Fivewin Science and Technology Museum

by Yingying Li / 2019-07-01 10:23:27 / Chine / 17587 / CN

Primary energy need :

41.65 kWhpe/m².

(Calculation method : Other)

ENERGY CONSUMPTION

Economical building *Building*

- *< 50* **A**
- *51 à 90* **B**
- *91 à 150* **C**
- *151 à 230* **D**
- *231 à 330* **E**
- *331 à 450* **F**
- *> 450* **G**

Energy-intensive building

Building Type : Office building < 28m
Construction Year : 2018
Delivery year : 2019
Address 1 - street : 450000 ,
Climate zone :

Net Floor Area : 3 822 m²

Construction/refurbishment cost : 40 590 000 ¥
Number of Work station : 70 Work station
Cost/m2 : 10620.09 ¥/ m ^{2}

Certifications :

General information

Fivewin won the the Energy & Temperate Climates Award of the 2019 Green Solutions Awards et the China level + a mention for the international Energy & Temperate Climates Award.

The project is located 1.5 km south of the intersection of Zhengdeng Road and Southwest Ring Expressway in the Erqi District of Zhengzhou City, Henan Province, in Xigang Architectural Art Experience Park. The land area is 4338.98m2, the total construction area is 3822.39m2, and the demonstration area is 3822.39m2. The property of the project is public construction + residential. The total investment of the project is 40.59 million yuan. The public construction is the frame structure and the residential part is the special-shaped column frame-shear wall structure. The Fivewin Science and Technology Museum is divided into Hall A and Hall B. Hall A is used as a public building and it mainly displays the application, research, exploration, and innovation of cutting-edge technologies related to passive ultra-low energy consumption / near zero energy consumption of public buildings. The internal functions are mainly meetings, offices, accommodation and catering. As a residential building, hall B mainly displays the application, research, exploration and innovation of cutting-edge technologies related to passive ultra-low-energy/near-zero-energy residential buildings, with emphasis on the marketization of passive houses.

After more than a year of construction, the Fivewin Science and Technology Museum was completed in December 2018 and opened on January 19, 2019. The project adopts a new design concept to minimize building energy consumption, utilize renewable energy as much as possible and improve building comfort. The main application techniques are as follows:

(1) High-standard external wall thermal insulation system;

(2) High performance doors and windows;

(3) Good air tightness;

(4) Near no heat bridge design;

(5) Efficient fresh air heat recovery system;

(6) Comprehensive application of natural ventilation and natural lighting;

(7) Intelligent control and management of equipment and lighting;

(8) Utilization of renewable energy: a. ground source heat pump; b. solar photovoltaic technology; c. solar thermal technology.

The Fivewin Science and Technology Museum is the first passive ultra-low energy demonstration project in the Central Plains. The project has been certified by the China Passive Building Alliance, obtained the German PHI certification, technology Demonstration Project of the Ministry of Housing and Construction, and the National 13th Five-Year Major Project Demonstration Project, adopting "EPC + Architect Responsible System + Product House Delivery".

Data reliability

3rd part certified

Stakeholders

Contractor

Name :
Contact : 0371-60235796 13592616272@126.com
http://www.fivewin.cc

Construction Manager

Name :

Contracting method

General Contractor

Owner approach of sustainability

As the first passive ultra-low-energy building project in the Central Plains, the “Fivewin Science and Technology Museum” is designed, constructed and monitored in strict accordance with the characteristics of passive ultra-low-energy buildings. Compared with traditional construction projects, the construction indicators refer to domestic "Passive ultra-low energy green building technology guidelines" and Germany passive house PHPP design method, comprehensive optimization, to achieve a good thermal performance of the external insulation structure, high-performance door and window components, fresh air with full heat recovery, high COP soil source and air source heat pump unit. Realizing healthy, comfortable and energy-saving indoor living environment which plays an important role in promoting the innovative and healthy development of modern buildings.

