VELUX China Headquarters

by Aryan ROSTAMZAD / 2015-07-06 10:17:52 / International / 13414 / EN

Primary energy need :

170 kWhpe/m^2.year

(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 : 2012
Delivery year : 2013
Address 1 - street : 065001 LANGFANG, Other countries
Climate zone : [ET] Tundra - Polar tundra, no true summer.

Net Floor Area : 2 000 m^2
Construction/refurbishment cost : 1 714 285 €
Number of Work station : 54 Work station
Cost/m2 : 857.14 €/m^2

Proposed by :

VELUX

General information

VELUX Langfang Office is the headquarters of VELUX China. Located in the Hebei province, around 45 kilometers from Beijing, the building houses management, marketing and the technical department and sales division.

The two-storey building, with slopping walls and in the shape of a pyramid with cut-out top, is the workplace of 54 employees. They enjoy a range of facilities on the company site, which is shared with the nearby VELUX window factory.

The office was completed in June 2013. It has significantly lower energy consumption than standard Chinese office building.

The new Velux office in Langfang has been designed and built to meet several objectives:

- A real estate objective:
  - Consolidate the operations on a single site (2 sites before)
  - Being a showcase of the Velux products
  - Show the commitment of the Danish company to sustainability and low carbon corporate policy.

- An economical objective:
    - The operation must be neutral: the construction and operation costs are paid back by the saved rent
    - Controlled construction cost in order to replicate the model in the Chinese market.
- An environmental objective:
    - Reach a target value of 40 KWh/m²/year (excluding office equipment), and 55 kWh/m²/year (including office equipment) of final energy consumption (2020 Danish thermal regulations)
    - Having a great indoor environmental quality: The VELUX Langfang Office aims to show that we can improve working conditions with minimum environmental impact

Stakeholders

Stakeholders

Function : Thermal consultancy agency

Terao

anovel@terao.fr

http://www.terao.fr, http://www.teraochinagb.cn
Energy modeling, building envelope optimization, design of HVAC systems and associated controls

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Function : Designer

Velux

christian.olsen@velux.com

http://www.velux.com
Design of the facades and daylighting optimization

Contracting method

Macro packages

Type of market

Table 'c21_maroc.rex_market_type' doesn't exist

Energy

Energy consumption

Primary energy need : 170,00 kWhpe/m^2.year

Primary energy need for standard building : 370,00 kWhpe/m^2.year

Calculation method : Other

CEEB : 0.0001

Breakdown for energy consumption : Heating: 8kWh/m²/y
Cooling: 13kWh/m²/y
Fans and pumps: 10kWh/m²/y
Lighting: 10kWh/m²/y
Office equipment: 14kWh/m²/y

Envelope performance

Envelope U-Value : 0,60 $W.m^{-2}.K^{-1}$

More information :
200mm insulation in walls and roof
250mm insulation below slab
High performance windows from Velux, Uw = 1.2W/m²K

Building Compactness Coefficient : 0,25

Indicator :

Air Tightness Value : 0,80

none

More information

The project is followed-up using the IPMVP protocol during two years.
The real life energy consumption is 51 kWh/m²/y for the first year.

Real final energy consumption

Final Energy : 55,00 kWhfe/m^2.year

Real final energy consumption/m2 : 51,00 kWhfe/m^2.year

Real final energy consumption/functional unit : 0,94 kWhfe/m^2.year

Year of the real energy consumption : 2 014

Renewables & systems

Systems

Heating system :

- Geothermal heat pump
- Low temperature floor heating
- Radiant ceiling
- VAV System

Hot water system :

- Solar Thermal

Cooling system :

- Water chiller
- Geothermal heat pump
- VAV Syst. (Variable Air Volume system)
- Floor cooling
- Radiant ceiling

Ventilation system :

- Natural ventilation
- Double flow heat exchanger

Renewable systems :

- Solar Thermal
- Heat pump (geothermal)

Renewable energy production : 6,00 %

Other information on HVAC :

The remarkable fact is that due to the thermal mass of the TABS and the optimization of all energy requirements, the preconditioned fresh air is sufficient to meet comfort requirements even during peak summer heat or peak winter cold.

