Air and Light House, VELUX Model Home 2020

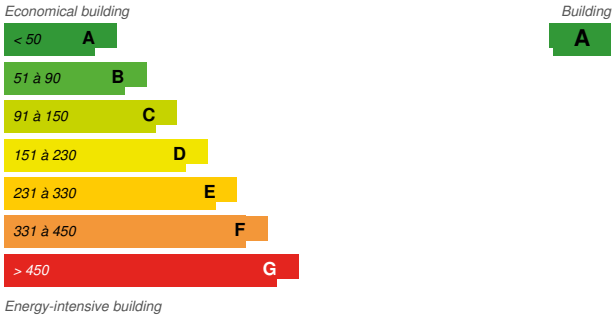
by SEBASTIEN PREVOT / 2014-02-27 14:18:49 / Francia / 21153 / FR

Primary energy need :

35 kWhep/m^2.an

(Calculation method : RT 2012)

ENERGY CONSUMPTION



Building Type : Isolated or semi-detached house
Construction Year : 2011
Delivery year : 2011
Address 1 - street : 35 Chemin des Justices 91370 VERRIèRES LE BUISSON, France
Climate zone : [Cfb] Marine Mild Winter, warm summer, no dry season.

Net Floor Area : 188 m^2
Construction/refurbishment cost : 350 000 €
Number of Dwelling : 1 Dwelling
Cost/m2 : 1861.7 €/m^2

Certifications :

effinergie

Proposed by :

NOMADE ARCHITECTES — VELUX — CARDONNEL Ingénierie le confort durable du bâtiment

General information

1. Context

The Air & Light House is a European call for projects launched in 2009 by VELUX "ModelHome 2020", to experiement new ways of designing the habitat of the future, with the experimental construction of a detached house destined to reach a positive energy balance (Active House) and a neutral environmental impact, focusing on the comfort of its inhabitants.

2. Feedback

This experimentation and its organisation was rich in lessons, since the project was open to professionals for 6 months then inhabited for a year by a family. this generated a real feedback and allowed us to validate major Active House principles.

This experimentation will let us replicate the concept on individual or collective habitats for a sustainable comfort that saves energy and resources while stressing on a reasoned bioclimatic design and recycling fatal energies.

Sustainable development approach of the project owner

The Air & Light House VELUX ® Model Home 2020 was designed in a bioclimatic approach to produce more energy than it consumes. This is meant to implement a concept developed by VELUX ®: integrate the construction of a house into a holistic approach to consider all the design parameters of a contemporary home with a low environmental footprint, to offer a "whole package" combining quality and comfort of life.

Architectural description

ModelHome 2020 by VELUX:
- Timber frame (wood and zinc on facades)
- Solar and photovoltaic panels
- Heat pump, double flow ventilation, WINDOWS MASTER system (autmated management of heating, ventilation and solar protection nees) with inner comfort, CO2 and lighting monitoring.
- Weather station that anticipates external factors.
- Instrumentation, monitoring and supervision of consumptions for a year off and during the inhabited period.
- Specifific ModelHome 2020 requirements focusing on comfort of life (daylight, indoor air quality, summer comfort) and energy savings for a Positive Energy Building level, domestic uses included.
- HQE approach, especially followed on this project, inspired by the tertiary buildings requirements.
- BBC (Low Consumption Buildings in France) approach followed

Results:
- A positive energy building on regulatory needs (heating, hot water, lighting, ventilation and distribution), covered domestic consumption to 69%
Thermal comfort of the living room in class 1-2 (very efficient to efficient) according to EN 15251
- Observation on a hot day (36°C outside): the temperature inside the hosue is 8°C colder than outside.

Building users opinion

The feedback by the PASTOUR family:
"The different seasons are not felt in the house, the house is cool but still bathed in light"
"In summer, we are immersed in the light without feeling hot in the house. "
"The management of the temperature room by room allowed to adapt to individual needs, for example Rayan prefered the temperature of the room is 18°C to sleep well at night. "

If you had to do it again?

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See more details about this project

http://www.maisonairetlumiere.fr

Stakeholders

Stakeholders

Function : Construction Manager

CARDONNEL Ingénierie

PREVOT SEBASTIEN

http://www.cardonnel-cube.fr/cardonnel.fr/

Function : Contractor

VELUX France

Catherine Juillard

http://www.velux.fr

Function : Designer

NOMADE Architectes

communication@nomade.info

http://www.nomade.info/accueil

Contracting method

Other methods

Energy

Energy consumption

Primary energy need : 35,00 kWhep/m^2.an

Primary energy need for standard building : 60,00 kWhep/m^2.an

Calculation method : RT 2012

Breakdown for energy consumption : Heating: 6.5 kWhef/m².year
Hot Water: 4 kWhef/m².year
Lighting: 1.3 kWhef/m².year
Ventilation: 2.1 kWhef / m².year
Distribution: 0.2 kWhef / m².year
PV Production: 22.9 kWhef/m².year

