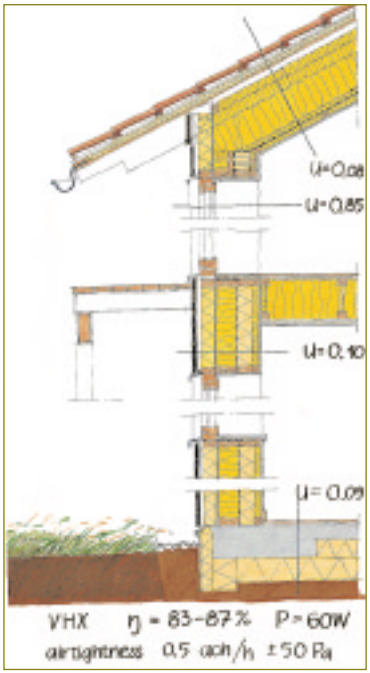
Houses without Heating Systems

20 low energy terrace houses in Göteborg

In an environment of great natural beauty at Lindås, 20 km south of Göteborg, the city owned company Egnahemsbolaget has built 20 terrace houses in which a traditional heating system has been replaced by a heat exchanger in combination with an exceptionally well insulated construction. Solar collectors on the roof provide half the energy needed for the supply of hot water. The terrace houses were designed by the architectural practice EFEM arkitektkontor, and are the result of a research project extending over many years, carried out in cooperation with Chalmers University of Technology, the Swedish Council for Building Research (Formas), Lund University, and the Swedish National Testing and Research Institute.

The buildings have been designed to provide a pleasant indoor environment with minimum energy use. The courtyard facade towards the south has large windows to make full use of solar heat. Balconies and projecting eaves provide protection against excessive solar radiation during the summer. Owing to the terrace construction with houses of 11 m depth, there are few external walls, and these are exceptionally well insulated and airtight. The roof window above the staircase gives light in the middle of the house, and is also used for effective ventilation in the summer.



täthet = airtightness - oms/h = ach

External wall:
U value: 0.10 W/m^{2}K
Framed construction with 43 cm insulation.

Roof:
U value: 0.08 W/m^{2}K
Masonite beams with 48 cm insulation.

Floor:
U value: 0.09 W/m^{2}K
Concrete slab laid on 25 cm insulation.

Windows:
U value: 0.85 W/m^{2}K
Three pane windows with two metallic coats and krypton fill.
Energy transmittance 43%.
Light transmittance 63%.

External door:
U value: 0.80 W/m^{2}k

Heating

Supply air is heated by the exhaust air in a heat exchanger. The rest of the heat requirement is covered by heat from the occupants, appliances and lighting. The heat from occupants is equal to an energy increment of ca 1200 kWh/year. Heat gains from lighting, fridge, freezer, cooker and other appliances come to about 2900 kWh/year, provided that the most energy efficient appliances available in the market are used. A part of this is useful to heat the building. The houses have been designed for normal climatic conditions. Low outdoor temperatures over extended periods are rare and are regarded extreme. In such cases the indoor temperature may drop by a degree or two.

Hot water supply

Solar collectors of 5 m^2 per house are estimated to provide the energy for half the hot water requirement. The 500 l storage tank is equipped with an electric immersion heater to cover the rest of the requirement