The project is designed and constructed in strict accordance with the German passive house standard and domestic relevant energy-saving standards, from (1) high standard external wall thermal insulation system; (2) high performance doors and windows; (3) good air tightness; (4) near no thermal bridge design; (5) efficient fresh air heat recovery system; (6) comprehensive application of natural ventilation and natural lighting; (7) intelligent control and management of equipment and lighting; (8) utilization of renewable energy: a. ground source heat pump; b. solar photovoltaic technology; c. solar thermal technology, controlling various performance parameters, continuously optimize the node design, maximize the proximity to the idealized model, and finally make the building wall heat transfer coefficient 0.22 w/(m2.k), roof heat transfer coefficient is 0.20w/(m2.k), glass heat transfer coefficient is 0.61w/(m2.k), overall air tightness N50=0.17h-1<0.6h- 1. The fresh air heat recovery efficiency is 77.3%>75%. The energy consumption index meets the German passive house standard and has been certified by the Germany Passive House Institute.

Architectural description

First, the project uses high-efficiency fresh air heat recovery system, the sensible heat recovery efficiency is greater than 75%, and the total heat recovery efficiency is greater than 70%, effectively reducing the fresh air load. The outdoor fresh air passes through the plate type coarse filtration and medium efficiency filtration to filter out dust, PM2.5 particles and harmful substances, and exchanges heat through the plate-fin heat recovery section, then the temperature and humidity treatment from the cold section, and finally sent indoors. The unit not only saves energy but also delivers high-quality fresh air to the interior to meet people’s needs.

Secondly, the project has designed near no thermal bridge design for the building envelope, avoiding the damage caused by the heat bridge to the building envelope, such as condensation and mildew, effectively improving the comfort of the building.

Third, the ground source heat pump is used for energy conversion. The ground source heat pump is a clean renewable energy source, which greatly reduces the pollution to the environment. According to statistics, the use of ground source heat pump technology can save an average of 30% to 40% of air conditioning operating costs.

Fourth, the project adopts the building photovoltaic integrated system, which ingeniously

integrates the photovoltaic film with the landscape gate and the landscape rain shelter slope roof. The translucent film not only plays the role of sunshade and rain, but also provides cleaning renewable energy for the science and technology museum. It is the perfect combination of new energy and architectural landscape. Photovoltaic power generation effectively saved the traditional energy sources for the Science and Technology Museum.

Fifth, the intelligent control system can intelligently control indoor lighting, air conditioning, fresh air, sunshade and other equipment.

Building users opinion

In terms of thermal comfort, the thermal stability of the enclosure structure of this project is significantly better than that of ordinary houses, creating an indoor environment with warm winter and cool summer, winter temperature ≥20℃, summer temperature ≤26℃, relative humidity 30%-60%, which is good for the health of residents.
In terms of air quality, the good airtightness of the building makes it impossible for outdoor polluted air to enter the room directly. At the same time, the outdoor fresh air is sent into the room through the coarse and medium-efficiency filtration of the fresh air unit, ensuring good indoor air quality, and the user is more assured and comfortable.

In terms of light environment, the building window and wall ratio is relatively large, which ensures sufficient brightness and good light quality in the room. At the same time, external shading is set to avoid glare.
In terms of acoustic environment, the building has the characteristics of sound absorption and sound insulation, and is free from traffic noise and neighbor noise, giving users a quiet and private environment.

Energy

Energy consumption

Primary energy need : 41,65 kWhpe/m^2.

Primary energy need for standard building : 379,05 kWhpe/m^2.

Calculation method : Other

Final Energy : 54,30 kWhfe/m^2.

Breakdown for energy consumption :
Heating: 10.8 Kwh/m2/year
Cooling + Dehumidification: 15.7 Kwh/m2/year
Domestic hot water: 11.8 Kwh/m2/year
Other: 16.0 Kwh/m2/year

Envelope performance

Envelope U-Value : 0,22 $W.m^{-2}.K^{-1}$

More information :

The external wall is made of 150mm thick graphite polystyrene board, double layer staggered, the heat transfer coefficient is 0.22w/(m2.k). The roof is 150mm thick extruded polystyrene board, the heat transfer coefficient is 0.20w/(m2.k). Adopt three glass, two cavity, low-e interior argon - filled doors and windows, and the glass heat transfer coefficient is 0.61w/(m2.k).

