Study on the Design of Prefabricated Exterior Wall Insulation Decorative Panel for Wind Energy Utilization

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Abstract. Human exploration for the realization of a better life building materials has never stopped, this article in the green building thought of the advocacy, explore the outdoor wind environment, the effective use of wind energy in an assembly-type building exterior wall insulation decoration plate, through wind energy conversion verification, show that the plate can effectively compensate for the winter cold wind brought about by the energy loss, with insulation effect; With the continuous optimization of the material and construction of the panel, more values and a wider range of application of the panel are expected to be achieved.

1. Introduction

Building energy saving technology is a focus of research since the start of this century. The expected functions of external wall panels of buildings include thermal insulation, fire prevention, moisture proof, decoration, etc. The existing building external wall panel has some weaknesses. On the side, when cold wind hit on their outside surface, it will spread around, increasing the contact area between the wall panel and the cold air brought by the cold wind, accelerating the distribution of wall temperature, and reducing the insulation effect. On the other side, the decoration effect of exterior wall panels in the current market is insufficient. In the absence of effective utilization of pollution-free wind energy resources, the efficiency of the integration of insulation, decoration and rational utilization of wind energy is not realized [1][2]. With the progress of building energy conservation science and technology and the mutual support of various disciplines, the development of building wall panels changes quickly. More attentions are paid to the structural and performance characteristics of building wall panels. Building wall panels are developing towards a comprehensive utilization of new energy sources and green building materials for energy conservation and environmental
protection [3]. With this background, this paper explores a prefabricated external wall panel which can utilize wind energy, at the same time integrates decoration and thermal insulation functions.

2. Development status of external wall insulation panel technology
At present, domestic enterprises learn from the advanced experience of western countries, and independent research and development and other innovative technological means. A composite insulation panel for building wall is developed, which integrates the properties of heat preservation, heat insulation, waterproof, decoration and corrosion resistance. On the basis of the scientific formulation of raw materials, relatively reasonable results have been achieved in the aspects of the products' components, standardization, combination diversification and comprehensive economic cost. But in the panel structure and wind energy technology application, there are still several aspects of the following problems.

1) The prefabricated installation technology of building insulation wall panel is not significant. The external insulation material is polystyrene panel, and the installation technology mainly includes the point-and-base method of installation of polystyrene panel and wall, and the method of hanging and sticking of one-time pouring molding of polystyrene panel and wall. However, as a result of the building insulation panel by ultraviolet radiation, winter, heat, rain, strong wind, corrosion moisture and other particularly adverse environmental factors. The internal surface of the external panel is exposed to dew and mildew, and then through freeze-thaw cycle, material corrosion and other reasons. Moreover, due to the limitations of technical measures and construction methods, wall maintenance is very difficult, which directly affects the service life of panels [4] [5].

2) The energy-saving and environmental protection performance of building thermal insulation wall panel materials has technical limitations. Meanwhile, the wastes generated during construction of thermal insulation materials also pollute the surrounding environment to some extent, so the application and development prospect is restricted. The development and utilization of the new energy - wind energy by building insulation wall panel is seriously inadequate. The development and utilization of renewable resources and new energy in China only accounts for about 20% of new energy, which is far behind that in foreign countries [6]. China has a large amount of wind energy resources with a wide range of distribution. With the increasingly obvious world energy crisis, China has been gradually moving into the field of architecture since the 1980s with the support of national policies and the introduction of green building ideas in recent years, and the concept of wind energy utilization has gradually moved into the field of architecture, which has attracted people's attention and applied research.

3) The design of the integration of building insulation panel and decorative performance is insufficient, and the construction is tedious. The decorative surface layer of the board is easy to fall off under the influence of adverse ecological environment factors, thus affecting the effect of building insulation and damaging the effect of building facade, and affecting the overall beauty of the city [7].

3. Design and Research idea of prefabricated exterior wall Insulation decorative panel for wind energy utilization
In view of the existing thermal insulation wall panel structure technology and the lack of wind energy utilization, explore the installation of prefabricated, efficient use of wind energy, the research of composite wall panel with decorative integration has gradually entered people's research field of vision. Solve the problem that the frontal invasion of cold wind accelerates the temperature decrease of the wall, so that the panels have the performance of integrated insulation and decoration, rational use of wind energy, free from environmental factors and performance for easy assembly.
4. Design and research ideas of prefabricated exterior wall insulation decorative panel for wind energy utilization

