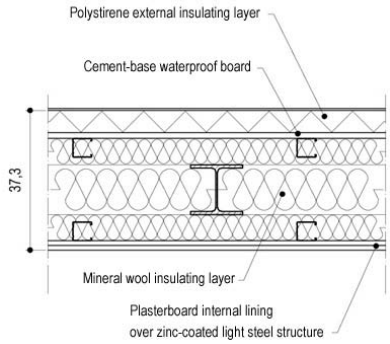
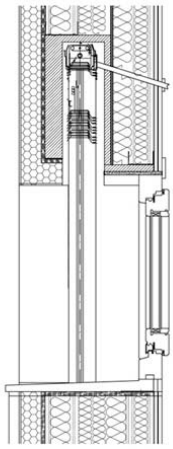
Chignolo, Italy

International Energy Agency

IEA – SCH Task 28 / ECBCS Annex 38:

Sustainable Solar Housing





The project

4-flat detached house with two 60 m^2 units (one bedroom) and two 120 m^2 units (two bedrooms). Building has two floors above ground, plus basement with storage and parking and attic floor.

The house was built by a construction company wishing to realize a demonstration building for low-energy strategies and light Str/En construction with a relatively traditional appearance.

Flats are wheelchair accessible thanks to a lift linking basement and first floor levels.

Construction period was from February 2002 to January 2003.

Objectives

The house was built with the aim of demonstrating the feasibility of an extremely low energy consumption level for winter and summer comfort in the climate of Pianura Padana.

The house complies with the German “Passivhaus” standard (15 kWh/m2 per year) for winter heating and guarantees artificial summer cooling mostly through renewable energy.

Moreover, light Structure / Envelope (Str/En) technologies were used, in order to provide high thermal and acoustical comfort, minimum energy for transport and assembly (the whole building weighs some 100 t) and possibility of final dismantling and recycling of components. This is possible by layering light and functionally specialized materials on independent sub-structures.

Marketing strategy

The house was followed, during the construction stage, by a research group of the Politecnico di Milano – Dipartimento BEST, in particular on the occasion of a PhD work. This is being followed by a monitoring campaign that will control the most critical parameters during one or more years.

The experience was made public by articles on specialized and generic reviews, books and conferences (some of them international).

Building construction

The design strategy relies on heat conservation in winter and protection from direct solar radiation in summer. The envelope is hyper-insulated and made air-tight by a continuous windproof layer in the walls, while thermal bridges were minimized by the use of a continuous, 6 cm thick thermal insulation layer outside the perimeter walls.

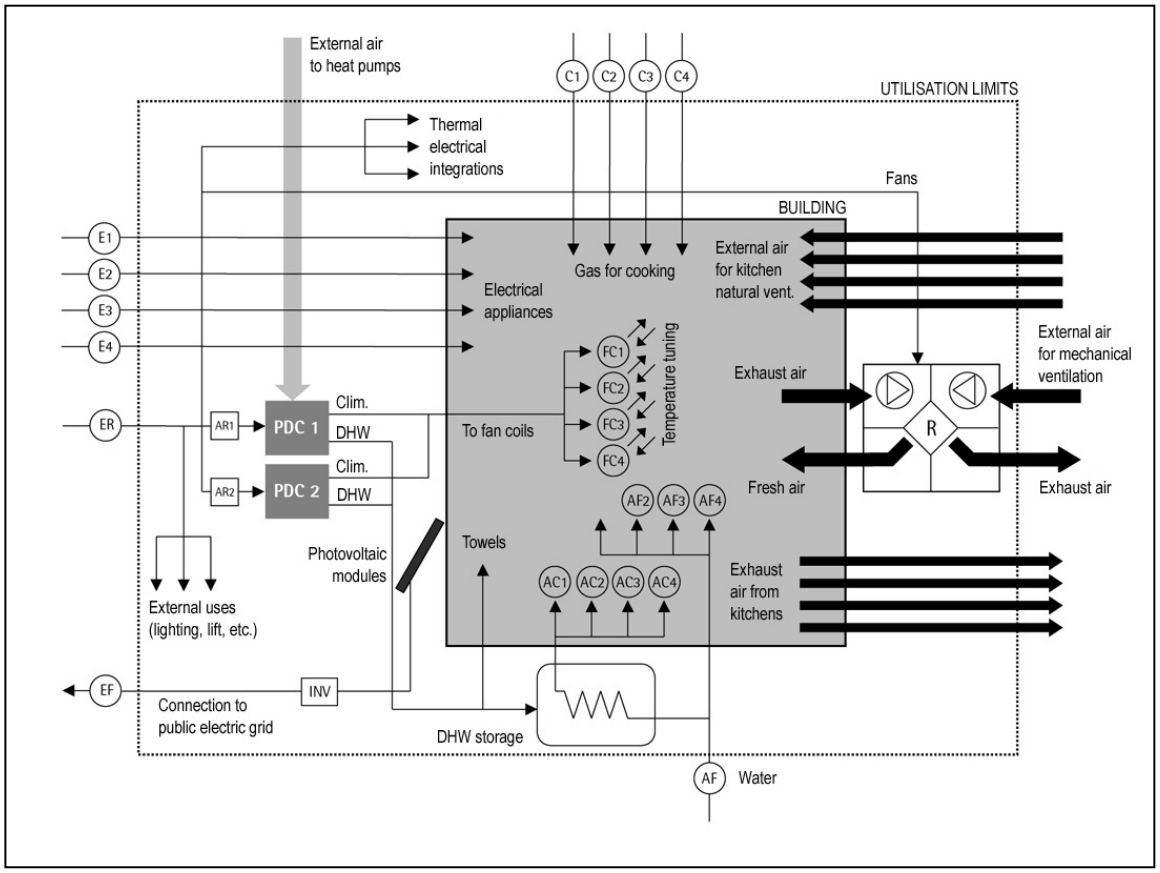
As concerns summer, the windows are smaller than is the norm in Central European countries and they are all equipped with solar control devices (aluminum Venetian blinds). South-facing windows are protected from the sun by PV panels that in winter do not prevent the sun from entering the house.

