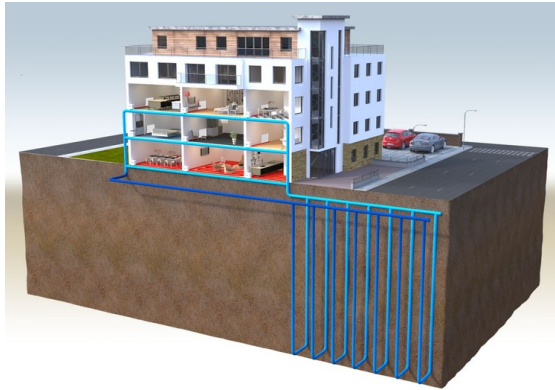


Fig.1. Geothermal pump device.

Another method of energy supply is the use of wind energy, which implies the principle of converting the kinetic energy of air masses in the atmosphere into electrical, mechanical, thermal or any other form of energy used in life. This process occurs with the help of such units as a wind generator (for generating electric power), a windmill (for conversion into mechanical energy), a sail (for use in transport), and others.

The branch of wind energy refers to alternative energy sources, which scale and rapidly develop in the present time. For example, by early 2016, the total installed capacity of all wind generators was 432 gigawatts, and thus exceeded the total installed capacity of nuclear power. However, practice shows that external power factors influence the power of wind generators (CIUM), therefore on average for a year it goes several times lower than the installed capacity, in comparison with the NPP.

At the same time, in 2014, the amount of electric energy produced by all wind turbines in the world amounted to 706 terawatt hours, which is 3% of all electric power produced by mankind. Knowing the advantages of this industry, some countries are particularly intensively developing wind power, in particular, in Denmark, 42% of all electricity is generated by wind generators in 2015; 2014 in Portugal - 27%; in Nicaragua - 21%; in Spain - 20%; Ireland - 19%; in Germany - 8%; in the EU as a whole - 7.5% [3]. In 2014, 85 countries of the world used wind power on a commercial basis. By the end of 2015, wind energy

employs more than 1,000,000 people worldwide (including 500,000 in China and 138,000 in Germany)

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Wind power industry refers to alternative energy sources, which are developing rapidly and rapidly at the present time. For example, by the beginning of 2016, the total installed capacity of all wind generators was 432 GW and, thus, surpassed the total installed capacity of the nuclear power industry. However, practice shows that wind power (ICF) power is affected by external factors; therefore, on average per year it goes several times lower than the installed power compared to nuclear power plants.

At the same time, in 2014, the amount of electric energy produced by all wind turbines in the world amounted to 706 terawatt hours, which is 3% of all electric power produced by mankind. Knowing the advantages of this industry, some countries are especially intensively developing wind power, in particular, in 2015, 42% of all electricity is generated using wind generators in Denmark; 2014 in Portugal - 27%; in Nicaragua - 21%; in Spain - 20%; Ireland - 19%; in Germany - 8%; in the EU as a whole - 7.5% [3]. In 2014, 85 countries of the world used wind power on a commercial basis. At the end of 2015, more than 1,000,000 people were employed in wind power [4] (including 500,000 in China and 138,000 in Germany).



Fig.2. Wind farm project.

Another power supply method works with the help of solar collectors, that is, devices for collecting solar thermal energy (solar power), transported by visible light and near infrared radiation. They work on the principle of the heater material coolant and are usually used for hot water and space heating.

3 CONCLUSION

Thus, in this article, technologies were considered that are capable of maximally efficiently providing

buildings with the necessary energy during the operational period. There are several types of alternative energy sources. Today, humanity seeks to use the energy of the sun, wind, earth, water, biosphere. Along with the established technologies, new and more ecological methods for the reproduction of alternative energy appear every day. Many countries, due to critical environmental indicators, are forced to urgently switch to new alternative energy sources. In Kazakhstan today, this problem has not moved to a dangerous level, but scientific progress is slowly reincarnating the architectural appearance of many cities, especially the capital of Astana. As part of a rational search for alternative energy sources in Kazakhstan, the first international exhibition EXPO 2017 was held, the purpose of which was called “the energy of the future”.

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