

The Low-Energy House Project
The Danish Ministry of Commerce

6 Low - Energy Houses
at
Hjortekær

Description of the Houses

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Technical University of Denmark

6 Low-Energy Houses at Hjørtetekær

PROJECT

The Low-Energy Project of the Danish Ministry of Commerce is the name of a research and development project for constructing six prototypes of low-energy houses.

In this context a low-energy house is a one-family house with a living area of about 120 m² and with an energy supply of 5000 kWh/year covering space heating, ventilation and hot water supply for domestic purposes.

ORGANISATION

The project is sponsored by a government grant of 4.05 million Danish kroner. It is part of a larger Danish energy research and development programme.

The project is directed by the Thermal Insulation Laboratory of the Technical University of Denmark in cooperation with six groups of private firms.

GROUPS OF FIRMS

Each group may consist of architects, engineers, construction firms, manufacturers of building materials etc. The groups deal with the technical planning of the houses and are also economically involved in the project. Each group is the owner of one of the houses and is economically responsible until the house is sold.

LOW-ENERGY ARRANGEMENTS

The very low energy consumption of the houses is due to an interplay of extra thermal insulation, of heat recovery from the exhaust air, of use of alternative energy sources (sun and earth) and of free heat stored in the building constructions. Free heat means heat emitted from persons, from electric lighting, from domestic appliances, and from solar heat gain through windows. All the houses have a controlled fresh air system. Through project management,

the laboratory has made an effort to have as many technical solutions as possible represented in the houses. On the other hand the laboratory has not stipulated any specifications concerning the architecture or the building materials for the houses.

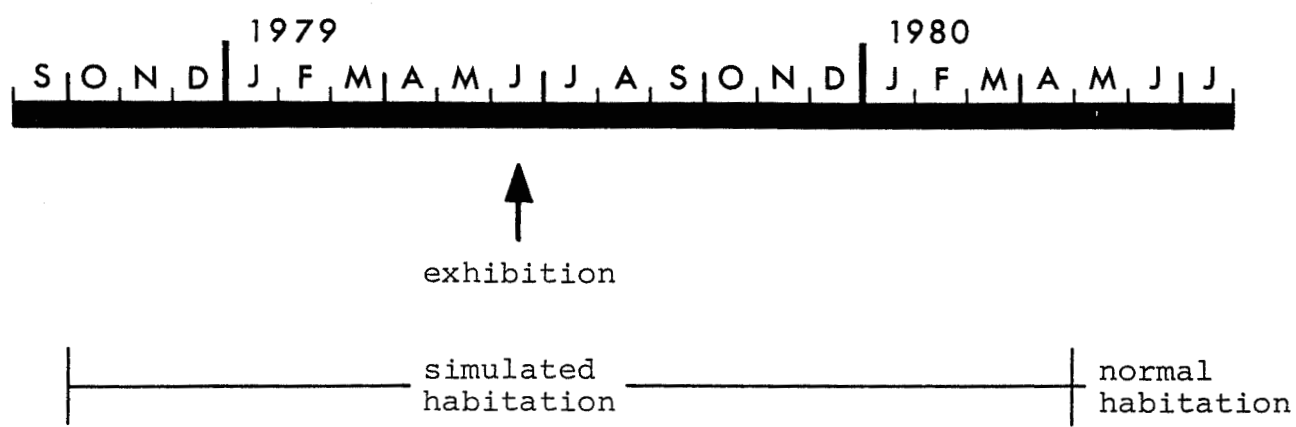
MODEL CALCULATIONS The laboratory has participated in the technical planning of the houses and has calculated their energy consumption in the so-called "Test Reference Year".

ENERGY MEASUREMENTS The habitation of the houses is being simulated for a period of approximately 1½ year (from the autumn of 78 to the spring of 80), and during these months the laboratory is carrying out detailed energy measurements. Thereafter, the houses will be sold and the laboratory hopes to obtain the owners' permission to continue the measurements with normal inhabitation of the houses.

EXHIBITION The six low-energy houses at Hjortekær will be presented during the period June 16th - June 24th 1979.