U of opaque components (walls, roof) is lower than 0.10 W/m^2K;

U of windows is 1.5 W/m^2K;

U of roof skylights is 0.8 W/m^2K.

Double shell construction was used throughout to ensure optimal thermal and acoustic separation between exterior and interior.



Technical systems

All flats have mechanical ventilation for indoor air quality reasons with heat recovery of 75% efficiency. This ventilation air is post-heated, or post-cooled, when the building is no more able to guarantee spontaneously the indoor comfort conditions (envelope as efficient climate filter). Post-treatment of air is performed by a simple fan-coil unit per apartment and floor, which is fed by hot or cold water from an air-to-water heat pump.

The same heat pump produces domestic heat water, thus eliminating completely fossil fuel burning from the house – except for cooking.

Temperature and ventilation can be controlled directly by the users, also remotely thanks to a state-of-the-art domotic system.

In mild seasons, users can switch off the ventilation and simply open windows (free-running mode).

A photovoltaic field installed on the south façade (36 m^2) supplies electrical energy, covering some 40% of the overall need over the year. Its production is higher in summer, satisfying energy-demanding cooling loads.

Energy performance

The heating consumption for the cold season is lower than 15 kWh/m^2 per year, that is some 80% lower than current Italian regulations require.

Heating of space and ventilation air: 15 kWh/m²

(Air-to-water heat pump)

Domestic hot water: kWh/m²

(Air-to-water heat pump)

Fans and pumps: kWh/m²

Lighting and appliances: kWh/m²

Total calculated/monitored auxiliary energy demand: kWh/m²

Total calculated/monitored energy demand: kWh/m²

(Please state if the figures are calculated or monitored, or both)

Planning tools

Energy performance was checked against the Passivhaus Institut tool Passivhaus Projektierungspaket 2002 in order to classify the house as such.

Costs and benefits

Capital costs for hyper-insulation and other energy-saving strategies were in line with the mean costs of Central European experience, but of course higher in absolute value as the energy consumption reduction is larger than in Germany (Italian current consumption standard is far higher).

Innovative products

Str/En technologies

www.vanoncini.it

Building envelope

Window: www.faliselli.it; www.velux.it

Walls: www.knauf.it; www.sto.de; www.rockwool.it

Ventilation and cooling

Heat/cooling recovery unit: www.daikin.it

Controls

Solar and shade control:

Space heating and DHW

Heat pump: www.climaveneta.it

Electricity

Solar PV: www.siemens.it

Financing

None.

Project team

Design:
Brandolini Valdameri studio di architettura associato
Structures:
G. P. Imperadori
Technical installations:
Silvestri & Associati
Construction and detail design:
Vanoncini S.p.A.

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Literature and links

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