

THE USE OF RENEWABLE ENERGY IN ARCHITECTURAL DESIGN: TAKING CHINA AS AN EXAMPLE AND ITS IMPLICATIONS FOR BELARUS

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Abstract

With the development of science and social progress, the research on renewable energy has been continuously deepened and gradually penetrated into the field of construction industry. The application of renewable energy in the construction industry can effectively promote the sustainable and stable development of the construction industry. This paper mainly explores the application of renewable energy in the architectural design process. By exploring the use methods and application situation of renewable energy in the field of architectural design in China, it is expected to provide some research value and reference for the renewable sustainable development of the Belarusian construction industry.

Keywords: Renewable energy, sustainability, architectural design, application and development.

Introduction

As an emerging energy type, renewable energy has outstanding advantages over traditional fossil energy. The application of renewable energy in the architectural design industry can effectively change the current problems of high energy consumption and poor environmental performance in the construction industry, and can provide sufficient power support for the low-carbon and environmentally friendly development of the construction industry, thereby promoting the progress of a resource-saving and environmentally friendly society.

Advantages of renewable energy applications in China's architectural design industry

The first is the energy-saving effect. The application of renewable energy in the field of architectural design can have a significant energy-saving effect. Most renewable energy needs to be converted into other energy types required by the building through electrical energy conversion.

Through the efficient use of renewable energy in the process of architectural design, it is necessary to combine the actual situation of the construction project to calculate the required energy type and the actual amount of energy resources required to maintain the operation of the system, so as to replace the traditional energy resources that are more polluting to the environment and have high energy consumption, reduce the energy resource consumption in the use of construction projects, and achieve the development goal of energy conservation and emission reduction.

The second is that it can provide a more comfortable and environmentally friendly construction and living environment. Environmental protection issues have always been a key issue in China's social and economic development. For the high-pollution, high-energy-consuming construction industry, it is necessary to strengthen the application of environmental protection concepts and the research on green buildings, and achieve sustainable development of buildings through the organic combination of green buildings and renewable energy.

In modern building design and construction, the application of renewable energy can provide residents with a more comfortable and healthy living environment. With the development of social economy and the improvement of people's living standards, people's aesthetic ability and requirements for living environment are getting higher and higher, and traditional construction methods can no longer meet people's growing material and cultural needs. Therefore, it is necessary to strengthen the research and development and application of renewable energy, make full use of geothermal energy, solar energy, tidal energy and wind energy through the promotion of renewable energy, reduce the damage to the surrounding environment caused by additional products in the process of energy production and use, and maintain ecological balance.

Third, it will provide higher economic benefits. Renewable energy has the advantages of being renewable and relatively wide in coverage, and has very high economic value. In the actual use of engineering and energy resource conversion, it does not require too much capital cost to achieve the effective use of renewable energy.

However, when applying renewable energy in architectural design, it should be noted that a certain amount of capital must be invested in advance in the initial use of renewable energy, such as introducing advanced production technology and hardware equipment, so as to maximize the value and advantages of renewable energy. At the same time, it is also necessary to provide sufficient talent reserves and talent support, continuously innovate renewable energy collection technology and production technology, and ensure the safety of renewable energy use and supply.

Application of renewable energy in architectural design in China

First is the application of wind energy.

As an important renewable energy source, wind energy is widely used in the current field of wind power generation in China. The application of wind energy in buildings can mainly be achieved by utilizing indoor ventilation to form good natural ventilation, thereby improving indoor temperature and humidity, removing indoor pollutants, and promoting indoor air flow. This can effectively reduce the application of air conditioning systems and save electricity.

China has a vast land area, and there are large differences in the geographical environment between different regions. Therefore, in the process of architectural design, it is necessary to reasonably set the type of building in combination with local climatic conditions and wind energy characteristics, and require the building monomer to have good ventilation effect. By utilizing the pressure difference between the back and sunny sides of the building to drive the air, increase air convection inside the building to form air flow.

As the technology that supports wind power matures, concerns about wind turbines interfering with wildlife and radar are being addressed through research as blade technology continues to improve. Innovations such as offshore wind and floating foundations are advancing rapidly, with the potential to deliver large amounts of wind energy in places where deployments were unthinkable not long ago. Even familiar wind turbine models may be tweaked as researchers continue to explore the potential of horizontal axis wind turbines (HAWTs) and vortices (Figure 1).