4.1. Explore the use of wind energy for panels
Based on the zero pollution, renewable, safe and clean characteristics of wind energy, as a research breakthrough of prefabricated exterior wall insulation decorative panel. Wind energy, by its very nature, the effective use of wind energy has become a major strategic initiative for sustainable energy development and the first choice for energy substitution. In the research of wall insulation panels, it is an important practical design research to convert the kinetic energy contained in wind energy into friction heat energy through mechanical rotation, and then conduct energy exchange through conduction and radiation to improve the temperature of the enclosure wall, so as to achieve the effect of building insulation. It is a powerful supplement to the short board of wind energy in the design, development and application of wall panel. With the in-depth study of wallboard using wind energy and the increasingly mature technology, the utilization of wind energy wall panel will become an important building energy saving technology in China.

4.2. Explore assembly mounting of sheet metal
Actively advocate the panel assembly type plug-in installation technology, adopt the installation method of keel direct hanging panel, realize the panel can be "insulation decoration integration, product production industrialization, product installation panel assembly", conducive to the panel installation and maintenance. At the same time prevent the deformation of stress structure caused by temperature change, causes the wall inclined crack, the character crack and the wall panel to fall off and so on. Reduced the rain, snow, freezing, thawing, dry, wet cycle caused by structural damage.

4.3. Explore panel insulation and decoration integration
Research and design of insulation panel decoration integration, so that the wind energy collection components become part of the building facade decoration, reflect the architectural high-tech artistic charm. At the same time, reasonable selection of decorative materials, the organic combination of panel decorative materials and thermal insulation materials, so that the building surface in corrosion resistance and aging resistance performance is better at the same time, more choices in color, style, variety and other aspects, while a wider range of customization, more potential for the future market.

5. Technical measures for design and research of prefabricated exterior wall insulation decorative panel for wind energy utilization

5.1. Compositions of the wall panel
In order to realize the research goal of exterior wall insulation decorative panel for prefabricated wind energy utilization, the structure of the wall panel is designed as a joint panel (1), thermal insulation panel (2), thermal preservation panel (3), cover panel (8) and wind cylinder (11) decorative component, as shown in (Figures 1-3), The heat shield is a rectangular body with a hollow-out on the left side.

The four corners of the left inner wall of the heat shield are provided with countersunk holes. The countersunk head hole is movable connected with a fixed bolt. The shape and size of the joint panel (1) are the same as those inside the heat shield (2). The joint panel (1) is fixed to the left side wall of the heat shield (2), and flush with the left wall of the heat shield [8].

Arabic numerals in the Figure 2, Figure 3 are: 1 joint panel, 2 heat shield, 3 thermal preservation panel, 4 sink hole, 5 fixing bolts, 7 threaded grooves, 8 cover panel, 9 rotating shaft hinge, 10 clamping member, 11 wind cylinder, 12 air holes, 13 partition, 14 circular hole A, 15 triangular panel , 16 rotating bar, 17 fan blade, 18 Bevel gear A, 19 round table groove, 20 wear-resistant rubber A, 21 heat conducting rod, 22 circular hole B, 23 circular rod, 24 wear-resistant rubber B, 25 driving wheel A, 26 round hole C, 27 driving lever, 28 Bevel gear B, 29 driving wheel B, 30 synchronous belt
Figure 1. Compositions of the wall panel

Arabic numerals in Figure 1 are: 1 joint panel, 2 heat shield, 3 thermal preservation panel, 8 cover panel (decorative panel), 9 rotating shaft hinge, 10 clamping member, 11 wind cylinder, 12 air holes.

Figure 2. Section A of the panel

Figure 3. Section B of the panel

The insulation panel is a hollow rectangular body. The four corners of the left wall surface of the insulation panel are provided with threaded grooves (7). The four fixing bolts (5) are connected with the four threaded grooves (7) respectively to make the thermal preservation panel (3) fit effectively with the thermal insulation panel (2). The right side of the cover panel (8) is curved with the top and bottom ends higher than the middle end. The right side panel of the heat preservation cover panel (8) is fixed connected to two corresponding wind cylinder (11) up and down. The wind cylinder (11) is cylindrical in shape, and the top and bottom surfaces of the wind cylinder (11) are laid with air holes. The two ends of the wind cylinder are provided with a baffle which is fixed and connected with the wind cylinder. The wind cylinder (11) and the cover panel (8) are provided with thread slots and are connected by fixed bolts to make the cover panel (8) fit effectively with the wind cylinder (11) clapboard. The center of the air duct baffle and the back side of the air duct are provided with circular hole A (14). The circular hole A (14) is fixed with rotating bearing, the inner ring of the rotating bearing is fixed with rotating bar (16), the rotating rod (16) located in the right wind cylinder of the
The outer wall of the cover panel (8) is fixed with fan blade (17), and the rotating bar (16) is fixed with an Bevel gear A (18) [8].

