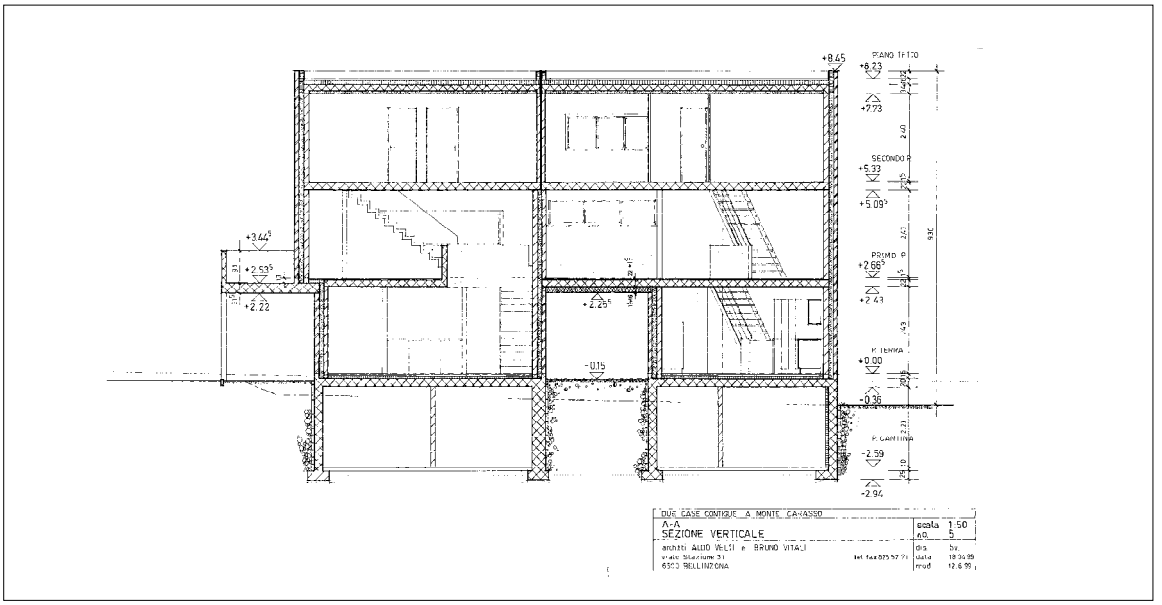
Monte Carasso, Switzerland

International Energy Agency

IEA – SCH Task 28 / ECBCS Annex 38:

Sustainable Solar Housing



The project

The "Vitali-Velti house", designed by the two architects A. Velti and B. Vitali; is located in the village of Monte Carasso, near Bellinzona, south of the Alps in Switzerland. The site is in a densely built-up area at the bottom of a south-facing valley. The project demonstrates that low energy housing can and has to take into account local limitations (shape, orientation, local and distant shadowing, etc.). Architecture, aesthetics, costs, reliability and simplicity were all carefully considered in evolving the design.

The house is a massive construction, two-family semi-detached house. Each house half has approximately 200 m^2 of net heated floor area (5 ½ rooms on three floors). The main house entrance is on ground floor. This level includes the kitchen – dining area, which also have direct access to the garden. The living room / office is on the first floor. The three bedrooms on the second floor are separated from the rest of the house. Each house has an individual, unheated basement for the laundry, the utility room and the storage room. The basement is only accessible from the inside of the house.

The house was built privately under the supervision of the two architects that now live in it. The financing was provided by the owner and a bank, as is normal done for private housing.

The house was completed in 1999.

Objectives - Goals

The main motivation of this demonstration project is to prove that it is possible to achieve superior performance at no additional investment cost compared to standard construction. The design should also demonstrate that such constructions can also be good architecture. Drastically reducing energy consumption and environmental impact guided their choices during the design of the house.

Building construction

The structure of the house is massive. Each floor is a concrete slab construction. Part of the walls is also made of concrete. In order to reduce the number of thermal bridges, the house bearing structure is built inside the polystirol insulation envelope (13 to 20 cm of insulation thickness). The exterior of the wall is a brick masonry construction. The overall wall construction achieves a calculated U-value of 0.25 W/m^2K. Special care was given to reduce the remaining thermal bridges.

Large windows have been integrated in the south-east façade. Windows have a global U-value of 1.1 – 1.3 W/m^2K (frame included). They are made of two panes (selective surface / filled with argon gas) and a wood frame.

The flat roof was partially prefabricated (10%) and includes two layers of polystirol and foamglass insulation . The resulting construction U-value is about 0.15 W/m^2K.

Technical systems

Fresh air is provided by means of a two-flow ventilation system with a cross-flow heat recovery unit, each house having an independent system. The system operates with a constant airflow rate in the incoming and exhaust air channels. The simplicity of the design and its ability to guarantee good air quality in all conditions were the reasons for its selection.

The southeast facade has a large window area for spaces mainly used during the day (i.e. kitchen, dining-room, living-room and office). This provides large passive solar gains as well as daylight. The solar heat gains are stored in the extensive building mass. Indoor curtains control glare. External louvered blinds provide an effective solar overheat protection.

The remaining heating requirement is covered by a wood stove in each house. Heating is distributed simply by free radiation and room air convection, thanks to openings in the south and north areas of the first floor.

Hot water is produced with two independent solar hot water systems, one in each house. Each system is sized at one square meter flat plate solar collectors per person (4 people per house). An electric resistance heating element in the hot water tank delivers auxiliary heat as needed.

Energy performance

The annual heating demand of the Velti house, referred to the energy reference area (determined to 260 m^2 with outside dimensions), is measured for the Velti house to 50 MJ/m^2y for the 2001-2002 monitored year. The electric energy indexes for ventilation, hot water and domestic use were measured to 0.7, 6 and 34 MJ/m^2y respectively.

Costs

The house construction costs no more than that of a conventional house. The cost saving from not installing a conventional heating system offsets the extra cost for the superior envelope of the building, the two air controlled ventilation units and the two solar hot water systems.

Energy saving resulted in substantial immediate reductions in operating costs.

Planning tools for LCA, energy performance, solar energy design and more

Performance indicators and quality labels were the determining factors for the choice of appliances. Environmental aspects were considered when information was available. The annual heat demand of the house was calculated with LESOSAI. Possible moisture problems in the construction were analysed with the program LESOKAI. Shading calculations were performed to address the problem of summer overheating.

Marketing strategy

Thanks to the monitored project, the house is documented with architectonic, energy, economical and environmental aspects. This documentation is used for the information of the Swiss Minergie Standard in Tessin.

Innovative products

The innovative features of this project are the large mass inside the insulated building envelope and the natural distribution of heating energy inside the house (natural air convection). Another point are the solutions found to reduce thermal bridges.

But the main innovation seems to be that the project works with very simple measures and doesn't need any specific innovative products.

List of publications

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- A. Velti (2000) Casa calda a basso prezzo. Spendere meglio, n°4, agosto 2000, pp. 6 – 8.

A. Velti e B. Vitali (2000) Ecco la casa che si calda da sola. Casa Nostra, n° 58, Dezembrer 2000, p. 11.

-D. Pahud, M. Generelli, A. Velti e B. Vitali (2003) Low Energy Housing in Ticino. The "Vitali-Velti" house. Final report, Swiss Federal Office of Energy, to be published (in Italian).

Contact for possible visits

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