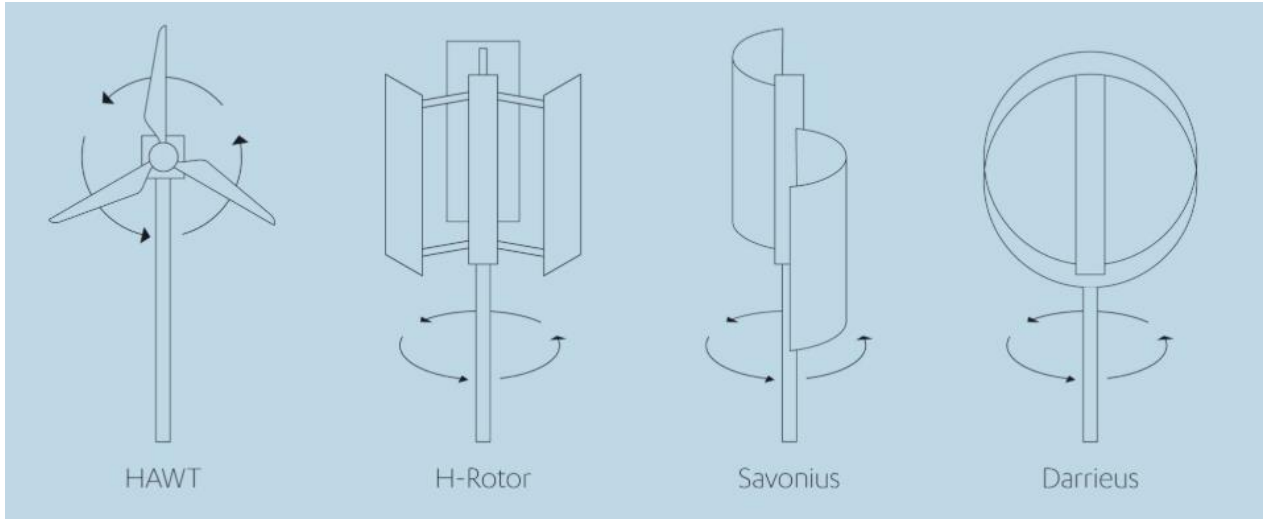


Figure 1 – Types of vertical axis wind turbines

In some dense building groups, the air flow is relatively poor, so the efficiency of indoor air exchange can be improved by installing wind capture devices in the building to increase internal air convection.

Solar energy resources are typical representatives in the application of renewable energy. In the current Chinese society, energy converted from solar energy is widely used in all walks of life, effectively saving the use of fossil energy.

Solar energy itself has the advantages of abundant reserves, clean and pollution-free, renewable, directly developed and utilized, and no need for transportation and mining. China has very rich solar energy resources, which can create a good environment for the application of solar energy resources in the construction field. The utilization technology of solar energy in the current construction field in China is relatively mature. The most common way to utilize solar energy is the solar water heating system. By converting solar energy into thermal energy and storing it for water heating, people can obtain the hot water needed in their lives and reduce the consumption of energy resources (Figure 2).

The most important component of the solar water heating system is the collector, which mainly includes two types: flat-plate collector and vacuum collector. The flat-plate structure device is safe and reliable in operation and has a good pressure-bearing effect. The vacuum tube collector has good thermal insulation performance, simple structure, and high efficiency at relatively low temperatures. However, the pipe is more likely to break and the structural pressure-bearing capacity is poor, while the flat-plate collector is more suitable for the low temperature range and has a relatively low efficiency in the high temperature section. With the continuous develop-

ment of science and technology and the accelerating process of development and utilization of renewable energy resources, various emerging materials are directly used in the utilization of solar energy and the design and development of solar collectors, which can greatly improve the thermal insulation performance of solar collectors, have the advantages of high heat collection efficiency, fast speed and low cost, and can prevent heat conduction.



Figure 2 – Curved surface heat absorption solar water heater

Finally, the application of bioenergy.

Bioenergy is a relatively new type of renewable energy. It is an application form that treats domestic waste and construction waste during the operation of buildings and turns waste into treasure. In the past, people in China usually burned or landfilled domestic resources and construction resources, which not only caused secondary pollution, but also wasted a lot of public resources. Combined with biotechnology, effective classification and application of construction waste and domestic waste, and using these wastes as raw materials for the production of renewable energy such as biogas can achieve resource recycling and reduce energy resource consumption. At the same time, this operation can also prevent damage to the surrounding environment during garbage disposal and improve the greenness and environmental protection of buildings.

Conclusion and Recommendations

What designers need to pay attention to during the building design process is that the building fresh air system needs to be well matched with the ventilation equipment to prevent the air conditioning system from using too much power and causing waste of resources. The optimization and upgrading of building ventilation design should be continuously strengthened, and the advantages and disadvantages of local wind energy conditions should be clarified in combination with local meteorological data, and targeted measures should be taken to implement the wind energy use plan. In the process of building planning, the combination and connection between the building group and the building monomer volume should be strengthened in combination with the wind direction characteristics of the project area; attention should be paid to the orientation and spacing of the building, and the building enclosure structure should be carefully analyzed. The height and area of the building doors and windows should be reasonably designed, and the door and window structure should be used to make the indoor air circulation effect good.

In the process of solar energy application, architectural designers need to pay attention not only to the research progress of current new products, but also to comprehensively consider the local climate conditions and solar energy radiation conditions, and reasonably install solar energy devices. Energy resources should be effectively used to reduce energy loss, and the orientation and distance of buildings should be reasonably planned to maximize the use of solar energy resources.

Designers of construction units need to comprehensively consider the weight, type and treatment methods of construction waste, combine the actual construction requirements and operational needs of construction projects, match the operation system and development system for comprehensive utilization of bioenergy, rationally utilize construction waste and reduce the waste of energy resources.

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