There are two round table grooves (19) on the left inner wall of the insulation panel. The two round table grooves (19) are fixed and connected with wear-resistant rubber A (20). The wear-resistant rubber A (20) is round shape and the right side is hollow. The center of the wear-resistant rubber A (20) is fixedly connected with heat conducting rod (21), which passes through the heat preservation board (3) and is attached to the right side of the joint panel (1). Thermal preservation board (3) the right side of the face should be the location of the two round table groove (19) with circular hole B (22). Circular hole B (22) internal fixation installation has A rotating bearing. The inner ring of the inner rotating bearing with circular hole B (22) is fixed and connected with a circular rod (23). The position of the round rod (23) corresponding to the wear-resistant rubber A (20) is fixed and connected with the wear-resistant rubber B (24). The wear-resistant rubber B (24) is round shape, which is attached to the right wall of the wear-resistant rubber A (20). The outer wall of the round rod (23) is fixedly connected with driving wheel A (25). On the right side of the insulation board, there should be two bevel gears A (18) with round hole C (26) respectively. Round hole C (26) have rotating bearing inner ring fixed installation. The fixed connection of the inner ring of the circular hole C (26) inner rotating bearing is provided with a driving lever (27). One end of the driving lever (27) corresponding to the bevel gear A (18) is fixedly connected with the bevel gear B (28). Bevel gear A (18) meshed with bevel gear B (28). The position of the driving lever corresponding to the driving wheel A is fixed connected with the driving wheel B. Every two adjacent driving wheels A (25) and B (29) are engaged with A synchronous belt. The cover plate (8) is provided with a triangular plate (15) between the two air ducts. The right side of the insulation panel is fixed with the cover panel (8) through the rotating shaft hinge (9), and the cover panel (8) is fixed with the thermal preservation panel (3) through the clamping member (10). [8]

5.2 Selection of wall panel materials
The wall panel is applied to the exterior surface of the building. With heat preservation, heat insulation, waterproof, decoration and effective use of wind energy and other compound performance. In the composition of the panel, Joint panel (1) the material is insulating thermal conductivity elastic butyl rubber. The heat shield (2) is made of polyurethane. Thermal preservation panel (3) choose low thermal conductivity coefficient, light weight, high strength, corrosion resistance, weathering resistance, long life of the material. At present, the new insulation decorative boards for building exterior walls mainly include XPS board, rock wool board, PS board and Cement particleboard etc. When the panel is integrated, industrialized, assembled, processed and produced, according to the actual needs of the project to choose the most appropriate insulation panel. It is suggested that the insulation board (3) panel (8) be made of cement particleboard [9][10].When selecting the materials for the wind cylinder (11) and the wind cylinder (11) at both ends, it is necessary to choose materials with high strength, good corrosion resistance, long life, impact resistance and superior decorative performance as far as possible according to the requirements of the building. At present, china's new building materials used in the face plate (8) materials are mainly silicon and calcium plate and aluminum plastic board [4]. The heat conducting rod (21) is made of copper.

5.3. Wind energy utilization of wall panel
5.3.1. Principles of wind energy utilization of wall panel.
The wall panel as shown in (Figures 1-3),by setting the right side of cover panel (8) to be curved, when the flowing wind blows towards the cover board (8),the wind will flow through the curve towards the center of the cover panel (8),the wind flows into the wind cylinder(11),a driving force is
generated on the fan blade (17) to drive the rotating rod (16), by engaging the bevel gear A (18) and B (28), drive the driving lever (27) to rotate, the driving lever (27) is driven by the synchronous belt (30), drive the circular rod (23) to rotate, friction between wear-resistant rubber B (24) and wear-resistant rubber A (20) generates heat, the heat generated is transmitted to the joint panel (1) and the inter air layer through a heat conducting rod (21). A triangular panel (15) is arranged between the two wind cylinder (11) and is fixed on the cover panel (8). Triangular panel (15) is used to guide the wind. Avoid wind interaction from two wind cylinders (11) [8].