Building Compactness Coefficient : 0,26

Indicator :

Air Tightness Value : 0,17

Renewables & systems

Systems

Heating system :

- Geothermal heat pump
- Fan coil

Hot water system :

- Solar Thermal

Cooling system :

- Geothermal heat pump
- Fan coil

Ventilation system :

- Single flow

Renewable systems :

- Solar photovoltaic
- Solar Thermal
- Heat pump (geothermal)

Solutions enhancing nature free gains :

Fully considering natural ventilation measures, the orientation of the building is 10 degrees south to west.

Smart Building

BMS :

The building has an automatic control system, which can automatically control the start and stop of the fresh air unit and other equipment, the wind speed and the temperature and humidity of the air supply according to the indoor CO2 concentration. The indoor air conditioning system can set the temperature and humidity with one button, and can also set the temperature of each room separately. At the same time, the monitoring system can monitor the temperature and humidity, pm2.5, pm10 and VOC parameters of each room in real time

Users' opinion on the Smart Building functions :

Very intelligent, you can control the start and stop of the device with one click, and save energy.

Environment

Urban environment

The project is located 1.5 km south of the intersection of Zhengdeng Road and Southwest Ring Expressway in the Erqi District of Zhengzhou City, Henan Province, Zhengzhou Architectural Art Park. Zhengzhou Xigang Art Experience Park takes the theme of "architectural art" as its theme. The park has a total of 86 acres of construction land, and is adjacent to the surrounding 400 acres of water ecological conservation forest land, with an area ratio of less than 0.4. It is built by Vanke, Sunac, OCT, Central China, Zhuguiyuan, Fivewin Design, Rongqiao, Yasin and other enterprises. Henan Fivewin Architectural Design Co., Ltd. is the only design enterprise in the nine enterprises. The investment is about 600 million yuan. The surrounding area is the Cherry Valley Ecological Park and Jianye Football Town.

The Fivewin Science and Technology Museum has a total construction area of approximately 3,820 square meters and three floors above ground. Its main function is to demonstrate passive ultra-low energy/near zero energy building technology, as well as demonstration, display, research and development, experience and communication of other new building technologies.

Hall A - As a public building, the internal functions are mainly conference, office, accommodation and catering.

Hall B - As a residential building, focus on the marketization of passive houses.

Land plot area

Land plot area : 4 338,98 m^2

Green space

Green space : 156 658,00

Products

Product

Waterproof and breathable membrane

SIGA

Rütmattstrasse 7 CH-6017 Ruswil

https://www.siga.swiss/global_en

Product category :

The waterproof and breathable membrane is waterproof and airtight material.

The project designer: Try to use new products for the first time. Before adopting new products, conduct many field investigation, visit, study and exchange, so as to ensure the design is foolproof.
Construction workers: Slightly different from traditional construction, the construction of the project is more refined, the requirements are relatively high, and workers need to be specially trained before construction.
Users: The most direct feeling is that electricity consumption is less, and it has better comfort than traditional buildings.

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waterproof vapor-proof membrane

SIGA

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Product category :

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heat-breaking bridge anchor

ljmkj@lijianmei.net

http://ljmkj.51pla.com/

Product category :

The heat-breaking bridge anchor is a fixed and heat-insulating component that the thermal bridge value is extremely small.

The project designer: Try to use new products for the first time. Before adopting new products, conduct many field investigation, visit, study and exchange, so as to ensure the design is foolproof.
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three-glass two-chamber double low-e glass window

Info@alrunsd.com

http://www.alrunsd.com/

Product category :

The door and window are three-glass and two-chamber double low-e glass, and the heat transfer coefficient is 0.61. w/(m2.k).

The project designer: Try to use new products for the first time. Before adopting new products, conduct many field investigation, visit, study and exchange, so as to ensure the design is foolproof.
Construction workers: Slightly different from traditional construction, the construction of the project is more refined, the requirements are relatively high, and workers need to be specially trained before construction.
Users: The most direct feeling is that electricity consumption is less, and it has better comfort than traditional buildings.

