Graduate School of Inner Mongolia Academy of Agriculture and Animal Husbandry

by CBTGC CBTGC / 2017-06-14 14:11:13 / Chine / 7936 / CN

Primary energy need :

304.66 kWhpe/m².

(Calculation method :)

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 : School, college, university
Construction Year : 2009
Delivery year : 2012
Address 1 - street : 4309280 ,
Climate zone : [Dwb] Humid Continental Mild Summer, Dry Winter

Net Floor Area : 15 800 m^2 SRE
Construction/refurbishment cost : 83 801 500 ¥
Number of Pupil : 360 Pupil
Cost/m2 : 5303.89 ¥/ m^2

Certifications :

Proposed by :

General information

This project is located in a campus which owns a large land, and has a good visual effect as a result of green plant throughout the year. This project has reached the second level of green building operation, and saves resources, protects the environment, reduces the pollution and has the very good environmental benefits of the whole life cycle. While saving energy and resources and providing economic benefits, it also provides a comfortable office environment for building users, and it also sets a reference for other similar office buildings in Inner Mongolia.

By adopting the design concept of low-carbon, green and ecological strategies, this project has achieved energy-saving, reduced influences to other buildings, and complied with national architectural policy. As a result of building energy-saving technologies (solar heating water system, ground source heat pump, natural ventilation, photovoltaic power generation), building water-saving technologies (water-saving implements and irrigating) and green lighting system, economy energy rate and unconventional water use reach 61.61% and 7.61%, respectively. 26.67% electricity use of the building is supplied by renewable energy power generation and 15.35% material is supplied by recycled building materials. Due to considerable energy saving, this project has become an actual energy-saving and low-carbon building, which provides an active and comfortable environment for undergraduate students. Also, this building has become a harmonious space of natural and humanistic, environment and life.

Data reliability

3rd part certified

Stakeholders

Stakeholders

Function : Thermal consultancy agency

30 010-64517190

http://www.cabr.com.cn/

Contracting method

General Contractor

Owner approach of sustainability

This project adopts the design concept of low-carbon, green and ecological strategies and applies the following key technologies and products solar heating water system technology of rainfall penetration, sprinkler irrigation, thermal insulation of external wall, extruded polystyrene plate insulation material, aluminum alloy low-E hollow glass window, solar lamps, photovoltaic power generation technology. By adopting these integrated solutions, economy energy rate and unconventional water use reach 61.61% and 7.61%, respectively 26.67% electricity use of the building is supplied by renewable energy power generation and 15.35% material is supplied by recycled building materials.

Architectural description

1) Use of renewable energy
Graduate Building of Inner Mongolia Academy of agricultural & Animal Husbandry Sciences takes good use of solar heating water system, which achieves concentrated heat collection and heat storage affiliated by water-source heat pumps. Also, this project takes waste water as heating /cooling sources and applied photovoltaic power generation on façades and on the roofs.
2) Use of unconventional water source
There are lots of fields for seedling and planting and greenhouses in Graduate Building of Inner Mongolia Academy of agricultural & Animal Husbandry Sciences. The artificial green space can collect natural rain water to make greening irrigation without special artificial curing. According to the irrigating requirements of water quality, rainfall can be recycled directly after collection. As a bare grand, planting fields can not only collect rainwater for irrigation, but also have the effect of increasing rainwater infiltration and conserving groundwater.

Building users opinion

The user of this project has a good living experience, and the main living room near the window has better lighting effect. The performances of ventilation of different house types are great and the distribution of air flow is also perfect. Some secondary areas of this project have poor ventilation performance due to the obstruction of internal wall, and the air age is higher in some areas with less personnel activities such as corridors. It is a solution for these areas to close windows in transition season to achieve adequate air age and create comfortable living environment. The indoor temperature is controlled by intelligent control and can be adjusted flexibly based on requirements. The sound insulation the enclosure structure performs well, and the indoor acoustic environment meets the requirements of standard.

Energy

Energy consumption

Primary energy need : 304,66 kWhpe/m^2.

Primary energy need for standard building : 383,89 kWhpe/m^2.