Real final energy consumption

Final Energy : -8,00 kWhef/m^2.an

Envelope performance

Envelope U-Value : 0,33 $W.m^{-2}.K^{-1}$

More information :
See attached document for energy efficiency

Building Compactness Coefficient : 0,58

Indicator : I4

Air Tightness Value : 0,60

More information

Heating: 8.9 kWhef/m².year
Hot Water 2.8 kWhef/m².year
Lighting: 1.7 kWhef/m².year
Ventilation: 0.66 kWhef/m².year
PV Production: 22.8 kWhef/m².year

Renewables & systems

Systems

Heating system :

- Heat pump
- Low temperature floor heating
- Solar thermal

Hot water system :

- Heat pump
- Solar Thermal

Cooling system :

- No cooling system

Ventilation system :

- Natural ventilation
- Nocturnal ventilation
- Nocturnal Over ventilation
- Free-cooling
- Double flow heat exchanger

Renewable systems :

- Solar photovoltaic
- Solar Thermal
- Other, specify

Renewable energy production : 100,00 %

Smart Building

BMS :
BMS WINDOWS MASTER control of the whole house and instrumentation of all energy flows and interior comfort

Environment

Urban environment

Land plot area : 630,00 m^2

Built-up area : 15,00 %

To meet the criteria of environmental, societal and urban requirement of the project, the research field of the future house is oriented areas under Layouts in Ile-de-France. The choice involves a subdivision incorporating specific characteristics to an eco-neighborhood: Parc des Justices on the common Verrieres-le-Buisson (91). The houses in this subdivision are particularly common in the use of the principles of construction and ecological design, while respecting the diversity of styles and architectures, in this city where half the area is wooded.

Products

Product

Hybrid ventilation: alliance between natural ventilation by opening the windows and mechanical ventilation double flow

VELUX - ALDES - WINDOW MASTER

http://www.windowmaster.com/

Product category : Table 'c21_italy.innov_category' doesn't exist SELECT one.innov_category AS current,two.innov_category AS parentFROM innov_category AS oneINNER JOIN innov_category AS two ON one.parent_id = two.idWHERE one.state=1AND one.id = '19'

Innovative system:Hybrid ventilation controlled by the rate of CO2, humidity and temperature: VMC Double Flux Activated winter (limitation of energy losses) and Natural Ventilation + VMC-Single Feed-season and summer (synchronized opening vertical transom windows and roof to create a stack effect and nocturnal cooling).

Costs

Construction and exploitation costs

Total cost of the building : 295 000 €

Health and comfort

Indoor Air quality

Categories 1 to 2 according to EN 15251 in all parts of the house

Comfort

Health & comfort : In the design stage of the Air & Light house, certain aspects were specifically attended to:
a. Daylight
Different daylighting simulations were performed to optimize positioning and sizing of vertical windows and roof windows. The goal was to obtain a daylight factor greater or equal to 5% in the living rooms, so as to maximise the well-being of residents and impact down the consumptions of artificial lightings. Ultimately, the glass windows ratio compared to the living surface reaches 33% (or 2 times the regulatory minimum requirements of 1/6 of glassed bays edicted by the French RT2012)
Attached, natural lighting final analysis done with the VELUX Daylight Visualizer software.

b) Summer comfort
The Air and Light house benefitted from a thermal comfort strategy and particularly summer comfort, right from the design stage:
Structural aspects
- High concrete floor to increase inertia (the hosue is timber framed)
- Awining in the south, to protect the terrace and all the southern windows.
- Strategic positioning of roof windows to exploit the natural thermal draft and crossed natural ventilation
- For roof windows: use of double glazed windows with solar control.
*Active systems
- Automated management of openings (motorized skylights façade, roof windows motorized roof) according to the indoor and outdoor temperature levels (probes) optimization of night cooling in summer - automatic closing roof windows when it rains (Detector Integrated rain to motorized skylights).
- Automated management of external sunscreens according to the outside temperature and solar radiation.
Thermal comfort Simulation - Brager diagram attached

c) Indoor Air Quality:
* Harmlessness Cage materials
- Choice of materials classified A +
- Plasterboard Using Activ'Air® Technology (Placo): active ingredient which captures VOCs, converts to inert species, and thus protecting against the rebroadcasting of pollutants.
* Systems:
Establishment of a hybrid ventilation combining the advantages of the double flow mechanical ventilation and natural ventilation by opening windows seasonally. In both cases, the air change is managed according to the level of CO2 and humidity in each room of the house.

• In testing phase by the family who lived in the house for a year:
a) quantitative monitoring of energy consumption, water, energy production (photovoltaic tiles) and also rational indicators of comfort:
* Outside temperature (weather station)
* Internal temperature in each room
* CO2 and humidity rate in every room
b) Monitoring of quality life experience of the family for a year
* Blog run by family
* Monitoring conducted by the sociological sociologist Monique Eleb.
Monique Eleb, researcher and member of ACS Laboratory the National School of Architecture Paris-Malaquais.

