The BOLEA/QUEMENER Passivhaus project started in July 2014, with the architectural conception and PHPP thermal study.

The works for this wood frame building began in January 2015 and were achieved in February 2016, followed by the measurement of the ventilation flow rate.

The Passivhaus certification process was engaged after a while, in March 2017. The certification for the house occurred in July 2017.

Our studies and advices allowed to improve the house performance and comfort, especially concerning:

- The thermal envelope (choice for insulating elements and windows, thermal bridges optimisation, solar gains optimisation, solar protections, airtightness treatment, ...)
- The ventilation system (choice for equipment, sizing of air flow rate, acoustic designing, ...)
- The heating system (heat power, choice for equipment, ...)

KEY FEATURES

Two storey wood frame construction with an unheated annex (outside the thermal envelope, on the North side), solar thermal panels for hot water:

<table>
<thead>
<tr>
<th>Type</th>
<th>U-value</th>
<th>PHPP space heat demand</th>
<th>PHPP Primary energy demand</th>
<th>Pressure test $n_{50}$</th>
<th>Heat recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-value external walls</td>
<td>0.143 W/m².K</td>
<td>12.70 kWh/m².year</td>
<td>93 kWh/m².year</td>
<td>0.29</td>
<td>83.4%</td>
</tr>
<tr>
<td>U-value floor</td>
<td>0.174 W/m².K</td>
<td>PHPP Primary energy demand</td>
<td>93 kWh/m².year</td>
<td>Pressure test $n_{50}$</td>
<td>0.29</td>
</tr>
<tr>
<td>U-value roof</td>
<td>0.087 W/m².K</td>
<td>Heat recovery</td>
<td>83.4%</td>
<td>0.29</td>
<td>83.4%</td>
</tr>
<tr>
<td>U-value window</td>
<td>0.85 W/m².K</td>
<td>PHPP space heat demand</td>
<td>12.70 kWh/m².year</td>
<td>Heat recovery</td>
<td>83.4%</td>
</tr>
</tbody>
</table>
BRIEF PROJECT DESCRIPTION

The BOLEA/QUEMENER Passivhaus is a four-bedroom 139 m² detached dwelling which was conceived for private clients, who wanted to build for themselves and their children an energy efficient home.

Their choice for a wooden frame structure was motivated by their research for an environmental friendly construction, with the lowest grey energy.

On the site, the building replaced an ancient house, which was demolished.

INNER VIEWS
ELEVATIONS

East
South
CONSTRUCTION DETAILS

Ground floor details

To help minimise thermal bridge, an insulating block was inserted along the side of the concrete slab (circled in red).

Intermediate floor details

The wooden ledger (circled in red) connects the intermediate floor with the walls (and his thermal bridge is reduced thanks to the outer insulating board), meanwhile it allows a continuous inner “skin” (Durelis panel), which is important to ensure an excellent airtightness.

Partition/dividing walls and connections to other elements

There are no partition walls, only light dividing walls. They don’t interrupt the external wall insulating elements and are fixed to the concrete slab at ground floor. Therefore, there are no thermal bridges.

Roof section
These connections were the result of a cooperative work with the carpenter: the goal was to reduce the thermal bridges.

Windows
Again, a collaborative work with the carpenter (who had the task to install the windows during the works) resulted in efficient details, with reduced thermal bridges and optimised solar gains.

The windows were made by Menuiseries ANDRE company, the model is called Smartwin Classic and is PHI certified:
Concerning the glazing, it is a Glaströsch Silverstar on every window, with the following characteristics:

- $U_g = 0.639 \text{ W/m}^2\text{K}$
- g-value = 63.13%
AIRTIGHTNESS STRATEGY & AIR TEST RESULT

We used a continuous set of Durelis Vapourblock panels (see details above), a specially treated wooden panel with excellent airtightness, to ensure that no air leaks could occur through external walls and roof. These panels were connected with a special adhesive and also with the ground slab.

Moreover, every element (ducts, sleeves, ...) that crosses the heated envelope was treated with a special weldable pipe grommet.

The result is very efficient:

<table>
<thead>
<tr>
<th>n50</th>
<th>0.29 h⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q₄Pa-surf</td>
<td>0.05 m³/(h.m²)</td>
</tr>
</tbody>
</table>

VENTILATION STRATEGY

A HELIOS KWL EC 270 unit was installed in the annex (due to limitation of space and noise reduction), very close to the external wall (see photos), so that the pipes are very short lengthened before penetrating the heated envelope.

The ducting system and noise dampers were installed in the heated envelope.

The unit is equipped with a pre-heating battery, to avoid freezing of the heat exchanger.
HEATING STRATEGY

With the same objective of reducing environmental impact, our clients opted for a wood stove (CONTURA C 850W, 4 kW heating power and airtightness tested), with a complementary heating system in the bathrooms (electric radiators).

The heating need for this house was calculated in PHPP as being 11.7 W/m² when the outside temperature is minus 7.2 degrees Celsius, which means a total demand of 1622 W.

VERIFICATION

EXPERIENCE

The house has now been occupied for two years, and feedback from occupants has been very positive.

COSTS

The final cost of the project was not compiled by the client.