Restoration of San Cristobal House

by Maixi Maruri San Vicente / 2013-01-18 00:00:00 / España / 7898 / ES

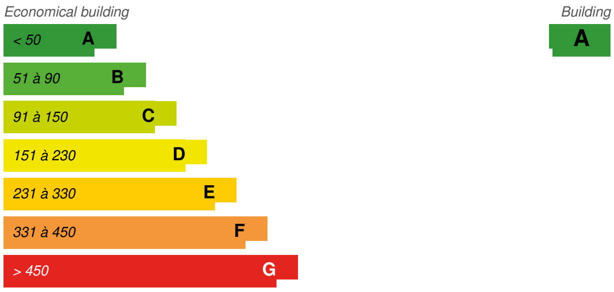
Primary energy need :

23.2 kWhpe/m^2.year

(Calculation method : RD: 47/2007)

ENERGY CONSUMPTION

Economical building



Energy-intensive building

Building Type : Collective housing > 50m
Construction Year : 2012
Delivery year :
Address 1 - street : El Baular, nº 14 48860 ZALLA, España
Climate zone : [Csa] Interior Mediterranean - Mild with dry, hot summer.

Net Floor Area : 546 m^2 Superficie útil
Construction/refurbishment cost : 604 603 €
Cost/m2 : 1107.33 €/m^2

General information

The project is about making use of an abandoned ancestral palace from the XVIII Century, consisting of three floors and an attic, which was in a fairly bad state both inside and out.

Given the dimensions of the building, the option proposed was to restore the building and convert it into four two-bedroom flats and two duplexes that connect the second floor and the attic.

In terms of architecture, the perimeter load-bearing walls and the original openings have been maintained and others that were blocked up have been recovered. The roof has also been refurbished in laminated timber.

The design pays special attention to all aspects of energy efficiency. In short, the following points should be noted:

-**Passive design**: reinforced thermal insulation in the enclosure, high quality exterior joinery, interior thermal mass and cross ventilation.

One of the *innovative* elements of this project is the installation of "free heating" in the cold months, using the excess energy acquired by the solar collectors, and that by bypassing the electric meter (with a three-way valve) produces free heating by means of underfloor heating. To do so, 12 solar collectors were placed in a south-facing position with an angle greater than 45º so that the sun's rays strike them as close to perpendicular as possible in the months that the sun is at its lowest. They are arranged in banks of three units that automatically connect and disconnect (self-draining) depending on the requirements of the building, so that in the summer months it is not heated excessively.

-**Active design**: heating based on the use of renewable energy for collective use, in this case geothermal energy with a geothermal heat pump and an installation of solar collectors to produce domestic hot water and heating, each with its accumulation tank, that work jointly with a buffer tank of 1 500 l and heat exchanger panels.

The technical characteristics of the geothermal heat pump used in this restoration are a consumption of 6.8 kW and a coefficient of performance (COP) of 4.4. This installation is completed with four wells to a depth of 125/130 m.

Heating is provided by means of latest-generation underfloor systems, which also provides significant economic savings. In addition, each home has a chimney for installing pellet stoves that can provide 7 kW and above.

With the application of this set of measures, they have obtained energy classification "A".

Data reliability

3rd part certified

https://www.construction21.org/espana/data/sources/users/710/sistema-de-equipos-premontados-alb.docx

Stakeholders

Stakeholders

Function : Facility manager

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Owner approach of sustainability

It was clear to the developer from the start that energy savings were a fundamental part to be taken into account when developing the project and therefore a commitment to respecting the environment was vital. New passive heating systems have been applied jointly, with no additional economic costs for the future owners of the homes, as have other innovative systems to reduce energy consumption as much as possible.

Architectural description

Basically the architectonic attitude present in this project was to observe, as far as possible, the most representative elements of the building, such as using timber for the roof, replicating the original. Nothing in the interior could be preserved as it was completely ruined and had no architectonic value.

If you had to do it again?

We would probably have had to opt for a new structural system, e.g. CLT (Cross Laminated Timber)

Energy

Energy consumption

Primary energy need : 23,20 kWhpe/m^2.year

Primary energy need for standard building : 129,80 kWhpe/m^2.year

Calculation method : RD: 47/2007

Final Energy : 10,40 kWhfe/m^2.year

Breakdown for energy consumption :

Target building: - Final energy consumption (kWh): 10.4/m2 and 4 261/year
- Primary energy consumption (kWh): 23.2/m2 and 9 517.8/year
- CO2 emissions (kgCO2): 5.7/m2 and 2 336.3/year

Envelope performance

Envelope U-Value : 0,39 $W.m^{-2}.K^{-1}$

More information :

Regarding the envelope, it is important to note that the greatest effect has been in the care taken in the execution of the roof, using the same materials that were originally used and paying special attention to its insulation, obtaining U= 0.24 W/m2k.