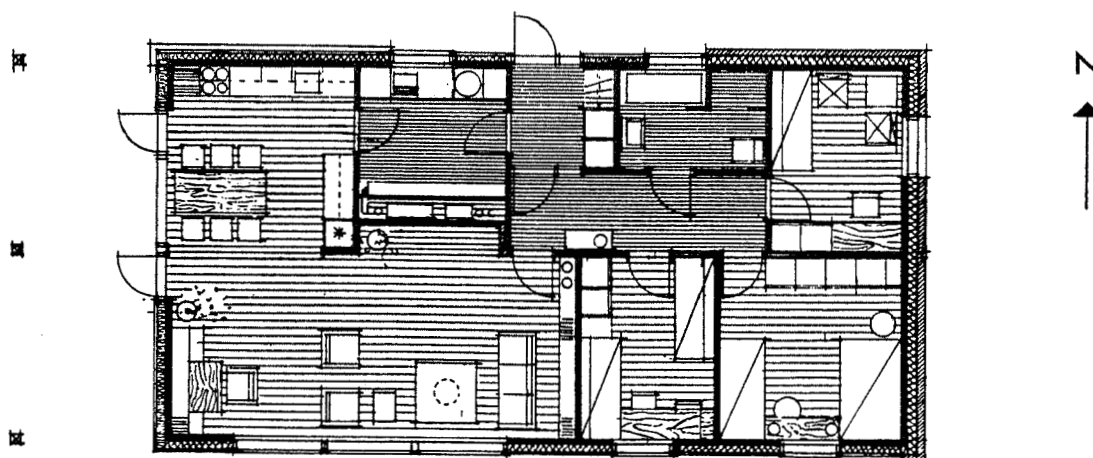
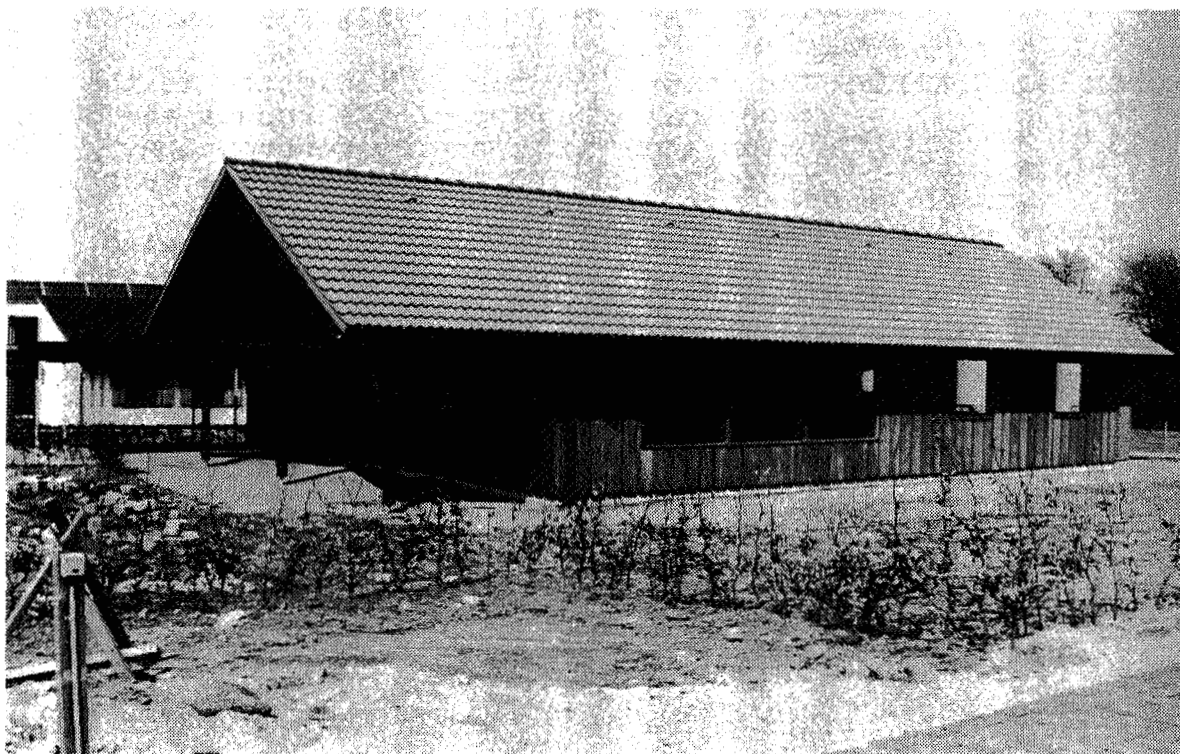
The houses are identified by the letters A-F.

Thermal Insulation Laboratory
Technical University of Denmark



Low-Energy House A

JOHAN CHRISTENSEN & SØN Ltd. (owner)
P.E.MALMSTRØM, consulting engineers Ltd.

