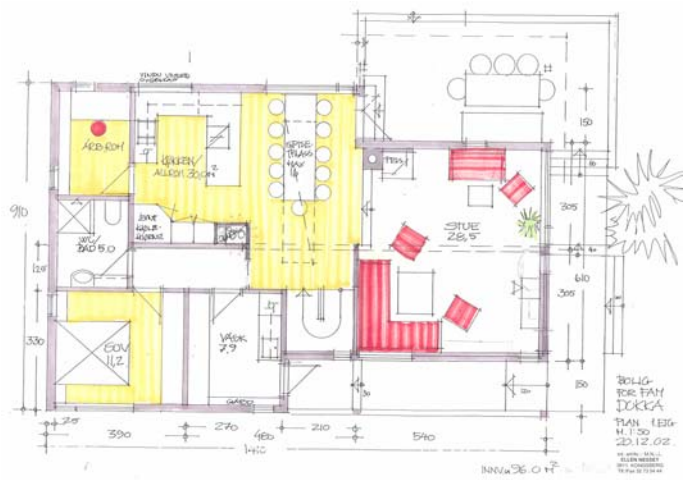
Budstikka 18
Kongsberg, Norway

International Energy Agency

IEA – SHC Task 28 / ECBCS Annex 38:

Sustainable Solar Housing



Plan of main floor.

The project

A single family house is being built in the central eastern part of Norway. The house is 300 m^2 including the main part, a small apartment for rent, and a home office. The construction will be completed during summer 2004.

The house is situated in a family friendly area with limited traffic. As many trees as possible are being kept on the site as part of the green design of the building.

Objectives

Low energy demand and low environmental impact has been focused from the start of the planning phase. Auxiliary energy demand should be less than half of average energy demand for the same type of houses built according to the Norwegian building code. The energy demand for room heating should be reduced with 75%. The climate is typical inland climate with low humidity, little wind, cold winters and fairly warm summers.

The energy design should also result in a robust and user friendly home with good indoor climate. The project should be cost effective in a way that make the concept interesting for other builders.

Building construction

Several measures will be carried out to improve the building envelope compared to normal building standard. All of these actions are optimized in the regard of energy and cost efficiency, and the total concept is crucial for the good result.

Windows are triple glazed with argon gas and two low emission coatings, wooden frame and a total U-value of 0.95 W/m^2K. Two large windows have krypton gas and a U-value of 0.85 W/m^2K.

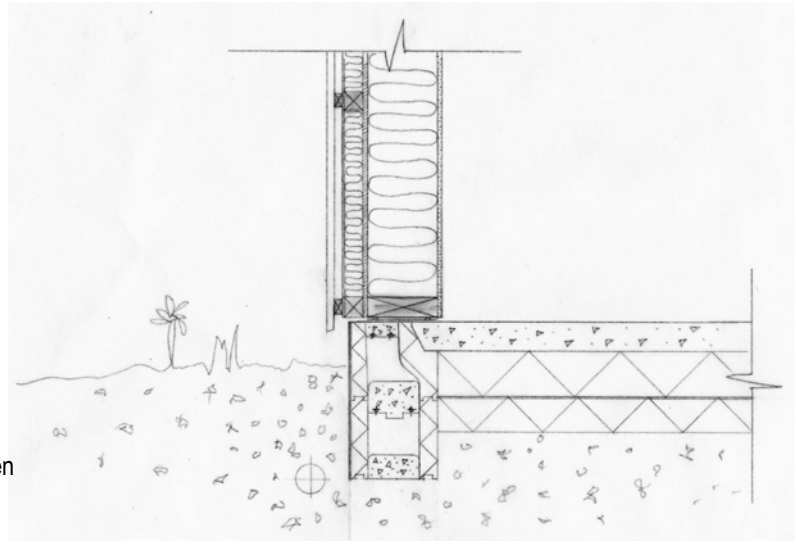
Entrance doors have a U-value of 0.8 W/m^2K.