5.3.2. Beneficial effects of wind energy utilization of wall panel
The wall panel has the following beneficial effects through the guidance and utilization of wind:

1) The wall panel surface is arranged through the curved surface, When the wind blows against the wall panel, the curved shape of the wall panel acts as a guide to wind currents, it can reduce the diffusion of cold air from outer wall to interior. Through the setting of two air ducts (11) of each wall panel, to convert the wind force into the rotational power of the rotating rod (16), Effectively deplete the adverse effects of cold winds, Avoid wind damage to the exterior surface of building walls.

2) The wall panel is arranged through the air duct (11), the wind force is converted into power, as shown in Figure 2 and 3. Drive friction between the wear resistant rubber A (20) and wear resistant rubber B (24), The heat generated by the friction is transmitted to the wall and the air layer through the joint panel (1). Further increase the external wall insulation effect, improve the cold environment of the indoor temperature.

6. Energy saving calculation and analysis of prefabricated exterior wall insulation decorative panel for wind energy utilization
6.1. Calculation and analysis of insulation effect of wall panel structure
1) The structural levels of the wallboard from inside to outside are as follows: the first is joint panel (1), the second is the air layer between joint panel (1) and the heat insulation panel (2), the third is the heat insulation panel (2), the fourth is the heat insulation panel (3), the fifth is the air layer between the heat insulation panel (3) and the cover panel (8), and the sixth is the cover panel. The panel is shown in Figure 2, Figure 3. The physical properties of each structure layer are as follows: joint pane (1) material is insulating thermal conductivity elastic butyl rubber. Thermal conductivity \( \lambda_1 = 0.09 \text{W/m}\cdot\text{k} \), The thickness \( d_1 = 0.01\text{m} \). The heat shield(2) material is polyurethane, Thermal conductivity \( \lambda_2 = 0.024\text{W/m}\cdot\text{k} \), The thickness \( d_2 = 0.01\text{m} \). The thickness of the air layer between the two is. \( d_{3} = 0.02\text{m} \) The Thermal preservation panel(3) is the main part of the whole system, and it is the hollow inner concave shape; Use cement particleboard : dry density \( \rho_0 = 700\text{kg/m}^3 \), Thermal conductivity \( \lambda_3 = 0.19\text{W/m}\cdot\text{k} \) The thickness is: panel against the wall \( d_3 = 0.03\text{m} \) Concave on the outside of the molding plate \( d_8 = 0.01\text{m} \) The average thickness of its internal air layer is regarded as \( d_{2} = 0.035\text{m} \).

2) Considering the harmonic thermal effect outside, it is usually necessary to calculate and check the heat storage coefficient S of the wall panel structure, because the size of a single panel is 0.6m x 0.7m and the area is small; The joint pane(1) is made of butyl rubber and the steam permeability coefficient is very small, so the heat storage coefficient S of the whole structure can be ignored.
3) According to the thermal resistance calculation formula [4, 12]:

\[ R = R_1 + R_{\text{int}1} + R_2 + R_3 + R_{\text{int}2} + R_5 \quad R = \frac{\delta}{\lambda} \]  \hspace{1cm} (1)

According to the different thickness of the vertical interior layer in winter, the thermal resistance of the inter air layer can be obtained [11, 12]:

\[ R_{\text{int}2} = 0.18m^2 \cdot \frac{k}{W} \quad R_{\text{int}1} = 0.16m^2 \cdot \frac{k}{W} \]  \hspace{1cm} (2)

Put into the thermal resistance calculation formula, it can be obtained that:

\[ R = \frac{d_1}{\lambda_1} + 0.16 + \frac{d_2}{\lambda_2} + \frac{d_3}{\lambda_3} + 0.18 + \frac{d_5}{\lambda_5} = \frac{0.01}{0.09} + 0.16 + \frac{0.01}{0.024} + 0.03 + 0.18 + \frac{0.01}{0.19} \]  \hspace{1cm} (3)

\[ R \approx 0.11 + 0.16 - 0.42 + 0.16 + 0.18 + 0.05 = 1.08m^2 \cdot \frac{k}{W} \]  \hspace{1cm} (4)

4) Put thermal resistance \( R \) into the temperature calculation of the entire wall maintenance structure, according to the calculation formula [11]:

\[ \frac{t_i - t_c}{R_0} = \frac{t_i - \theta_1}{R_1} \]  \hspace{1cm} (5)

And the calculation formula of temperature between the material layers in the envelope wall [11]:

\[ \theta_{i-1} = t_i - \frac{\sum_{j=1}^{i-1} R_j}{R_0} (t_1 - t_i) \]  \hspace{1cm} (6)

Under the calculation conditions of average outdoor minimum temperature \( t_c \) and indoor temperature \( t_i = 18 \) °C in each region in winter, the wall panel can convert part of the wind energy into heat energy and improve the \( t_c \) temperature value, so as to improve the overall panel insulation effect, meet the requirements of general building energy conservation and insulation, and achieve the expected effect.