Building Compactness Coefficient : 1,00

Indicator : HE1 BD

Air Tightness Value : 27,00

Renewables & systems

Systems

Heating system :

- Low temperature floor heating

Hot water system :

- Heat pump
- Solar Thermal

Cooling system :

- No cooling system

Ventilation system :

- Natural ventilation

Renewable systems :

- Solar Thermal
- Heat pump on geothermal pile

Renewable energy production : 100,00 %

Smart Building

BMS :

The only smart management systems are for energy: free heating and automatic disconnection of the solar collectors

Environment

GHG emissions

GHG in use : 5,70 $KgCO_2/m^2/year$

Methodology used :

Although it was a restoration, CALENER VyP was used as its initial state meant it was considered a ruin.

Building lifetime : 40,00 year(s)

Water management

Consumption from water network : 64,00 m^3

Indoor Air quality

The air quality installation complies with the requirements established in the Technical Building Code.

Products

Product

Drain Back

VAILLANT

HTTP://www.vaillant.es

Product category : Climatización / Calefacción, agua caliente

Problems with excessive temperatures. Drain back system

As we have already mentioned, another of the major problems related to thermal solar power installations are the extreme conditions that can occur in summer.

When a thermal solar power installation is designed, an estimate must be made of the excess energy in the more favourable months, so the extreme conditions in the primary circuit due to an excess of this surplus energy are not reached.

The problem of excess surplus energy compared to what was initially calculated may be due to various causes such as a lower consumption than anticipated in the most favourable months, usually due to going away on holidays; erroneous initial climate information; variations in the extreme conditions anticipated initially, etc. This excess energy is generally converted into an increase in temperature of the fluid in the primary circuit and, consequently, as it is a closed circuit, an increase in the pressure.

Generally, the temperature increase in the circuit is not usually the main problem, provided it is functioning with materials that are able to work at high temperatures. The problem is usually the increase in the circuit pressure, because when the limits of the safety elements are reached, they make the circuit lose antifreeze and, consequently, the performance of the installation. There is even the risk of breakage of elements in the circuit such as the pumps due to working at no load.

In a drain-back system (auroSTEP), as it works with air in addition to a mixture of antifreeze and water, when the installation is stopped, due to the difference in weight, the air tends to go to the highest part of the installation and consequently into the collectors. As the solar collectors reach high temperatures, the problem of excess pressure does not occur in the pressurised systems as the air is compressed and, consequently, none of the components of the installation suffer due to increases in pressure.

The drain-back systems therefore do not work with bleeders or expansion tanks as they do not have problems with pressure

Drain-back systems (auroSTEP) are an advance in thermal solar technology in countries such as Spain as they solve the critical problem of these installations, making them more durable, cheaper in terms of maintenance and more profitable.

I understand that is an indispensable system for achieving proper performance from the hot water production facilities using solar collectors and making the installation more durable, effective and efficient.

Underfloor heating

ALB sistemas

fsalbidegoitia@alb.es

www.alb.es

Product category : Climatización / Calefacción, agua caliente

COMPONENTS OF THE UNDERFLOOR HEATING. PRINCIPAL PROPERTIES

ACUTEC insulating panel
The ACUTEC insulating panel, manufactured in ELASTICISED NEOPOR, 25 mm thick, with a density of 25 kg/m3, guarantees the acoustic insulation of impact noise according to DB-HR Protection Against Noise and at the same time complies with the conduction resistance indicated in UNE EN 1264-4. It has a heat-diffusing aluminium surface sheet of 0.25 mm, fitted with self-adhesive tabs and a printed grid as a guide.

ALB multi-layer pipe for underfloor heating
ALB multi-layer pipe for underfloor heating, 17 x 2; composed of an inner layer of polyethylene PE-RT (DOWLEX 2388), an intermediate layer of butt-welded aluminium, 0.2 mm thick, and an outer layer of high density polyethylene (PE-HD).

Preassembled collectors with hydraulic balancing.
These consist of an input collector with balancing lockshield valves and a return collector with stopcocks (they enable direct assembly of the thermo-electric header). Branching of 24 x 19 (mm) with interchangeable bi-cone for multi-layer pipe of 17 x 2 (mm) (distance between branches: 50 mm). Includes blind plugs of 1'' M, intermediate adaptors with manual bleeder, filling/emptying valve and stopcocks with thermometer and 2-part connector with o-ring.

This whole system means that instead of using water in the heating system at a temperature of 42°C, it is used at 36°C, which implies energy savings of approximately 15%, in comparison to an underfloor heating system with plates without plugs. If in addition we compare this system with a system of underfloor heating with plugs, the savings would reach approximately 20%. This type of plate used for the floor has the following advantages:
1- It does not have plugs so the energy is transmitted throughout the perimeters of the conduit, which used with the multilayer pipe makes the work quite easy as it retains its shape and is easy to manipulate.
2- In the upper part there is a layer of aluminium, which reflects all the energy and results in a very uniform heat radiation throughout the whole surface.
3- It provides an anti-impact layer so we save on labour and materials in addition to guaranteeing compliance with the DB-HR.

I understand that right now this underfloor heating, due to its properties, is the most efficient.

Urban environment

The plot is urban, but it is not within the nucleus of the town, although it is no more than 1 000 m away.

Land plot area

Land plot area : 1 931,86 m^2

Green space

Green space : 856,77

Parking spaces

There are four covered parking spaces and another four outdoors on private land.

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