AIDA AFFIRMATIVE INTEGRATED ENERGY DESIGN ACTION

Co-funded by the Intelligent Energy Europe Programme of the European Union

EURAC research

Operational success story

House Pillon

Year of construction (2008), Caldaro (IT)

GENERAL INFORMATIONS

Owner:	Private house (number of apartment: one)
Architect:	SOLARRAUM – architecture, energy, mobility – Bolzano in collaboration with Obrist&Partner
Design office:	SOLARRAUM – architecture, energy, mobility – Bolzano
Use:	Residential building (2 adults, 4 children)
Heated surface*:	182,88 m² (gross surface) 151,8 m² (residential heated floor area) 114,1 m² Treated floor area PHPP
Gross volume*:	600,52m³
Built in:	2008/09
Cost (only construction)	255'000.00 € 1'075.00 €/m²

*referring to the energy performance above (regional calculation)

ENERGY PERFORMANCE

Type of certification: *CasaClima certification (mandatory certification for Energy Demand for Heating):* 9,66 kWh/m²y standard 'Casa Clima Gold'.

*"Measured thermal energy consumption for heating (10 kWh/m²a) was lower than the calculated space heating demand (PHPP 14kWh/m²a/ CasaClima tool 11 kWh/m²a). The result confirms not only a good planning of the building, but also a good construction work. On the other side it shows a correct managing of the passive house with environmental- conscious users, who are well informed about functioning of their passive house. During the considered winter period, 81% of the electric energy was used for domestic electricity and 19% for the building equipment. The ventilation system worked well with adequate air exchanges and air velocity, what assured low CO² concentrations (90% of time <1000ppm) and good heat recovery. The hygro-thermal comfort in wintertime was evaluated as very good. Temperatures with around 22 ° C and relative humidity in the range from 30-50% confirm optimal comfort conditions."**

Primary energy: 29.90 kWh/m²a (by monitoring data)

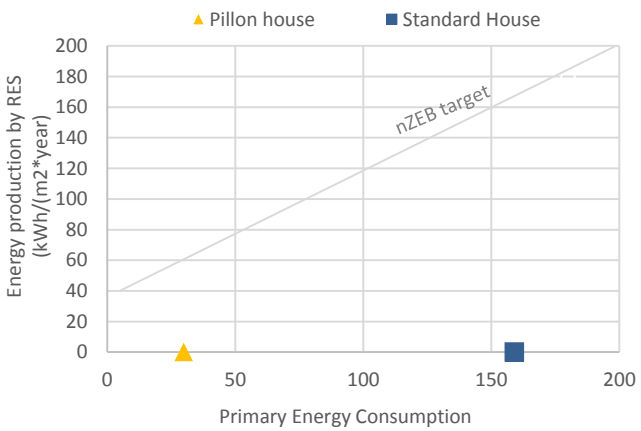

Grafico 1: Bilancio energetico annuale (Fonte: EURAC- ENERBUILD)

**Within the Enerbuild project the CasaClima Gold building Pillon" in Caldaro,in South Tyrol was monitored. The single family house was monitored in detail with fixed installed monitoring instruments in a long-term monitoring-campaign. The analysed period is the winter period from October 2010 to April 2011. (Source: H. Mahlknecht, D. Exner, R. Lollini. ENERBUILD - Part B: Analysis of the monitoring data of Passive House "Pillon – Caldaro – Kaltern" Winter report 2011-2012. Eurac research, Institute for Renewable Energy).*

House Pillon

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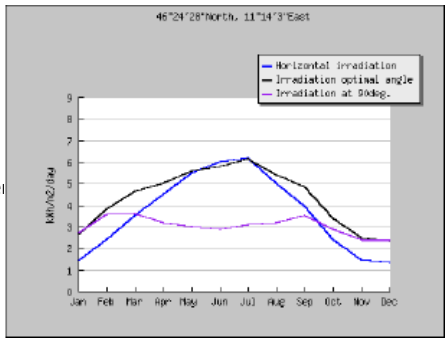
DESCRIPTION OF THE CLIMATE:

Address:	Caldaro Sulla Strada del Vino, Alto Adige, Italy.
GPS:	Latitude = 46.408, Longitude =11.235
Altitude:	510 m
Yearly solar radiation: (http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php)	3,03 kWh/m²*day (Average sum of horizontal global irradiation per square meter received) 1580 kWh/m² (Average sum of horizontal global irradiation per square meter received)
HDD20 (http://www.degreedays.net/):	HDD_{20}= 3131 Bolzano, IT (11.33E,46.46N)
CDD26 (http://www.degreedays.net/):	CDD_{26}= 106 Bolzano, IT (11.33E,46.46N)
HDD20, Italian Classification: (Italian law: n. 412 26/August/1993)	HDD20= 3074 Caldaro, IT (46,4141; 11,2422)



SPECIFICATIONS OF THE BUILDING

1) Building Envelope

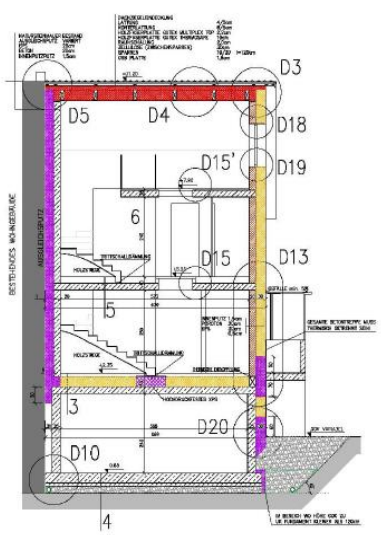
The building was built with passive house standard and certified with the local standard of energy consumption „CasaClima Oro", which means a heating demand in relation to net area of 9.66 kWh/(m²a).

S/V: 0, 56/m

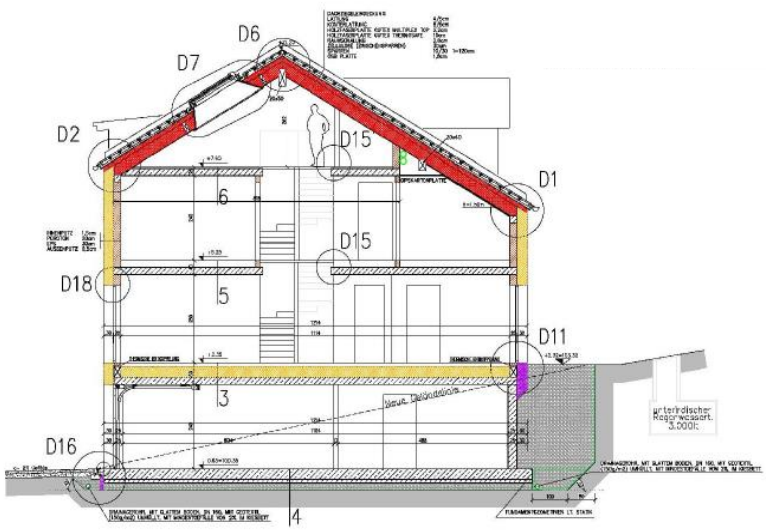
U-value of the surfaces:

- Walls: U-value: 0,092 W/m²K
  The construction method is brick wall with a thermal insulation composite system – the exterior walls are built of 20 cm "Poroton" bricks with "EPS" insulation of 30 cm
- Roof: U-value: 0,103 W/(m²K
  The wooden roof is built of wooden rafters of 10/30 cm (distance 1,20 m) plus 30 cm cellulose insulation in the space between and a wood fiberboard on the outside of 12,2 cm
- Basement: U-value: 0,097 W/(m²K)
  The ceiling above the basement consists of "EPS" insulation of 30 cm plus the reinforced concrete floor of 30 cm plus the usual floor construction
- Windows: Triple glazing Uw-value: 0,76 W/(m²K).
  - g-value: 0.52-0.45
  - Ug: 0.50 W/(m²K)
  - Uf: 0.95-1.30 W/(m²K)

