

Larixhaus: straw bale and timber passive house

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Building Type : Isolated or semi-detached house
Construction Year : 2013
Delivery year : 2013
Address 1 - street : C/Ponent 18 08178 COLLSUSPINA, España
Climate zone :

Net Floor Area : 94 m² Superficie útil
Construction/refurbishment cost : 113 800 €
Number of Dwelling : 1 Dwelling
Cost/m2 : 1210.64 €/m²

General information

Welcome to the first pre-fabricated straw bale passive house on the Iberian Peninsula. The Larixhaus is a single family home split over two floors, located in the town of Collsuspina, 70 km north of Barcelona, Catalonia, Spain.

The timber superstructure and external cladding is PEFC certified. Healthy indoor air quality is achieved by using non-toxic natural materials, with whole house ducted heat recovery ventilation. Embodied energy and CO₂ emissions over the life cycle are minimised by prioritising the use of natural, non-toxic, renewable building materials.

Through careful bio-climatic design, thermal insulation with straw, an airtight envelope and triple glazed windows, the Larixhaus has a projected space heating demand (calculated with PHPP) of 15 kWh/m².a, approximately 80% less than that required by the current Spanish Building Regulations. Summer comfort is achieved through the careful choice and orientation of opening areas with external shading devices on the southern façade.

Pre-fabrication allows for rapid on-site assembly, pre-installation of the airtight layer and window frames, with associated cost savings and near-zero on-site waste.

See more details about this project

http://www.passivhausprojekte.de/index.php?lang=en#d_3874

Data reliability

Assessor

Stakeholders

Stakeholders

Function : Thermal consultancy agency

Oliver Style, ProGETIC SCP

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Function : Construction company

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Function : Other consultancy agency

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<http://www.energiehaus.es/>

Contracting method

Maximum Guaranteed Price

Owner approach of sustainability

The owners wanted to a home where natural materials (such as timber and straw), comfort and energy efficiency were given priority over architectural design and floor area

Architectural description

Simple and elegant, with a compact design and larch cladding finish that will weather over time.

Building users opinion

The users are satisfied with the thermal comfort and energy efficiency of the home. Recently outdoor temperatures where reaching -3°C, with indoor temperaturass remaining above 20°C without active heating. They report that it is quiet and comfortable. Monitoring is planned to fully evaluate the thermal performance and air quality of the home.

Energy

Energy consumption

Primary energy need : 96,00 kWhpe/m².year

Primary energy need for standard building :284,00 kWhpe/m².year

Calculation method : Primary energy needs

Final Energy : 55,00 kWhfe/m².year

Breakdown for energy consumption :

Space heating: 15 kWh/m²aHot tap water [DHW]: 7 kWh/m²aElectricity: 21 kWh/m²a

More information :

We are currently preparing operational energy consumption and indoor climate conditions monitoring. Informal qualitative feedback from the owners shows that they use the electric radiators in the ground floor bedrooms during approximately 30 minutes in the evening and morning on the coldest days/nights to maintain comfort.

Envelope performance

Envelope U-Value : 0,21 W.m⁻².K⁻¹

More information :

Prefabricated structural timber system with straw bale infill insulation. Timber is thermally broken with cork insulation on the outside of the thermal envelope, positioned behind the wood fibre breather board and ventilated larch rain screen cladding void.

Cold bridges are avoided or reduced with analysis and modelling the design phase. Prefabrication allows for the installation of most of the air-tight layer and window frames, prior to on-site assembly, providing a speed and quality in the build phase.

Straw bales are 1200mm x 700mm x 400mm, positioned vertically in the timber frame super structure of the walls, with predominant fibre direction perpendicular to heat flow. Two straw bale roof cassettes with the bales positioned in the same direction as the walls provide a thermally efficient roofing system. Despite not meeting our environmental criteria, we decided that the most cost effective and thermally efficient solution for the floor slab was rigid polystyrene under the slab with perimeter insulation around the edge of the slab.

Triple glazing with two low-e coatings, argon gas filling and TGI warm spacers sitting in soft-wood timber frames thermally broken with cork reduces heat loss in winter and heat ingress in summer through openings.

We reached an impressive 0.32/h air change rate @50Pa on the first air-tightness test.