Exterior walls have 250 mm insulation and a U-value of 0.16 W/m^2K.

Roofs have up to 400 mm insulation and a U-value of 0.10 W/m^2K.

Floors on the ground are insulated with 250 mm expanded polystyrene and have a U-value of 0.11 W/m^2K.

Thermal bridges are minimized by the use of 50 mm insulation on wooden construction details and 100 mm insulation on concrete details. The infiltration loss is minimized by the use of double wind proofing and focus on air tight details between wood and concrete and round the windows.



Detail from connection between Foundation and exterior wall.

Technical systems

Ventilation is provided by a building integrated mechanical ventilation system with a rotating heat recovery unit with an efficiency of 82%. The ducts are short and placed in inner walls to prevent that the exterior walls are weakened. Electricity use for fans is low. SFP is 1.5 – 1.8 kW/m^3/s.

To reduce the electricity demand, A-labeled equipment for washer, refrigerator and lighting are used.

A user friendly and simple control system is installed. For each floor all the lighting can be turned of or dimmed with one switch. A display with possibility to turn down the ventilation is located by the entrance door.

Energy demand for heating will be very low and the heating installations are reduced to a minimum. Only one electric heater is located in the living area, and bathrooms has electric floor heating. This simple heating installations will be sufficient because the ventilation system will distribute the heat to all rooms and there is no need for heaters under the super insulated windows.

Wood from the building site will be used for heating on very cold days. This free wood should be enough for about ten years of consumption. The fireplace is energy efficient and result in clean combustion.

Energy performance

The net energy use for the main dwelling of 223m^2 is calculated to be 50% lower than for a similar dwelling built according to the Norwegian building code.

Energy use (net)[1]

Heating of space and ventilation air: 16 kWh/m²a

Domestic hot water: 30 kWh/m²a

Fans and pumps: 5 kWh/m²a

Lighting and appliances: 34 kWh/m²a

Total net energy use: 85 kWh/m²a

Delivered energy[2]

Calculated delivered energy: 85 kWh/m²a

1] The efficiency of the energy deliverance system is not taken into account.

[2] Energy supplied to the building, in form of electricity, oil, bio-fuel, gas, district heating, etc., taking into account the efficiency of the energy systems. The energy produced by the building itself, for example using solar water heater, photovoltaic systems, heatpump or co-generation and delivered back to the market is subtracted.

Planning tools

Simulations of energy demand and indoor climate are done with the simulation tool SCIAQ Pro 2.0. (ProgramByggerne, www.programbyggerne.no)

Costs

The extra costs are estimated to be 2% higher than for a standard house, taking into account reduced cost for heating system. With the reduced energy cost the payback time will be 3-4 years.

Innovative products

Building envelope

WIndow: NORDAN: 3 pane, 2 low-e coatings, krypton gas and stainless steel spacer. www.nordan.no

Ventilation

Air hanling unit: Villavent VR 400 EV,

Rotary wheel exchanger with 82 % recovery rate,

www.villavent.no

Financing

The energy design is carried out and financed by the builder and owner of the house. No financing support is given. Results from the project IEA SHC task 28, Solar Sustainable Housing have been important for the pre design, though. IEA Task 28 was financed by NFR (The Norwegian Research Council), Enova, The Norwegian Housing Bank and SunLab/ABB. This brochure is financed by the same project.

Project team

Owner: Hanne and Tor Helge Dokka

Builder: Tor Helge Dokka

Architect: Ellen Nesset, M.N.I.L.

Contractor electricity: Forenede montører AS, Kongsberg

Contractor Plumbing: Rørleggermester Roar Omholtl

Ground work: Terje Sollid AS

Masonry work: Murmester Hellik Dokka og Kjell Dokka

Contact person

Tor Helge Dokka, SINTEF (tor.h.dokka@sintef.no)

Literature

T. H. Dokka, T.D. Pettersen, B. Helleren, “Forslag til energimerkeordning for nye boliger - forprosjekt”, SINTEF Rapport STF A03503, March 2003.