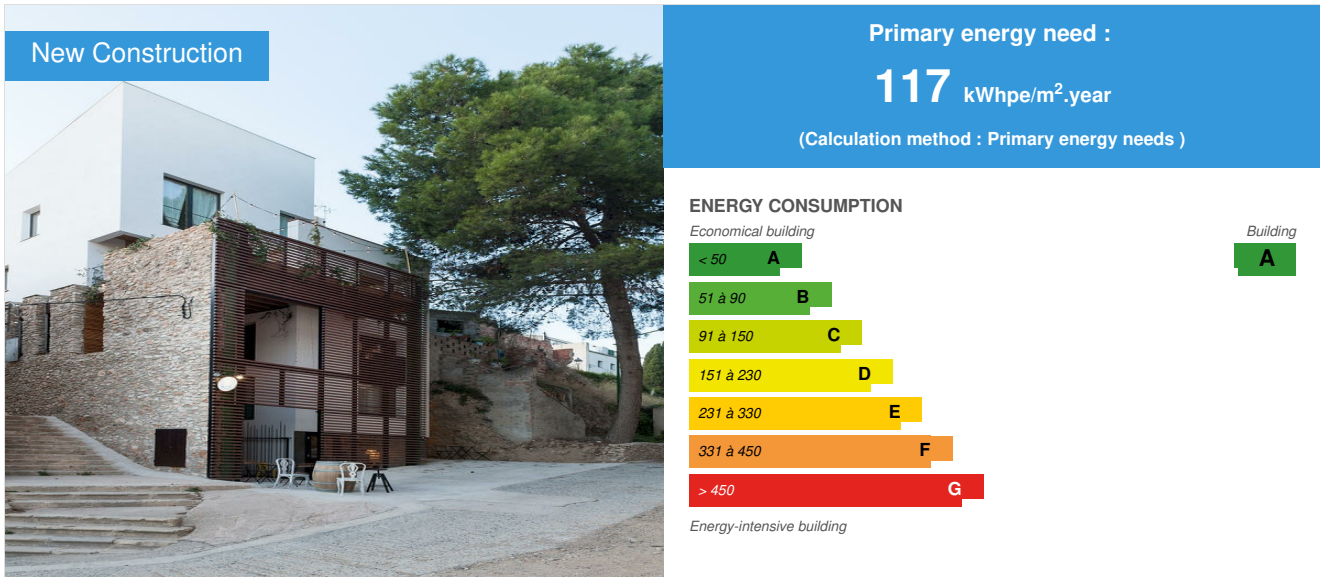


## Casa del Castell (Castle House): Efficient Hotel

by Oliver Style / 2016-06-06 09:27:26 / España / 11206 / ES



**Building Type** : Hotel, boarding house

**Construction Year** : 2014

**Delivery year** : 2015

**Address 1 - street** : Calle Calvari 2-4 43740 MORA D'EBRE, España

**Climate zone** : [Csa] Interior Mediterranean - Mild with dry, hot summer.

**Net Floor Area** : 304 m<sup>2</sup> Superficie útil

**Construction/refurbishment cost** : 364 800 €

**Cost/m<sup>2</sup>** : 1200 €/m<sup>2</sup>

### General information

La Casa del Castell is the first hotel designed and built according the Passivhaus standard in Catalonia, currently in the process of certification. Located in Mora d'Ebre, Tarragona, Spain, the Hotel offers four bedrooms in an area rich in history, with impressive wine growing and gastronomic treasures in the nearby Montsant and Priorat regions. This pioneering building is constructed with two different systems: cellular concrete on the bottom 2 floors, and light weight timber on the top 3 floors.

The hotel is located in the historic center of Mora d'Ebre, in front of the medieval castle. With an internal floor area of 304.4 m<sup>2</sup> over 5 floors, the two existing buildings on site were demolished to allow for the construction of the new hotel. The building was designed with a sensitive approach, so as to blend harmoniously with the surroundings of the old town.

In terms of layout, the strategy is based on two structural bays separated by a central vertical core formed by a low-power hydraulic lift and linear stairs. The vertical plane is divided into two different building systems: the lower 2 floors with a system of cellular concrete blocks and external XPS insulation, while the upper 3 floors are built with a lightweight prefabricated timber system with wood fibre insulation.