Calculation method :

Breakdown for energy consumption :
HVAC: 62.2% General lighting socket equipment: 21.7% General power equipment: 16.1%

Envelope performance

Envelope U-Value : 0,38 $W.m^{-2}.K^{-1}$

More information :
External wall: Clay block and extruded sheet thermal insulation material
Roof: reinforced concrete and extruded polystyrene board thermal insulation material
External window: aluminum alloy low-e hollow glass window
Heat transfer performance of building envelope is good enough to avoid heat transfer by heat bridge.

Building Compactness Coefficient : 0,17

Indicator : GB/T 7106-2008

Real final energy consumption

Real final energy consumption/m2 : 65,50 kWhfe/m^2.

Year of the real energy consumption : 2 012

Renewables & systems

Systems

Heating system :

- Heat pump
- Low temperature floor heating

Hot water system :

- Solar Thermal

Cooling system :

- Reversible heat pump
- Fan coil

Ventilation system :

- Natural ventilation
- Single flow

Renewable systems :

- Solar Thermal
- Heat pump

Renewable energy production : 26,67

Solutions enhancing nature free gains :

The building is located on the south by east 12°and is helpful for natural ventilation in summer and helpful for sunshine in winter. The layout of the building is adequate for indoor and outdoor environment of sound, light and ventilation. Based on compre

Smart Building

BMS :

Building management system of this project contains fire alarm system and linkage control system.

Users' opinion on the Smart Building functions : The management system of this project is comprehensive and convenient.

Environment

Urban environment

This project is located in the academy surrounding by public applications of graduate academy.

Land plot area

Land plot area : 8 779,40 m^2

Green space

Green space : 23 516,40

Products

Product

Sewage dedicated heat pump unit

46-2 bjrbl@hitrbl.com

http://www.hitrbl.com/

Product category :

It can be used to provide heating or cooling for the terminal systems in the building. Product function: It achieves heat transfer in untreated sewage and media to gain or release heat to the waste water.
Innovation highlights: The cold - media switching technology is applied to ensure that the sewage can be directly entered into the heat pump to heat effectively. The theory of normal water source pump is to achieve heat exchange through water. Thus, waste water will pollute the heat pump when switching the water path. This product can introduce waste water into heat pump system directly to finish heat transfer process. In this way, it can avoid secondary pollution and this product has achieved national patent.

Switching between heating and cooling modes can be achieved by controlling valves. The main body of the system is made from admiralty brass to improve the corrosion resistance of the heat pump. Imported compressor and special jet pump are applied in this system to avoid jam and leakage of the system. By using independent oil supply path, the system performs conveniently and effectively.

Costs

Construction and exploitation costs

Renewable energy systems cost : 518 800,00 ¥

Total cost of the building : 83 801 500 ¥

Energy bill

Forecasted energy bill/year : 952 000,00 ¥

Real energy cost/m2 : 60.25

Real energy cost/Pupil : 2644.44

Building Environnemental Quality

Building Environmental Quality

- Building flexibility
- acoustics
- waste management (related to activity)
- water management
- energy efficiency
- building end of life management
- integration in the land
- building process

Health and comfort

Water management

Consumption from water network : 57 688,00 m^3

Consumption of harvested rainwater : 6 731,70 m^3

Water Self Sufficiency Index : 0.1
Water Consumption/m2 : 3.65
Water Consumption/Pupil : 160.24

Indoor Air quality

Concentration of formaldehyde, TVOC and benzene tested in the building is 0.05~0.08 mg/m3, 0.2~0.3 mg/m3 and 0.02~0.03 mg/m3, respectively.

Comfort

Health & comfort : Average indoor air temperature in January: 21.8 oC
Average humidity in January: 42.1%%
Average indoor air temperature in July: 23.9 oC
Average humidity in July: 49.7%%
Independent opening/closing control fan coil unit (FCU), fan coil unit (FCU) and fresh air ventilation system which can adjust temperature and humidity separately are applied in this project. Floor coil system is also applied to provide heat 24h per day and heat transfer station in the housing estate acts as heating resources.

Acoustic comfort : In 2013, the monitoring value of acoustic environment in this area is 43.8dB at night and 44.9dB in the daytime. The test results meet the 2nd level requirements of the standards of GB 3096-2008. The sound value of the apartment on the northwest is 22.77 dB(A) in the daytime and 23.67dB(A) at night when the its windows are closed. Sound absorbing materials and flexible shock absorber hoses are applied in pump and mechanical room to reduce the influence of noise.

Contest

Building candidate in the category

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