• Feedback:
Following this comprehensive approach for monitoring and tracking the life experience, the key points of feedback are:
a) positive energy balance: consumption of regulatory positions in line with forecasts
b) The key role of natural light
* Consumption of artificial lighting: reduced to 1.3 kWh ep / m².year!
* And especially on the health and well-being of the family - some excerpts from his blog:
"No more little bit of blues in autumn, it is the effect of light therapy home"
"A lot of natural light, has become a standard for our future home. When you go to another house, something is missing "
"In winter we light the light an hour later than our neighbors"
c) The satisfactory thermal comfort throughout the year including summer
d) Air quality regulated satisfactorily in the different rooms of the house.
Very positive testimony of the family: "The air is renewed, it's definitely metter up, forget about airing all the time and the air is really healthy. Health Rayan (11 years elder son) has improved, we would have never believed that he was asthmatic "
e) Automation and lifestyle:
One lesson is that the "all automatic" is not realistic. The possibility, as was the case in the house Air and Light, you can take control of the system is essential.
In parallel, the family could access in real time, thanks to a screen in the house, its water and energy consumption and energy production figures from home.
Here are excerpts from his blog:
"We could see that on the screen of sunshine days ago SBIPS big production, it's great! "
"It is not binding, it is empowering. we will less run the water ... it's easy to put a sweater or less water the garden ... ".
This virtuous behavior had a direct effect on water consumption:
The average consumption of the family home Air and Light was 84 liters / day / person or - 44% compared to the average consumption of French.
More information about the feedback: enclosed brochure.

Carbon

GHG emissions

GHG in use : -178,00 $KgCO_2/m^2/an$

Methodology used :
All consuptions, all uses, including domestic operations

Building lifetime : 50,00 année(s)

Contest

Reasons for participating in the competition(s)

Nomade Achitectes developed a holistic approach with a "Concept Home" contemporary habitat with a low environmental footprint, combining quality and comfort of life.

- A bioclimatic and contextualized design house, adapted to its environment, taking into account the orientation, the views and luminosity.
- A transposable concept: an adaptable shape for other urban configurations, based on 3 modular volumes.
- A fifth active facade: the roof becomes the "5th facade" by optimizing slopes as solar energy collect surfaces.
- A self-sufficient and responsible house designed to produce more energy than it consumes, with particular attention to the quality of the envelope and its permeability, the choice of materials (selected for their low environmental impact) the orientation of openings, natural ventilation and energy production systems (solar collectors and photovoltaïc cells integrated into the roof for hot water and electricity production, heat pump for heating and solar gains)
- A house opened on the sky: all rooms have plenty of natural light but controlled so as not to generate overheating in the summer.
- An airy and healthy home: the general volumes associated with the arrangements of facade openings creates a natural convection that aids natural ventilation.
- A house with variable geometry: this house can evolve in its inner envelope, especially with the transformation of the mezzanine into an additional room or by adding volumes
- A modern house: automated management of heating, ventilation and shutters, depending on the desired indoor climate and weather conditions.

Building candidate in the category

Santé et confort

Green Building Solutions Awards 2015
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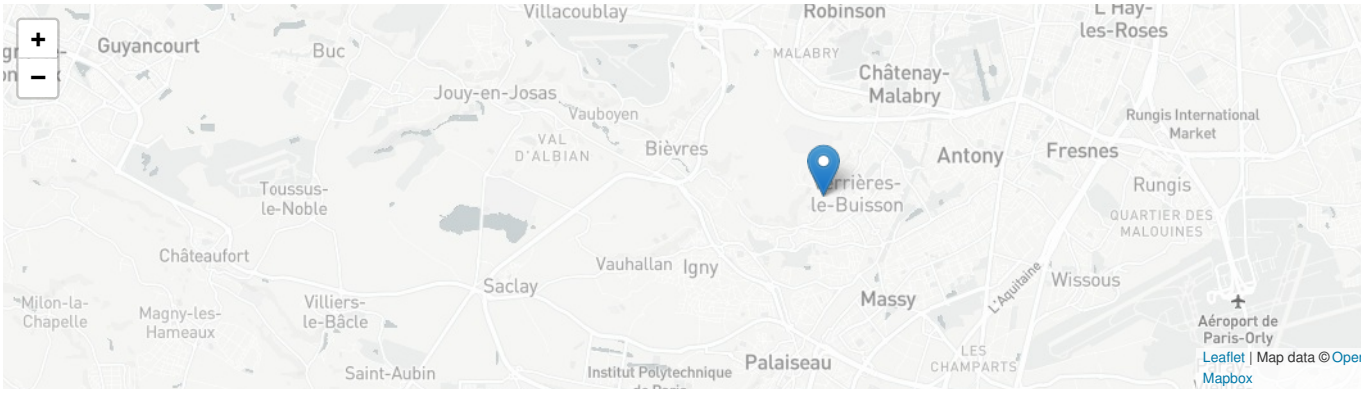

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