Blower Door: 0.2h^{-1} measured air tightness



Sezione trasversale
(fonte:Enerbuild, Action 5.4, Part.A)



Sezione longitudinale
(fonte:Enerbuild, Action 5.4, Part.A)

2) Building systems

Heating system

Compact unit "aerosmart xls" with a geothermal heat pump (surface collector in the underground 120 running meter), floor heating, in parts air heating by the ventilation system

Heat pump: compact machine

The heat pump covers the following three functions: hot domestic water, space heating by means of supply air and space heating by means of low temperature floor heating circuit (about 3kW). The compact unit contains a balanced ventilation system with heat recovery. Technical data compact unit:

- Air quantity 80 - 235 m³/h
- Nominal air quantity 160 m³/h
- Nominal output 2700 W
- Heat recovery efficiency 85 – 93%

Domestic hot water

The steel hot water storage tank has a capacity of 200 liter. The EPS-insulation minimizes the heat losses. The heat transfer from the heat pump is carried out by a double wall condenser. It is also integrated a sacrificial anode and an electric heating element with 2 kW.

Ventilation system

The ventilation units are with constant volume flow DC ventilators with a high efficiency.
Heat recovery: to recover the heat from the exhaust air a counter flow plate heat exchanger is used. The fins are out of aluminium with a thickness of 0,1 mm. The container is also out of aluminium.
The ventilators can be controlled regulated at 4 levels:

- Ventilation level 0: Ventilation switched-off
- Ventilation level 1: Lowered air quantity (Level 2 – 30%)
- Ventilation level 2: Nominal air quantity (160 m³/h)
- Ventilation level 3: Increased air quantity (Level 2 + 30%).

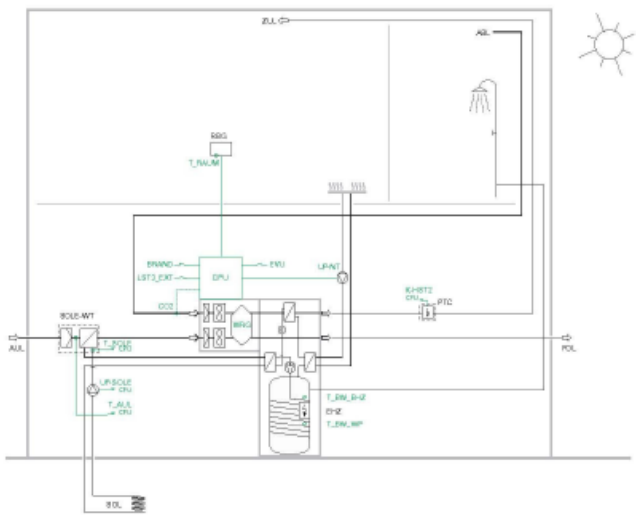
The regulation of ventilation levels can be effected manually or automatically. In automatic mode the ventilation levels are regulated by a time switch or by a CO2 depending regulation. For every day of the week an individual automatic programme is possible. The changing from summer- to wintertime is done automatically. To adapt the system on the building and to balance differences in the channels the nominal air quantity can be adjusted separately in the supply air and exhaust air channels.

Geothermal heat pump (air-brine)

120 running meter surface collector in the underground (-1,8 m) of the backyard.

Renewable energy production

As both roof surfaces of the saddle roof are north-west and south-east oriented and furthermore the surface of the south-east orientated part is not so big, the building owner decided for efficiency reasons not to put any solar technology on the building at the moment.



Schema impianti termici
(fonte:Enerbuild, Action 5.4, Part.A)

House Pillon

Year of construction (2008), Caldaro (IT)

CONTEXT AND HISTORY OF THE BUILDING

2007

Phase of the project assignment

The One-family house is located in a rural area with mainly one-family buildings at the foot of the mountain range „Mendola" nearby the lake of Caldaro south of Bolzano.