6.2. Calculation and analysis of wind energy conversion of wall panel

6.2.1. Calculation and analysis of wind energy inside wall panel wind cylinder.

According to the calculation formula of wind power [13],

\[ W = \frac{1}{2} \rho V^2 S \]  \hspace{1cm} (7)

wind power (\( W \)) is directly proportional to the area (\( S \)), air density and cube of airflow speed (\( V \)), among which wind, speed is the decisive factor. According to the structure of the fabricated external wall wind insulation wall panel (as shown in FIG. 2), it can be found that the wind energy of
the fan blade inside the pushing duct is affected by the wind speed and changes with the size of the wind panel face of the blade.

Taking Harbin as an example, the average annual wind speed $V$ of Harbin in winter is $V \approx 3.5 \text{m/s} \sim 4 \text{m/s}$, after inquiry, and outdoor air density is usually $\rho \approx 1.396 \text{kg/m}^3$; On the windward side, area $S=$ fan blade length $H \times$ duct length $L$. As shown in Figure 2, the air duct (11) can be designed with a diameter of 0.1m and length $L=0.6m$. The length of $H$ of the fan blade (17) is $4/5$ of the radius of the air duct, $H = 0.10 \times \frac{4}{5} = 0.04m$. According to the wind power calculation formula, the wind power of a single air duct can be calculated as follows:

$$W = \frac{1}{2} \rho V^2 S = \frac{1}{2} \times 1.396 \times 3.5^2 \times 0.04 \times 0.6 \approx 0.72 \text{kg} \cdot \text{m}^2 \cdot \text{s}^{-3}$$

(8)

6.2.2. Calculation and analysis of wind energy and heat energy conversion of wall panel.

According to the friction heat generation formula [15] $Q = F \times S$, when the inner blade (17) of the wind cylinder (11) rotates under the influence of the wind, there is a relative displacement $S$ between two wear-resistant rubbers. Under the influence of the wind, according to the conversion relationship between work and force, the heat generated by the friction is equal to the ratio of the wind energy to the friction coefficient of the system, $Q = \frac{W}{\mu}$ [15]. Cross-textured rubber friction produces a sliding friction coefficient that is $\mu = 0.32$, a single wall panel structure contains two air ducts, so the total heat produced by the plate is:

$$Q = \frac{W}{\mu} = \frac{0.72}{0.32} = 2.25$$

$Q_\bigcirc = 2.25 \times 2 = 4.5J$

(9)

6.3. Overview of wind energy conversion effect of wall panel

1) According to the calculation formula of physical heat [15], $Q = CM \cdot \Delta t$ When there is a temperature difference between the wall panel and the exterior wall surface, on the premise that the specific heat capacity $C$ and mass $M$ of the wall are fixed, if the temperature of the exterior wall surface of the building is lower than the temperature of the wall panel, The wall panel begins to convey heat to the outer wall at an efficiency of $4.5J$/ block per second, until the both reach thermal equilibrium. In practical construction engineering, the simple conversion between temperature and heat can be conducted according to the heat generated by the wall panel and the thermal resistance of its own structure [11].

$$Q = \frac{t_i - t_e}{R_2} \Rightarrow \Delta T = Q \times R = 4.5 \times 1.08 = 4.86^\circ \text{C}$$

(10)

The calculation shows that depending on wind energy, a temperature effect of $4.86^\circ \text{C}$ can be increased in a single panel structure, which greatly improves the insulation effect of the envelope.
2) When the panels are installed on the exterior walls of cold Zone A, according to the energy efficiency standards for residential buildings in cold and cold regions [16]. It specifies limits for heat transfer coefficient. The heat transfer coefficient of the 4-8 storey building exterior wall is $K \leq 0.4$. Then there is the calculation of temperature rise [11, 16]:

$$\frac{Total\Delta T}{R} = Q \times \frac{1}{K}$$

(11)

$$Total\Delta T = Q \times \frac{1}{K} = \frac{4.5}{0.4} = 11.25^\circ C$$

(12)

The calculation shows that each energy-saving panel can continuously increase the temperature of the wall by $11.25^\circ C$. The formula shows that the heat transfer coefficient of the exterior wall material is different, and the improvement of the wall temperature is also different. In practical application, the external wall materials with excellent thermal insulation effect should be selected.

