Single family Home

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 Building Type : Isolated or semi-detached house

 Construction Year : 2020

 Delivery year : 2021

 Address 1 - street : Confidentielle 4974 DIPPACH, Luxembourg

 Climate zone : [Cfb] Marine Mild Winter, warm summer, no dry season.

Net Floor Area : 1 004 m² Construction/refurbishment cost : 1 € Cost/m2 : 0 €/m²

General information

After the first sketches in May 2019, the construction of this single-family house project, integrating an approach that wants to be the most respectful of the environment, began in 2020.

Faced with a significant urban influence, it was obvious for the owners, from the beginnings of the project, to include it in a sustained logic of sustainable development, in line with current environmental concerns.

The major challenges of the program of this large-scale construction, with an approximate net surface area of 1,000m2, therefore consisted of a functional architectural design, responding to the energy and comfort constraints of the occupants and a discreet urban integration into the urban fabric. existing residential area and its surrounding natural environment.

The client and the project management team thus worked together to find inventive solutions and in particular focused on innovative construction techniques offered by the manufacturer Leko Labs. Indeed, the use of factory prefabricated wood materials, combined with 3D models created upstream is a first in a single-family house project of this magnitude.

Beyond the innovative side of the construction techniques, the energy production facilities and the refined architectural line making it possible to approximate the volumes of the neighboring houses to limit any impact on the surrounding urban fabric, the comfort of the occupants was at the center of concerns from the design phase.

Thus, in addition to taking into account the different possibilities of use, the members of the project management pushed their reflections on how the building could become a comfortable space and a source of well-being for its occupants. They were therefore interested in the different dimensions of comfort (thermal, acoustic, air quality, light, etc.) but also in the interior design that the architect took particular care of by working in collaboration with a Feng Shui expert from the habitat.

Particular care has therefore been taken in the study of fluids or even in the orientation and arrangement of the various rooms and furniture, to place the occupants in such a way that they capture the favorable energies of their environment.

Data reliability

Assessor

Photo credit

@Leko Labs

Stakeholders

Contractor

Name : Propriétaire privé

Construction Manager

Name : Vasistas Contact : atelier@vasistas.be Chttps://www.vasistas.be

Stakeholders

Function : Designer Vasistas

atelier@vasistas.be

C https://www.vasistas.be Architecture

Function :

Plan B Ingénieurs-Conseils

info@planb-ic.lu

C http://www.planb-ic.lu/ Technical engineer

Function : Other consultancy agency

Betic Ingénieurs-Conseils

mail@betic.lu

C https://www.betic.lu Technical engineer

Function : Manufacturer

Leko Labs

hello@lekolabs.com

https://www.lekolabs.com/
Manufacturer / Supplier of prefabricated elements

Function : Company François Kieffer

info@fkieffer.com

C https://www.fkieffer.com/ Installer

Contracting method

Separate batches

Owner approach of sustainability

Although the choice of a concrete framework and the use of "classic" materials were initially privileged, the discussions between the client and the architect led them in a second time to apprehend the project in a a more sustained sustainable development approach and thus favor a **prefabricated wooden framework**, of which the wood used for the manufacture of the walls comes from the Greater Region (Vosges, Black Forest, Luxembourg, etc.).

This choice made it possible to provide a more complete response to needs, by integrating urban planning, functional and technical considerations with the economy of resources, ecology and the biology of materials. The realization of this building thus demonstrates that **a new type of construction is possible** in the field of single-family homes, whatever their sizes.

Thanks to proven techniques such as underfloor heating or a cooling ceiling system to ensure comfort and techniques to increase the ecological quality of the building such as the **recovery of rainwater via 2 cisterns** (one on the garden side and one street side), a photovoltaic installation on the roof, treatment with biological filtration for bacteria in the swimming pool, the building was designed to promote a balance between ecological approach and functional construction. Also with an ecological perspective, the installation of two stations for recharging electric cars has also been planned.

The special techniques also include a **geothermal heat pump system** for heating needs, a **heat pump coupled with a thermal system** for the production of domestic hot water and a **double flow ventilation system with heat exchanger**.

The approach taken by the various actors in the project will enable the building to obtain an **energy performance class A** and aim to obtain the Luxembourg sustainable construction certification " **LENOZ** ".

Architectural description

The architectural concept consisted of creating a building that would dare to assert itself with certainly the purest lines, but while entering into dialogue with the existing heritage of the district. Thus, the architecture is intended to be **more timeless than contemporary**, in accordance with the wishes of the client. The creation of several volumes which "fit together" with in particular a recessed top floor, give a certain lightness to the volume. The lines are therefore intended to be rhythmic to avoid the massiveness that the creation of a block in one piece could have led. This architectural rhythm is also amplified just as much by the **play of facades**, mixing plastered surfaces and natural stone surfaces. The timeless character of the building is guaranteed by sober tones, which make the building warm and justify that contemporary shades such as black or white were not used.

The single-family house is made up of several levels, including a basement, a ground floor and two floors. The comfort of the inhabitants is reinforced by the large bay windows offering an impression of inside-outside and guaranteeing optimal contributions of natural light.

In this desire to be part of an **approach respectful of the environment**, the large-sized stones, found in the ground at the start of the works, were preserved and reworked in order to include them completely in the landscape architecture but also used as retaining walls. The use of mineral materials and wood, was carried out both outside and inside the house to give it a **family and cozy atmosphere**.