Design phase

When the owners decided to build them new house they didn't have a lot of money to build it. For first, they chose the design team which must to be able to realize a design proposal characterized by an high energy performance envelope and completed of high efficiency heating system plan. For this, they decided for:

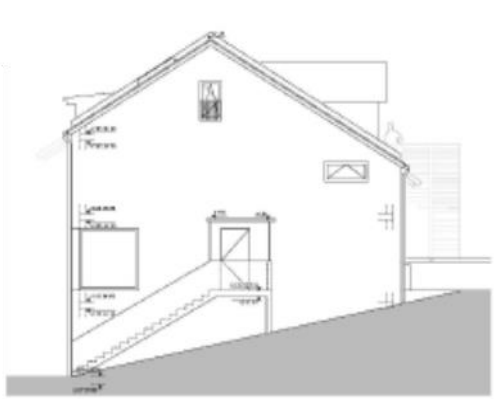
- Architectural concept: M. SC. Dr. Arch. Barbara Wörndle in collaboration with Obrist&Partner
- Energy concept: Dr. Ing. Oscar Stuffer
- Thermal plants: P.I. Ruedl Michael

The available budget of Sirs. Pillon was not very high, so they decided to invest a lot of money in the efficiency of the buildings' envelope and saving money in the interior design of the furniture.
The owners wanted to define the work team for the design and realization phases. They chose different professionals (architect, engineers, constructor…) that is get to collaborate together to realize a high energy performance building. So this, was necessary to use an Integrated energy design process and manage and control the project during the whole developing process.
The new family building was been designed such as a single building, separated to the existent unused one. For this reason the wall adjacent to the neighbor was been realized with an important thickness of insulation (26 cm of EPS panels).

2008

Construction phase

The old part of a barn from ca. 1915 was demolished and rebuilt during 2008 for residential use.



NORDOSTANSICHT M 1:50

SÜDOSTANSICHT M 1:50

2009

Utilization of the building

The building was built with passive house standard and certified with the local standard of energy consumption „CasaClima Oro", which means a heating demand in relation to net area of 9.66 kWh/(m²a). As the building is attached to the existing building with its southwest façade it has less solar gains from this side. The roof ridge of the saddle roof is therefore southwest – northeast orientated.

