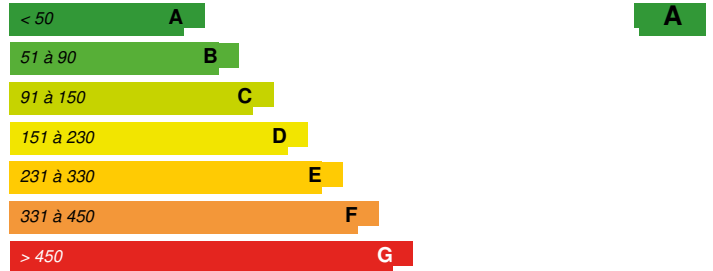


# Passive house in Burmerange (Luxembourg)

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**Building Type** : Isolated or semi-detached house  
**Construction Year** : 2014  
**Delivery year** : 2016  
**Address 1 - street** : 5675 BURMERANGE, Luxembourg  
**Climate zone** : [Cfb] Marine Mild Winter, warm summer, no dry season.

**Net Floor Area** : 386 m<sup>2</sup> NGF  
**Construction/refurbishment cost** : 1 €  
**Number of Dwelling** : 1 Dwelling  
**Cost/m2** : 0 €/m<sup>2</sup>

## General information

It is a passive single-family building equipped with geothermal energy, a smarthome function, a photovoltaic electric production unit but which has also been designed in a healthy way (reflection on chemical emissions, on the reduction of electromagnetic fields, on the radon problem) including the positive effects of construction materials: humidity regulation, absence of electrostatic effects, composition of indoor air ions. The construction was accompanied by a "baubiologe" health expert and an accredited laboratory which carried out preliminary chemical analyses of the materials to be used on the site. Chemical analyses (more than 150 different molecules), measurement of electromagnetic fields, measurement of radon, positive and negative ions, etc. were carried out after the building was completed to check the "health" aspect and the absence of disruptors. Continuous CO<sub>2</sub>, humidity or radon measurements have been made. In parallel, the project followed the passive design mode with in particular the calculation of the real energy consumption and the implementation of constructive details with absence of thermal bridges; this absence was verified during the winter season. The construction also serves as a pilot project and is described in detail in a 300-page book (French and German versions) currently under development. It has also been described in a two-hour documentary film (German and French versions) scheduled for release this fall 2018. More than fifty hours of raw film can be adapted to serve as specific training for many trades.

### Data reliability

Assessor

## Stakeholders

### Contractor

Name : Privé

## Construction Manager

Name : Beiler & François Architectes - depuis 2018: Beiler François Fritsch

Contact : contact@bffarchitectes.lu

<http://bf-archi.lu> - <http://bffarchitectes.lu>

## Stakeholders

Function : Assistance to the Contracting Authority

Ralph Baden, biologiste diplômé, baubiologe - expert en construction "saine", responsable qualité de l'air intérieur au Ministère du développement durable/Ministère de l'Environnement

ralph.baden@gmail.com

"Health" advice - material analyses and measurements - indoor air quality controls

## Contracting method

Separate batches

## Owner approach of sustainability

An adept of contemporary green energy production technologies (photovoltaic electric production installation on the old house), eager to go further in the passive and fanatical concept of computer technologies applied to the building - hence the interest for the "smarthome", the master of This work became sensitive to the health/quality aspects of indoor air following health problems in her children, these problems were related to the poor indoor air quality of the old house (expert assessments, laboratory analyses), hence the desire to integrate the health aspects in the overall constructive concept and in a sustainable project perspective.

## Architectural description

It is a passive single-family dwelling house under massive construction: concrete for load-bearing walls, insulating clay/perlite bricks for the other walls (with humidity regulation fu All materials were analysed before use.



## If you had to do it again?

Some choices in the trades would be different: mostly time and material quality problems, independent of the "health" aspect of the project.

## Energy

### Energy consumption

Primary energy need : 31,00 kWhep/m<sup>2</sup>.an

Primary energy need for standard building : 125,00 kWhep/m<sup>2</sup>.an

Calculation method : Other

CEEB : 94

Breakdown for energy consumption :

-

More information :

-

### Envelope performance

More information :

-

Building Compactness Coefficient : 0,50

Indicator : EN 13829 - n50 » (en 1/h-1)

Air Tightness Value : 0,39

[Blower Door intermediaire](#)

Users' control system opinion :

Interesting potential in terms of energy savings, safety, but also in terms of health and minimisation of exposure to low and high frequency electromagnetic fields. Limitations concerning the connection of the VMC which at the beginning was incompatible and consequently had to be replaced.

[Blower Door final apres achevement du batiment](#)

## Renewables & systems

### Systems

Heating system :

- Geothermal heat pump
- Low temperature floor heating

Hot water system :

- Heat pump

Cooling system :

- Geothermal heat pump

Ventilation system :

- Double flow heat exchanger

Renewable systems :

- Solar photovoltaic
- Heat Pump on geothermal probes

Renewable energy production : 37,00 %

East-west oriented photovoltaic installation to ensure a more balanced and smoothed electric production over the length of a day (although less important in absolute terms).

Solutions enhancing nature free gains :

-

## Smart Building

BMS :

Remote control.