Energy

Energy consumption

Primary energy need : 31,00 kWhep/m².an Primary energy need for standard building : 45,00 kWhep/m².an Calculation method : RGD du 30 novembre 2007 - bâtiment d'habitation CEEB : 14 Final Energy : 12,00 kWhef/m².an Breakdown for energy consumption :

Heating: Primary energy: 15.53 KWHEP / M2.AN Final energy: 5.84 KWHEF / M2.AN Sanitary hot water: Primary energy: 6.71 KWHEP / M2.AN Final energy: 2.52 KWHEF / M2.AN Auxiliaries and ventilation: Primary energy: 9.19 KWHEP / M2.AN Final energy: 3.46 KWHEF / M2.AN

More information :

The figures mentioned correspond to the building permit project.

Envelope performance

Building Compactness Coefficient : 0,47 Indicator : EN 13829 - n50 » (en 1/h-1) Air Tightness Value : 0,60

Renewables & systems

Systems

Heating system :

Geothermal heat pump

Hot water system :

- Heat pump
- Solar Thermal

Cooling system :

• Geothermal heat pump

Ventilation system :

• Double flow heat exchanger

Renewable systems :

- Solar photovoltaic
- Solar Thermal
- Heat Pump on geothermal probes

Renewable energy production : 22,00 %

Photovoltaic panels (22,000 kWh / year) 3 thermal solar panels with empty tubes

Smart Building

BMS :

The house is equipped with micro-perforated blinds. In summer, these let in just the right amount of natural light to illuminate the room, while rejecting most of the sun's rays during the day, and automatically open after dark to let the heat sink in. clear out.

In winter, the blinds close completely at night to conserve the heat of the day. The use of solar energy is maximized, both to light the rooms and to heat them.

The building also has a fully connected home automation system, making it possible to optimize the regulation of the building and thus avoid energy losses.

Environment

GHG emissions

GHG in use : 7,70 KgCO₂/m²/an Methodology used : Linked to the Energy Performance Certificate

Life Cycle Analysis

Developed in-house at Leko Labs Eco-design material : The LCA diagram is part of a logic of cradle to cradle certification . Positive carbon footprint, the structural part allows more storage than GHG emissions.

Water management

Rainwater collection via 2 cisterns (one on the garden side and one on the street side)

Indoor Air quality

Permanent controlled mechanical ventilation

Air quality: class 2 according to DIN EN 16798-1

Comfort

Health & comfort :

One of the advantages of the Leko superstructure is the use of up to 10 times less glue and the naturally strong, untreated wood material. In addition, the single-family house has bio-sourced insulation, that is to say without mineral wool, avoiding the inconvenience associated with it.

Calculated indoor CO2 concentration : < 1250 ppm donc classe 2

Calculated thermal comfort : Certificat de Performance Energétique et Simulations Thermiques Dynamiques

Product

Leko Labs wooden superstructure

Leko Labs

hello@lekolabs.com

https://www.lekolabs.com/

Product category : Structural work / Structure - Masonry - Facade

The wooden solution offered by the manufacturer Leko Labs has many advantages for new construction compared to more traditional methods. Based on the assumption that 2/3 of the world's population will live in cities and that concrete is one of the most polluting elements today, the company offers a rapid, efficient and ecological construction system.

In fact, the construction time with the Leko Labs superstructure is cut in half and can be used for any construction.

LEKO Labs has indeed developed a highly automated means of prefabrication which revolutionizes the way of approaching low carbon construction. Using software, they translate an architect's plans into a "LEKO Superstructure" in just a few minutes. Each wall of the digital model is represented by a data package which is then transmitted to an automated production line, at the heart of which the parts will be shaped and then assembled by robots to form the walls. All that remains is to assemble them on site. Greener houses, recyclable, positive carbon footprint, produced in a very short timeframe, this innovation clearly opens up the possibilities.

LEKO Labs is working with Betic Consulting Engineers on this project so that special techniques are also integrated into the process. In the long term, the openings, the passages, the dimensions will be automatically calculated on the basis of the technical drawings provided by the technical engineering offices to be integrated into the production.

Costs

Urban environment

Confidential

Land plot area

Land plot area : 1 063,00 m²

Built-up area

Built-up area : 36,00 %

Green space

Green space : 366,00

Parking spaces

1st basement: 5 parking spaces for cars Ground floor: 2 parking spaces for cars

Building Environnemental Quality

Building Environmental Quality

- consultation cooperation
- comfort (visual, olfactive, thermal)
- energy efficiency
- renewable energies
- · building end of life management
- building process



• products and materials

Contest

Reasons for participating in the competition(s)

Cette maison unifamiliale est non seulement des plus efficaces d'un point de vue énergétique et vise la certification très rigoureuse LENOZ qui prend en compte des critères dans 6 catégories :

- L'implantation du logement.
- La dimension sociétale : critères évaluant les fonctions sociales au sein d'un immeuble collectif et l'utilisation du sol.
- L'économie : critères évaluant les coûts énergétiques du logement.
- L'écologie : critères évaluant entre autres les effets environnementaux des matériaux de construction mis en œuvre.
- Le bâtiment et ses installations techniques : critères liés à la qualité du bâtiment et à ses installations techniques.
- La fonctionnalité : critères visant à garantir l'utilisation satisfaisante du logement.

En outre, le bâtiment se distingue par sa structure en bois innovante créée par Leko Labs, une première pour un projet de cette envergure, avec une telle hauteur. Cette construction agrémentée de cette ossature démontre les possibilités futures des constructions en bois pour les maisons unifamiliales et les résidences.

Building candidate in the category





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