House Pillon

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October 2010 to April 2011

Monitoring of the House

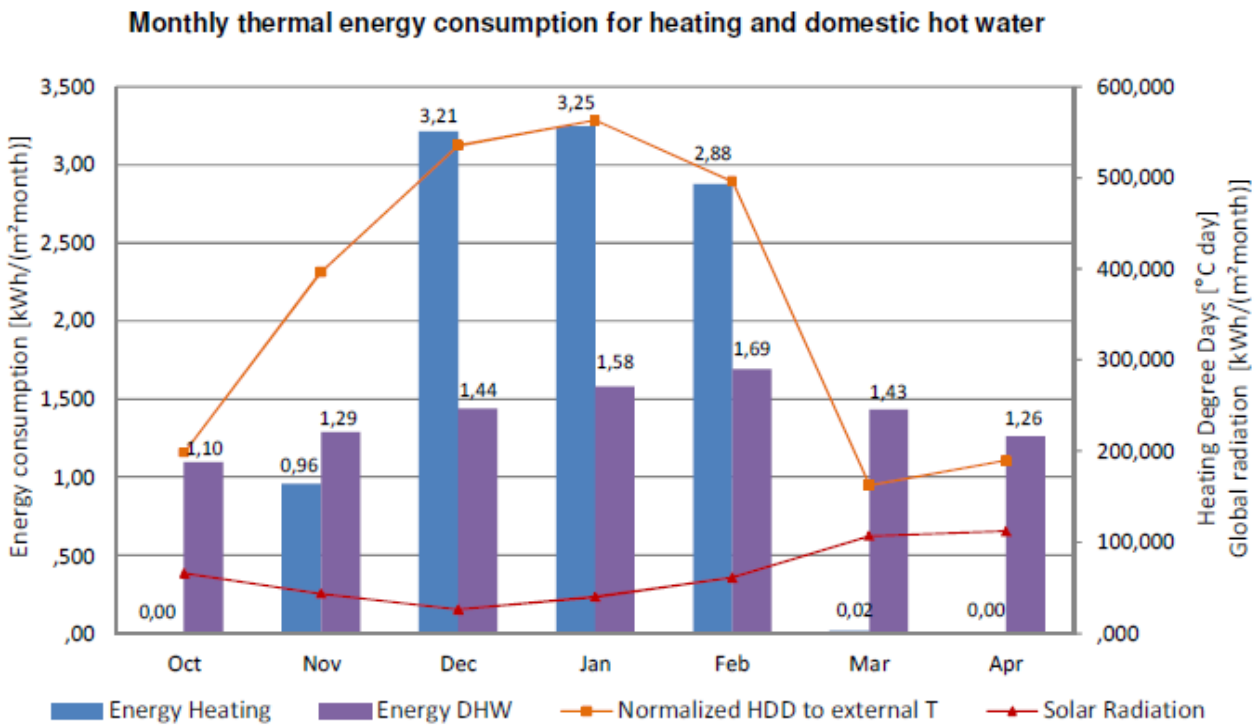
Within the Enerbuild project the CasaClima Gold building "Pillon" in Caldaro, in South Tyrol was monitored. The single family house was monitored in detail with fixed installed monitoring instruments in a long-term monitoring-campaign. Energy consumptions were measured in terms of thermal energy with the help of three heat meters for measuring the thermal energy for heating, domestic hot water and geothermal energy deployment. Electric energy consumptions were measured fore different plant consumers as electric energy of the heat pump, the circulation pump for floor heating, the circulation pump of geothermal circuit, the ventilators of the ventilation machine and the total energy consumption of the building.

For more information: H. Mahlknecht, D. Exner, R. Lollini. ENERBUILD - Part B: Analysis of the monitoring data of Passive House "Pillon – Caldaro – Kaltern" Winter report 2011-2012. Eurac research, Institute for Renewable Energy

***"Thermal energy consumption for heating was measured** with 10,3kWh/m²a. The result is lower than the energy calculation for heating established (PHPP calculation 14kWh/m²a and CasaClima calculation 11kWh/m²a). Even when taking the normalization for the real heating degree days into account the consumption is lower than the calculation. This excellent result is due to the efficient utilization of the building whit conscious users, who are well informed about functioning of their passive house.*

Thermal energy for domestic hot water preparation is quite stable during the winter period and merges from 150 kWh to 190 kWh/month (Report Winter 2010-2011 Page 23 of 25) which is a quite low consumption for a family with 5 members and therefrom three small children. The average consumption amounts to 42kWh/person/month.

***The electric energy consumption** shoed that the heat pump has the highest energy requirement of the compact machine. The heat pump reaches the maximum consumption in January with about 225 kWh/month, the other electric energy components of the plant consume about 37 kWh. In comparison to this amount the electric energy for lighting and household is a lot higher and amounts to 850 kWh/ month in average. This means that 81% of the electric energy is used for household and lighting and 19% for the building equipment."*



Graph1: Monthly Energy consumption for heating, domestic hot water, solar radiation and normalized heating degree days.

***Notes:** m² are referred to the treated floor area TFA, PHPP.*

***Comments:** Thermal energy for heating was measured with 10,3kWh/m²a (PHPP calculation 14kWh/m²a and CasaClima calculation 10 kWh/m²a). Thermal energy for domestic hot water ranges from 150 kWh to 190 kWh a month. This gives an average value of about 2000 kWh/year. The average consumption amounts to 42kWh/person/month.*