Fermacell plasterboard provides the final dry-lining finish, closing a 35mm service void behind. While providing limited thermal mass, the plasterboard was required by Spanish Building Regulations for fire protection. Gravel infill on the intermediate floor adds some thermal inertia, although with the air-tightness and thermal insulation specification, combined with careful opening size and orientation (modelled and tested in the design phase), the building's thermal mass was considered sufficient to maintain comfort with natural summer ventilation. Given the altitude, peak summer temperatures are lower than coastal Mediterranean regions, averaging 20°C in July and August. We're keen to see the building's summer performance, given frequent concerns in the low-energy building sector that super-insulated air tight buildings have a higher tendency of overheating.

Building Compactness Coefficient : 0,34

Indicator : n50

Air Tightness Value : 0,32

Renewables & systems

Systems

Heating system :

- Electric radiator
- Others

Hot water system :

- Heat pump

Cooling system :

- No cooling system

Ventilation system :

- Double flow heat exchanger

Renewable systems :

- Other, specify

Renewable energy production : 22,00 %

Environment

GHG emissions

GHG in use :25,00 KgCO₂/m²/year

Methodology used :

PHPP 7

Building lifetime : 100,00 year(s)

Indoor Air quality

Good indoor air quality is achieved by using non-toxic natural materials, with whole-house ducted heat recovery ventilation during the winter, consisting of a Zehnder ComfoAir 350 Luxe PHI certified unit with sensible heat recovery, distribution in HDPE 90 mm pipes, complete F7 and

G4 filters.

Natural single-sided, cross and stack ventilation is used in the spring, summer, and autumn months, according to outdoor air temperature, operated by users.

Products

Product

Zehnder ComfoAir 350

Zehnder

info@zehnder.es

<http://www.zehnder.es/>

Product category : Climatització / Ventilación, refrigeración

PHI Certified heat recovery ventilation unit with heat recovery efficiency of 90%

Comfort ventilation up to 370 m³/h

Low power consumption with DC motors

Automatic 100% summer bypass

Frost protection function: efficient even at low temperatures

Optional integrated preheater and humidity control

Wireless remote control and filter replacement indicator



Theodoor 300 PLUS

Theodoor

georenova@georenova.com

<http://www.georenova.com/>

Product category : Climatització / Calefacción, agua caliente

Thermodynamic compact air-source heat pump for hot tap water [DHW]300 litre capacity0.88 electrical : 3.6 kW thermal COP = 3.75 @ air 15°C / water 45°C



Costs

Energy bill

Forecasted energy bill/year : 350,00 €

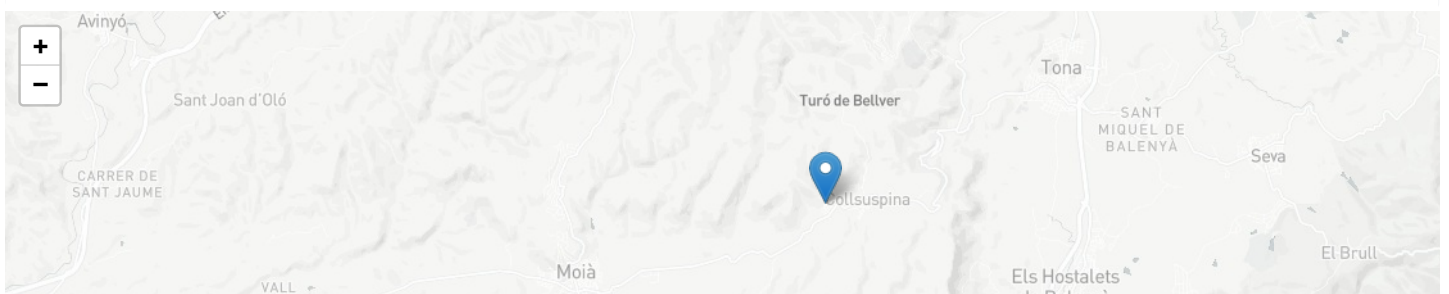
Land plot area

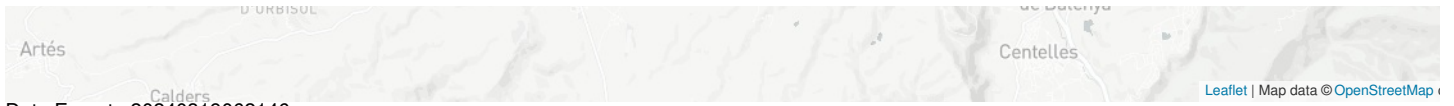
Land plot area : 442,00 m²

Built-up area

Built-up area : 135,00 %

Contest





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