Ventilation

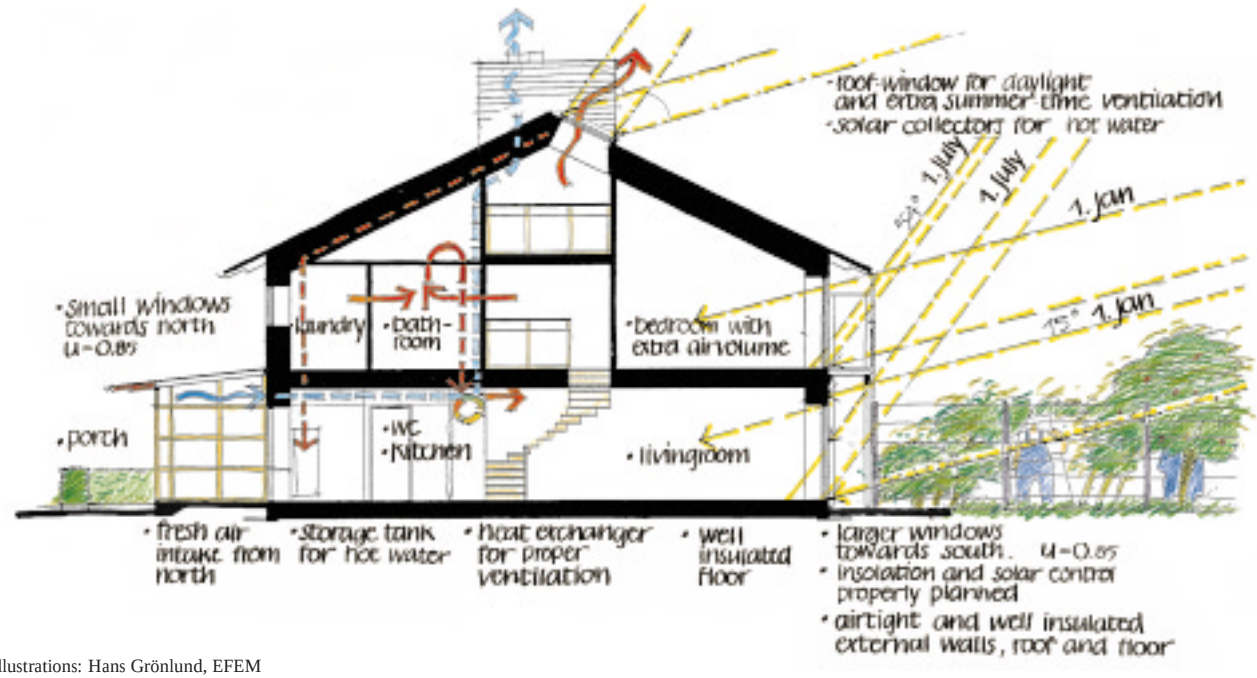
The ventilation system consists of a supply and exhaust air unit with a counterflow heat exchanger which provides 85% heat recovery. In the summer the heat exchanger can be turned off and the house ventilated with only exhaust air and open windows.

The houses are neither more nor less complicated to live in than ordinary houses. Obviously, a house without a heating system demands that those who live in it modify their behaviour, but mostly it is a matter of using their common sense. If it is cold outside, they do not open the windows to create a through draft. If it is warm and sunny, they lower the blinds or the awnings outside the southerly windows.

Costs

Building costs are estimated to be normal. The extra measures in the form of greater airtightness and insulation, adaptation to "passive solar heating" and heat recovery in the ventilation are paid for by the much lower costs of the heating system and the savings in energy costs.

Estimated energy use in a normal year:	Household electricity	2900 kWh
	Hot water	1500 kWh (50% of 3000 kWh, rest provided by solar collector)
	Electricity for services, fans, pumps etc	1000 kWh
	Total	5400 kWh



Illustrations: Hans Grönlund, EFEM

Seminars

The regular seminars about different research areas, attended by the players and experts, were an important part of this collaboration.

Research areas

Swedish National Testing and Research Institute SP has drawn up the specifications for the functions and properties of the building, and was responsible for measurements and evaluations. Its staff also took part in the research into heat exchangers.

Building Physics at Chalmers University of Technology CTH has studied the feasibility of preheating air in a buried pipe, and took part in designing the foundation insulation.

Energy and Building Design (EBD) at Lund University LTH performed computer simulations of indoor climate and researched into issues such as thermal bridges, properties of windows, the need of solar control, and into ventilation systems, heat exchangers and energy efficient electrical appliances.

The players in the project "Houses without heating systems"

Client: Egnahemsbolaget
Contractor: PEAB
Architect: EFEM arkitektkontor, Göteborg
Constructional engineer: J&W, Göteborg
HVAC consultant:
Bengt Dahlgren AB, Göteborg
Electrical services consultant:
Probeko, Göteborg
Site works consultant:
Landskapsgruppen, Göteborg

Those in charge of the different areas of the research project:

Project manager: Hans Eek,
EFEM arkitektkontor, Göteborg
EBD LTH: Maria Wall
Building Physics CTH: Carl-Erik Hagentoft and Fredrik Ståhl
SP: Svein Ruud and Leif Lundin

EGNAHEMSBOLAGET

efem arkitektkontor

formas