2) The energy-saving effect of the panel is not reflected in the improvement of thermal resistance of its own materials, but through the energy conversion of the panel structure, it increases the air temperature between the wall surface and the panel. The heat preservation and energy saving effect of building walls are realized by means of conduction and radiation heat transfer. In other words, under working conditions, the wall panel will continuously provide 4.5J/s of heat to the exterior wall surface. The running effect of the wall panel can prevent the building wall from generating unnecessary additional energy expenditure, thus achieving the insulation and energy saving effect of the building.

7. Design and installation method of prefabricated exterior wall insulation decorative panel for wind energy utilization

When the panel is installed, the installation main and secondary dragon backbone is installed; When building block walls, first of all the concrete horizontal reinforced beam embedment is preset, M8 expansion bolts are fixed for embedded parts and galvanized steel plates are fixed for bolts. In the case that the flatness of the wall cannot meet the requirements of plate keel installation, use full welded 5# Angle steel adapter, to adjust the spacing between the keel and the wall. Then arrange $L60 \times 6$ Angle vertical main keel, in 800 or less , connect with $L75 \times 50 \times 5$ Angle, and weld with the wall embedded galvanized steel sheet, or $M8$ expansion bolts can be used to secure Angle steel connectors. Then install u-shaped aluminum alloy horizontal secondary keel, weld vertical main keel with aluminum alloy connector and Angle steel, the spacing of the secondary keel is determined by the height and size of the plate. the second keel spacing according to the size of the panel height. Then fix the stainless steel pendant, then fix the stainless steel pendant, installation of prefabricated air insulation walls panels with tongue-and-groove, and fixed with AB glue, the final injection of glue to repair the seam [17].

8. Design effect of installation of prefabricated exterior wall insulation decorative panel for wind energy utilization

With the great improvement of people's living standard, people are more and more in pursuit of unconventional architectural expression; As the research and design application of science and technology products, we must attach importance to the decorative effect of prefabricated exterior wall insulation decorative panel [18]. The rapid development of architectural technology should bring
unique expressions to architecture. From the "Pompidou Art Center" in France to the “Japanese pavilion “at the Shanghai World Expo to the "fourth generation” residential building developed by Tsinghua University, architectural expressions constantly reflect the charm of high and new technology [19, 20]. The facade expression of the panel is prefabricated and high-tech. In terms of embodiments of assembly, the exterior design is divided into lattice structure, and the panels in the lattice are painted in a pleasant color to express the features of the fabricated wall panel. In the aspect of reflecting the high-tech, inherit the architectural features of constructivism, a duct that will collect wind energy, paint the finishing touch with red, yellow, blue and other avant-garde colors, so that it becomes a decorative component; Integrated with the above design techniques, the outer space of the building has added the high-tech artistic quality of the constructivism art characteristic of the past and the future. (Figure 4).

9. Results and discussion
The prefabricated exterior wall insulation panel designed and studied by wind energy is a new type of insulation and energy saving wall panel that ADAPTS to the natural wind environment and makes full use of wind energy. It can be assembled in assembly, which reflects the characteristics of green building and has the decoration function of rich architectural expression. Through the subsequent study of the panels, it is possible to eliminate the bad influence of summer on wall insulation by setting controllable switch tuyere in the panels and adopting technical methods such as diversion heat dissipation. Under the requirements of reasonable selection of materials in each parts and improvement of the structural connection measures of the panel, under the condition of ensuring the air layer sealing in the structure in winter, the panel can effectively solve the problem of the wall temperature decrease and heat loss when the wall is attacked by the front of the cold wind in winter.

10. Conclusion
The research on the design of prefabricated exterior wall insulation panel for wind energy utilization brings a new idea and solution for the design research and application of wind energy utilization in green buildings. Resources and environment are the basic conditions for human survival, reproduction and development. [21] With the vigorous development of new energy technology application in many countries, the increase of urban construction scale. As an architectural designer have the responsibility to conduct practical design research. Through to the continuous optimization of the material and the structure of the building wall panel, analyze and calculate the experimental data of thermal
conductivity of panel operation, it will be more and more mature, in the future construction of exterior insulation will be play a huge market potential, more extensive social and economic benefits.

Acknowledgment(s)
Thanks to the authors of the references for their support, which has enriched the content of this article. Thanks to the organizing committee of the conference paper for their kindness and encouragement, as well as the collaboration between the authors, so that the paper can be successfully completed and submitted.

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