To ensure good air quality with minimal heat loss, a balanced mechanical ventilation system with heat recovery has been installed, providing fresh air, fully filtered and at a comfortable temperature. By continually renewing indoor air, levels of CO<sub>2</sub> and volatile organic compounds (VOCs) are kept to a minimum.

Radiant heating and cooling panels on the walls meet the near zero energy demand during summer and winter. The thermal envelope was carefully designed to reduce heat loss in the winter and minimise heat gains in the summer: thermal bridges have been reduced and/or avoided, and windows with thermally efficient timber frames and low-e double glazing were installed to ensure minimal heat loss and high levels of airtightness. External shading devices reduce solar heat gains, with a ventilated façade on the upper floors and ventilated roof. Natural night ventilation through tilt-and-turn windows provides free cooling in the summer,

in combination with the automatic summer bypass function of the mechanical ventilation with heat recovery system.

## See more details about this project

<http://www.casadelcastell.com>

## Data reliability

Assessor

## Stakeholders

### Stakeholders

Function : Designer

Èlia Vaqué, Arquitectura Sostenible

elia@eliavaque.com

<http://www.eliavaque.com>

Function : Construction company

Progetic

progetic@progetic.com

<http://www.progetic.com>

Project execution of thermal installations, DHW heating, mechanical ventilation double flow, automation, plumbing; thermo-dynamic simulation and analysis of overheating

Function : Structures calculist

mp3 Arquitectura i Estructura

mp3@mp3web.cat

<http://www.mp3web.cat>

Function : Others

Zehnder Group Ibérica Indoor Climate, S.A.

info.es@zehndergroup.com

<http://www.zehnder.es>

## Contracting method

General Contractor

## Owner approach of sustainability

La Casa del Castell has been designed and built according the Passivhaus standard, and is currently in the process of certification. The standard prioritises thermal comfort and a drastic reduction in energy demands, through high levels of thermal insulation, reduced thermal bridges, and minimal air leakage, meaning cold spots and draughts are kept to a minimum. As far as possible, materials with a low environmental impact have been chosen, including cellular concrete, timber, wood fibre insulation and timber boards.

## Architectural description

The hotel has an internal floor area of 304.4 m<sup>2</sup> over 5 floors. The two existing buildings on site were demolished to allow for the construction of the new hotel. The building was designed with a sensitive approach to blend harmoniously with the surroundings of the old town. In terms of layout, the strategy is based on two structural bays separated by a central vertical core formed by a low-power hydraulic lift and linear stairs. The vertical plane is divided in two different building systems: the lower 2 floors with a system of cellular concrete blocks and external XPS insulation, while the upper 3 floors are built with a lightweight prefabricated timber system with wood fiber insulation.

## Energy

### Energy consumption

Primary energy need : 117,00 kWhpe/m<sup>2</sup>.year

Primary energy need for standard building : 284,00 kWhpe/m<sup>2</sup>.year

Calculation method : Primary energy needs

CEEB : 0.0005

Final Energy : 45,00 kWhfe/m<sup>2</sup>.year

Breakdown for energy consumption :

Space heating: 8.1 kWh/m<sup>2</sup>/y

Space cooling: 6.6 kWh/m<sup>2</sup>/y

Domestic Hot Water (DHW): 11.2 kWh/m<sup>2</sup>/y

More information :

Calculated with the PHPP tool.

## Envelope performance

Envelope U-Value : 0,21 W.m<sup>-2</sup>.K<sup>-1</sup>

More information :

The upper two floors of the building are constructed with a light timber prefabricated system, finished with a continuous façade of white silicate mortar and a ventilated façade of larch wood. Build-up is as follows:

In > Out

- 15 mm OSB 4 with vapour barrier [air-tight layer]
- 180 mm cellulose insulation between timber joists
- 40 mm Diffutherm insulation
- 4 mm white silicate mortar

The lower two floors are built with a system of cellular concrete blocks and external XPS insulation. Build-up is as follows:

In > Out

- 15 mm gypsum plaster
- 250 mm cellular concrete Ytong 400kg/m<sup>3</sup>
- 80 mm XPS insulation
- 4 mm white silicate mortar

On the lower two floors, the airtight layer is the plaster coating, while on the upper floors with timber structure it is the OSB board. The union of this two systems is made with an air tight membrane, placed behind the OSB board. The windows frames mixed pine - aluminum, with a thermal transmittance of U<sub>f</sub>=1.00 W/m<sup>2</sup>K.