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heat-insulating reflective coating

sto

http://www.sto.com.cn/

Product category :

The surface absorption coefficient of the heat-insulating reflective coating is 0.326 and exterior wall can reflect a large amount of sunlight in summer.

The project designer: Try to use new products for the first time. Before adopting new products, conduct many field investigation, visit, study and exchange, so as to ensure the design is foolproof.
Construction workers: Slightly different from traditional construction, the construction of the project is more refined, the requirements are relatively high, and workers need to be specially trained before construction.
Users: The most direct feeling is that electricity consumption is less, and it has better comfort than traditional buildings.

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passive skylight

21 support@velux.com.cn

http://www.velux.com.cn/

Product category :

The passive opening skylight is with a heat transfer coefficient of 0.83 w/(m2.k).

The project designer: Try to use new products for the first time. Before adopting new products, conduct many field investigation, visit, study and exchange, so as to ensure the design is foolproof.
Construction workers: Slightly different from traditional construction, the construction of the project is more refined, the requirements are relatively high, and workers need to be specially trained before construction.
Users: The most direct feeling is that electricity consumption is less, and it has better comfort than traditional buildings.

Costs

Construction and exploitation costs

Total cost of the building : 40 590 000 ¥

Energy bill

Forecasted energy bill/year : 56 000,00 ¥

Real energy cost/m2 : 14.65

Real energy cost/Work station : 800

Building Environnemental Quality

Building Environmental Quality

- Building flexibility
- renewable energies
- integration in the land
- products and materials

Health and comfort

Water management

Consumption from water network : 4 993,20 m^3

Water Consumption/m2 : 1.31

Water Consumption/Work station : 71.33

Indoor Air quality

The fresh air system can automatically adjust the fresh air volume according to the indoor carbon dioxide concentration. The wind turbine has four speeds variable frequency control. The air volume ranges from 2000m3/h to 4000m3/h, the average CO2 concentration exceeds 1000ppm (50hz, 4000m3), 1000-800ppm (35hz, 2800m3), 800-600ppm (30hz, 2400m3) and below 600ppm (25hz, 2000m3). The indoor PM2.5 is not more than 25μg / m3, PM10 is not more than 30μg / m3, VOC grade is excellent and good.

Contest

Reasons for participating in the competition(s)

This project is the first passive ultra-low energy building in Henan Province and is promoted as a demonstration project. According to design standards, the energy saving rate is increased to 90%.

From the perspective of the micro market of a single city in Zhengzhou, for example, the sales area of a new commercial house in Zhengzhou City in 2016 was 28590000 m2, of which the residential sales area was 25710000 m2. For example, according to 10% of the residential area is passive ultra-low-energy buildings, the construction market of passive ultra-low-energy houses in 2016 alone will reach more than 60 billion yuan.

Passive ultra-low-energy buildings are a large-scale system project, which will bring about a new revolution in many industries. Its popularity will drive green consumption in more than 20 industrial chains, such as insulation materials industry, energy-saving door and window industry, fresh air industry, solar energy, photovoltaic industry, shading industry, etc. The demonstration significance of the Fivewin Science and Technology Museum project is also a platform for product display, technical exchange and training activities in the fields of building,

building materials, design and construction, and it has become a “catalyst project” to promote the upgrading and transformation of the original green building materials production enterprises.

In the context of global warming, shortage of resources and energy, and deterioration of the ecological environment, the protection of the environment is imminent. Passive ultra-low-energy buildings strictly control energy consumption indicators, significantly reduce energy demand, reduce the use of fossil energy, use renewable energy as much as possible, reduce carbon emissions, and reduce environmental damage.

As a large population province and transportation hub in the central region, Henan has a strong market demand for real estate and a stable and dynamic development of the construction and real estate industries. These provide a broad space for the development of passive buildings in Zhengzhou and even in Henan province.

Building candidate in the category