Central control terminal (kitchen)

Smartgrid :

-

Users' opinion on the Smart Building functions :

## Environment

### GHG emissions

Methodology used :

-

-

### Life Cycle Analysis

-

Eco-design material :

Maximized use of eco-materials wherever possible: wood flooring, interior woodwork in solid wood, biosourced insulators, the whole having been analyzed beforehand to certify the absence of harmful substances within them.

### Indoor Air quality

Use of materials and products free of harmful substances (previously analysed in the laboratory). Air and dust quality controls for over 150 distinct harmful substances including aromatic and aliphatic VOCs, halogenated derivatives, terpenes, glycol ethers, biocides and pyrethroids, organophosphorus and polybrominated flame retardants, PCBs, PAHs, phthalates and heavy metals. Comparison with the German specific guidance values (Arbeitsgemeinschaft Ökologischer Forschung - AGOEF), among the most severe in Europe. Concentrations found below detection limits and guidance values except for glycol ethers in a particular room from cleaning products used after construction. CO<sub>2</sub> values measured over the long term with concentrations well below 1000 ppm (Pettenkofer), and mostly below 600 pp (cf. outdoor air 400-450 ppm). Formaldehyde concentrations below the detection limit of 10 µg/m<sup>3</sup> in living room and bedrooms. Radon 67 Bq/m<sup>3</sup> in the bedroom. No anomalies concerning high and low frequency electromagnetic fields: low frequency electric fields > 1 V/m, low frequency magnetic fields > 10 nT in sensitive areas (living room and bedrooms) and therefore far below the SBM-2105 orientation values (Baubiologischer Messtechnik Standard in Germany).

### Comfort

Health & comfort : Improvement of the regulation of the relative humidity of the indoor air by the use of buffer materials such as clay bricks (Proton), lime plasters without vitrifying paint, oiled and unglazed parquet. Window blinds are managed using smart technology.

## Products

### Product

Painting Verdello

Peintures Robin

<http://www.verdello.lu/contact>

<http://www.verdello.lu>

Product category : Table 'c21\_germany.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 = '12'

Ecological paint based on natural solvents, 100% biosourced.

Paint analysed by us for the absence of harmful substances that could emanate and contaminate the ambient air.

[Briques Poroton](#)



Wienerberger Poroton

Wienerberger

<https://wienerberger.de/service/kontakt>

<https://wienerberger.de>

Product category : Table 'c21\_germany.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 = '6'

Clay bricks used for non-load-bearing walls and partitions.

Interesting capacity of regulation of the interior hygrometry.



Wakol MS 290

Wakol

<https://www.wakol.com>

<https://www.wakol.com>

Product category : Table 'c21\_germany.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 = '16'

Glue used for parquet on underfloor heating and horizontal and vertical tiling.

Adhesive proposed by the parquet manufacturer, accepted by the tiler, without harmful emissions and without problems of implementation by the trades.

[Colle analysr par laboratoire avant utilisation.](#)



Poroton-T-Dünnbettmörtel

Wienerberger

<https://wienerberger.de/service/kontakt>

<https://wienerberger.de>

Product category : Table 'c21\_germany.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 = '6'

Heat insulating adhesive for insulating Poroton.

Is an integral part of the Poroton exterior wall system and prevents thermal bridges; powder product to mix with water on site; no preservatives.



Biologa NF 45

Biologa

[www.biologa.de](http://www.biologa.de)

<http://biosol.de>

Product category : Table 'c21\_germany.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 = '12'

Specific paint to reduce low frequency electric field emissions.

Application a little difficult because of the black color of the paint



Biosil

Keim

<https://www.keim.com/de-ch/>

<https://www.keim.com/de-ch/>

Product category : Table 'c21\_germany.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 = '12'

Paint tested beforehand in laboratory, without harmful emissions.

Paint that is suitable in shades not too dark (risk of clouds).



Haga-Bio-Plattenkleber

HAGA

<https://www.haganatur.ch>

<https://www.haganatur.ch>

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Glue without harmful emissions, in powder form and without preservatives or fungicides.

Normal use.



## Costs

### Construction and exploitation costs

Global cost : 1,00 €

Renewable energy systems cost : 1,00 €

Global cost/Dwelling : 1

Total cost of the building : 1 €

### Urban environment

The occupants are very satisfied. Children's health problems have disappeared (recurrent cough in the old house, due to proven exposure to organophosphate flame retardants from polyurethane insulation panels).

### Land plot area

Land plot area : 1 097,00 m<sup>2</sup>

### Built-up area

Built-up area : 25,00 %

### Parking spaces

Parking outside, on the surface.

## Building Environmental Quality

### Building Environmental Quality

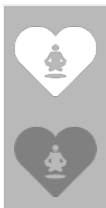
- indoor air quality and health
- comfort (visual, olfactive, thermal)
- energy efficiency
- renewable energies
- maintenance

## Contest

Reasons for participating in the competition(s)

- Rigorous integration of the concept of health and well-being in parallel with the concept of passive construction, proving that "passive" and "health" are not in contradiction;
- Controls, analyses and measurements upon completion of construction;
- Production of teaching material (documentary film, book, specific documentaries);
- Contact with the owner-occupiers established and maintained in order to allow long-term observation of the construction and validate the choices made.

Building candidate in the category



Santé & Confort



Coup de Cœur des Internautes