Glazing is double, 4-16a-6, low-emissivity, 10% air – 90% argon, with a thermal transmittance of U<sub>g</sub>=1.00 W/m<sup>2</sup>K. The average installed thermal transmittance of U<sub>w</sub>=1.25 W/m<sup>2</sup>K.

Building Compactness Coefficient : 0,65

Indicator : n50

Air Tightness Value : 1,00

## Renewables & systems

### Systems

Heating system :

- Heat pump
- Radiant ceiling

Hot water system :

- Heat pump

Cooling system :

- Reversible heat pump
- Radiant ceiling

Ventilation system :

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

Renewable systems :

- Heat pump

## GHG emissions

GHG in use : 30,60 KgCO<sub>2</sub>/m<sup>2</sup>/year

Methodology used :

PHPP 8 with GEMIS CO<sub>2</sub> emissions data

Building lifetime : 100,00 year(s)

## Indoor Air quality

It is guaranteed by using non-toxic, natural and renewable materials, together with a mechanical ventilation system with heat recovery which supplies external 100% fresh air pre-heated by the extracted air.

## Comfort

**Health & comfort :** Thermal comfort is provided through high levels of thermal insulation, reduced thermal bridges, and minimal air leakage, meaning cold spots and draughts are kept to a minimum.

## Products

### Product

Heat pump Rotex HPSU compact 8 kW

Daikin

marketing@daikin.es

<http://www.daikin.es>

Product category : Climatización / Calefacción, agua caliente

Integrated compact unit that produces domestic hot water by using the energy stored in ambient air.

Unit is working well.



Biomass stove Rika, Vitra Passivhaus

Rika

info@rika.es

<http://www.rika.at/es>

Product category : Climatización / Calefacción, agua caliente

Stove adapted to the low heat demand for passive houses, completely independent of room air.

Unit working as expected.



Zehnder ComfoAir 550

Zehnder Group Ibérica Indoor Climate, S.A.

info@zehnder.es

<http://www.zehnder.es>

Product category : Climatización / Ventilación, refrigeración

Ventilation unit certified by the Passivhaus Institute. It provides comfort ventilation until 550 m<sup>3</sup>/h with automatic bypass in summer. Heat recovery with a performance up to a 95%. Efficient electronically commuted DC motors.

Unit working as expected.



Zehnder ComfoDew 500

Zehnder Group Ibérica Indoor Climate, S.A.

info@zehnder.es

<http://www.zehnder.es>

Product category : Climatización / Ventilación, refrigeración

Component installed in the ventilation system which controls the levels of humidity in the supply air, keeping it below the dew point when the radiant panels are working in cooling mode, avoiding condensation on the surface of the panels.

Unit working as expected.



Zehnder NIC 300

Zehnder Gourp Ibérica Indoor Climate, S.A.

info@zehnder.es

<http://www.zehnder.es>

Product category : Climatización / Calefacción, agua caliente

Plasterboard with polystyrene insulation, with an embedded water circuit circulating hot and cold water for heating/cooling, providing silent, low temperature, high comfort and efficient heating and cooling.

Unit working as expected.



## Costs

### Construction and exploitation costs

Total cost of the building : 364 800 €

## Urban environment

Móra d'Ebre is the capital of the county of the Ribera d'Ebre in Catalonia, Spain. Situated on the banks of the Ebre river, it is served by the N-420 road to Reus and Gandesa, and the N-230 road to Lleida. The railway line between Tarragona and Saragossa runs along the left bank of the river, with a station at Móra la Nova opposite the urban centre of Móra d'Ebre. The hotel is located in the old town of Mora d'Ebre, in a square that was formed by three buildings in front of the castle. The site is on consolidated urban soil, previously with two buildings in a state of ruin and pending demolition. The third building is located on the north side of the plot. The corner plot has 134 m<sup>2</sup> and an irregular shape resulting from the union of the two plots mentioned.

## Land plot area

Land plot area : 134,00 m<sup>2</sup>

## Building Environmental Quality

### Building Environmental Quality

- indoor air quality and health
- energy efficiency

## Contest

### Building candidate in the category



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