Solutions enhancing nature free gains :

Solar passive heating is enhanced with the optimized glazed area. Not only the window to wall ratio is optimized but the window type is highly selective. Moreover the blinds design and control strategies have been thought to maximize solar gains in winter

Smart Building

BMS :

BMS allows energy performance monitoring and visualization, controls HVAC systems. Blinds have automatic controls.

Environment

Urban environment

Langfang Industrial Park

Green space : 1 500,00

Products

Product

VMS

VELUX

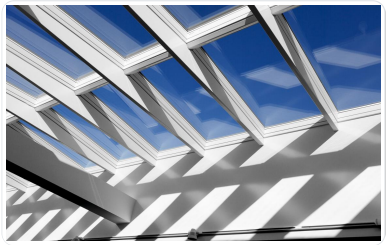
+45 45164000

http://www.velux.com/

Product category : Second œuvre / Menuiseries extérieures

Very advanced insulation coefficient skylights Uw = 1.1W/m²K

Velux has carried out the acceptance procedure internally



Costs

Construction and exploitation costs

Reference global cost : 1 371 428,00 €

Renewable energy systems cost : 103 857,00 €

Reference global cost/Work station : 1371428

Cost of studies : 92 857 €

Total cost of the building : 1 714 285 €

Energy bill

Forecasted energy bill/year : 7 541,00 €

Real energy cost/m2 : 3.77

Real energy cost/Work station : 139.65

Health and comfort

Life Cycle Analysis

LCA has been conducted using Active House LCA tool
https://www.construction21.org/data/sources/users/12034/p022achlca-tool110406veluxlfii.xlsx
Material impact on GHG emissions :
48

Material impact on energy consumption : 3 265 357,00 kWhEP

Water management

Consumption from water network : 119,00 m^3

Water Consumption/m2 : 0.06

Water Consumption/Work station : 2.2

Indoor Air quality

IAQ has been central to the project from the start. In particular, above standard fresh air renewal rate have been planned. This was calibrated at 30% above European standard requirements. This has been both a requirement in terms of IAQ and a mean to achieve thermal comfort, only blowing fresh air in spaces (thanks to the TABS contribution to daily thermal load leveling). Moreover, it is possible to use operable Windows to increase fresh air everywhere in the building.

Comfort

Health & comfort : Thermal comfort is very good, thanks to radiant system both in the floors and ceilings. Besides the temperature difference between slabs, room air is lower than usually (with radiant systems) for three reasons:
- the slabs are "loaded" during the night, therefore during the day the surface temperature has already varied towards room temperature,
- The water pipes are in the mid plan of the slab, meaning the actual slab surface temperature is quite different from that of the water,

- and lastly the radiant system ensures to meet the "base load" whereas the fresh air system meets the daily variable loads meaning that the system is not sized with large temperature difference to meet high loads. Since fresh air only is used to bring additional comfort, users are not subject to heavy drought induced by large airflow rates.

Calculated indoor CO2 concentration :
900ppm

Measured indoor CO2 concentration :
between 600ppm and 1200ppm

Calculated thermal comfort : 22°C in winter and 24°C in summer
Measured thermal comfort : 21°C to 26°C

Acoustic comfort : Acoustic panels have been installed below ceilings. They are distributed in a way to allow the concrete to radiate the heat/cold from the TABS system while improving significantly the acoustic comfort.

Carbon

GHG emissions

GHG in use : 10,20 $KgCO_2/m^2$/year

Methodology used :
Active House Life Cycle Tool - Energy consumption calculated using EnergyPlus energy modeling tool

GHG before use : 463,00 $KgCO_2$ /m^2

Building lifetime : 50,00 year(s)

, ie xx in use years : 45.39

GHG Cradle to Grave : 1 436,70 $KgCO_2$ /m^2

Contest

Reasons for participating in the competition(s)

The project participates in the NZEB and Health and Comfort contests because:

- It yields very high energy efficiency, especially if we consider the double challenge of achieving Denmark 2020 energy performance threshold in China and in a climate zone where both winter (-10°C with siberian Wind) and summer (40°C humid) are hard.

- The building has achieved the expected energy performance in real life after a careful M&V period of two years

- The building achieves a good ratio of renewable energy rate with the contribution of Ground Source Heat Pump and Building Integrated Solar Thermal systems (although it was not designed to reach NZEB at this stage but there is a potential of coupling the project with cogeneration based on the wood waste from the window factory on site)

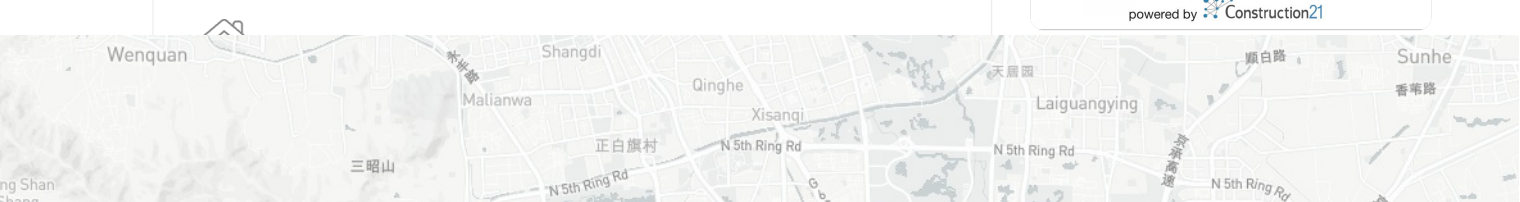
- The building design was focused around the objective of energy performance. Not only the envelope is very efficient but the HVAC systems are well combined, a proper mix between efficient technologies and innovation. We must mention that combining VAV dedicated outdoor air system, radiant slabs/ceilings based on extreme thermal mass effect and ground source heat pump was a challenge in China and a lot of effort has been put on the integration of systems and on quality insurance. Lastly the BMS has been carefully designed and defined to just meet the need (no extra/unnecessary functions, the priority has been given to the use)

- The building also aims at very good comfort level. The target comfort and indoor air quality level have been defined as per CEN recommendation report 1752:1999 Class B

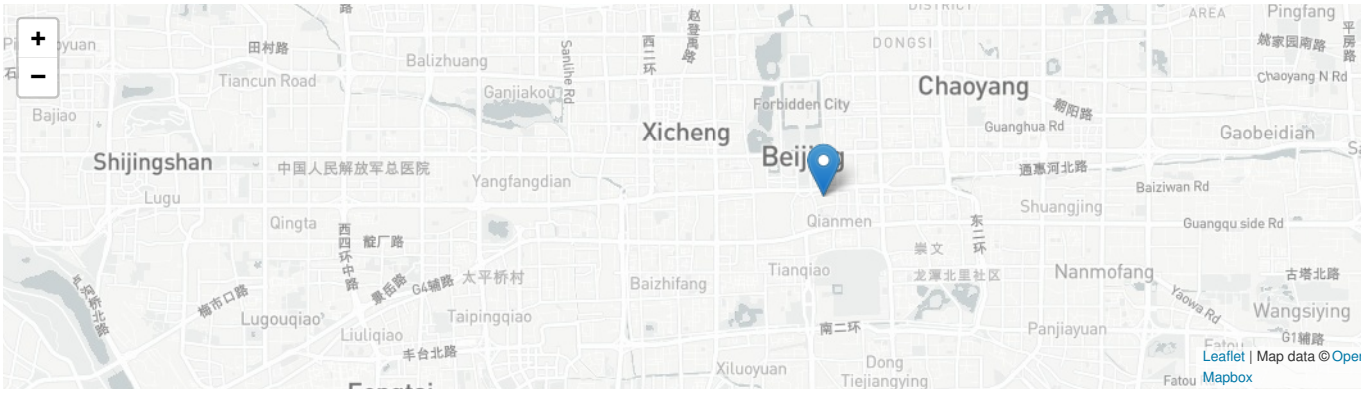
- Fresh air rate has been increased by 30% compared to the above mentioned Baseline both in order to improve IAQ and to meet comfort zone. Indeed the project is so efficient that only preconditionned fresh air is required to meet comfort. This is also possible thanks to the principle of TABS (Thermally Active Building Slab) that make best use of thermal mass

- Comfort and Health is also ensured by an abundant daylight. One can say that Velux has designed the architecture of the project around daylight, that it is the DNA of the building. As a result indoor spaces are very pleasant. Daylight and views on outdoor space (large green spaces with "happy farm" concept are visible from one side of the building) are known to be important factors for workers well-being.

Building candidate in the category



Health & Comfort



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