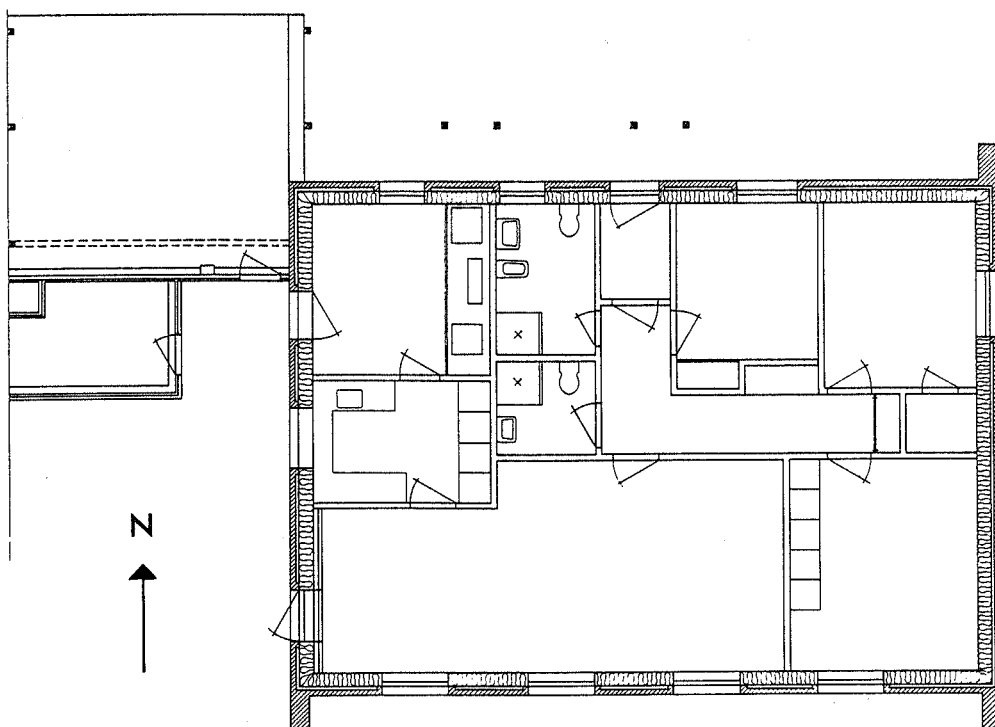
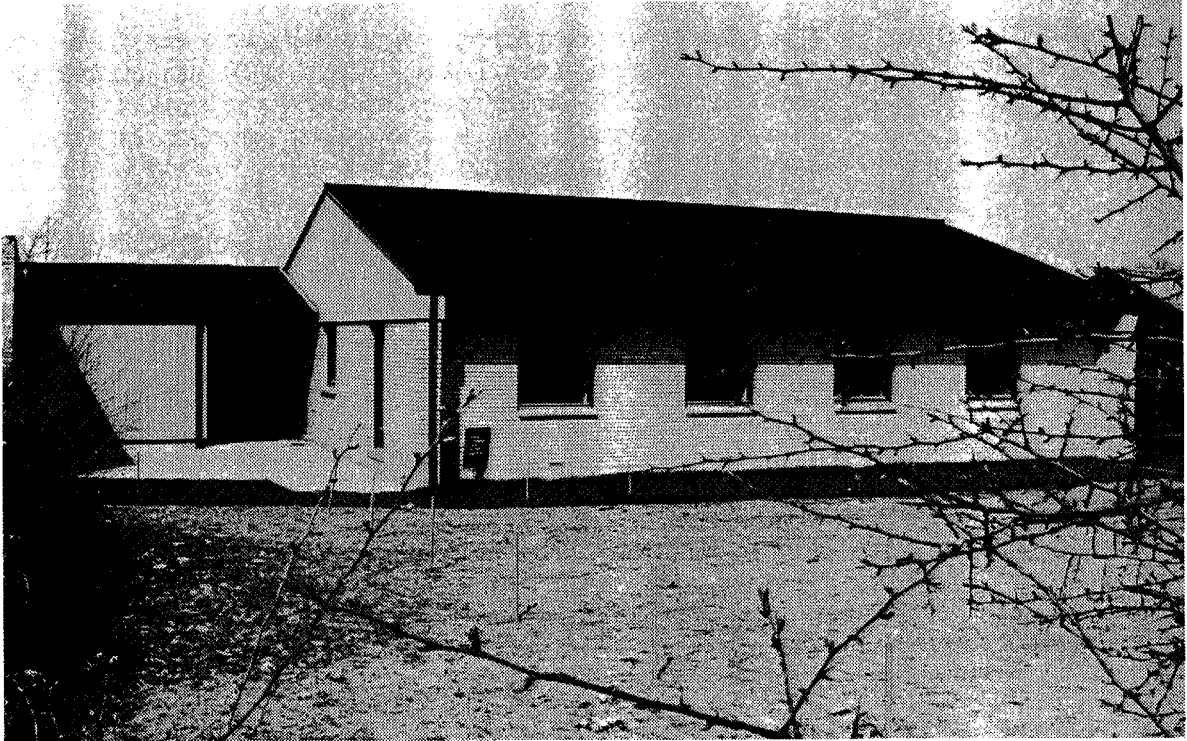


Low-Energy House A

SIZE, DESIGN	<p>House A is a one-floor house with a pitch roof and a living area of 125 m².</p>
CONSTRUCTIONS, INSULATION	<p>The floor construction is a slab-on-ground construction insulated with 100 mm mineral wool and 200 mm expanded clay clinkers. The foundation is a sandwich construction completely insulated down to the depth of foundation.</p> <p>On the outside the exterior walls are provided partly with a brick facing and partly with a wooden covering. They are insulated with 200 mm mineral wool and 100 mm gas concrete components.</p> <p>The horizontal ceilings are insulated with 380 mm mineral wool.</p>
WINDOWS	<p>The windows are fitted with a double-glazed sealed unit with reduced heat transmission.</p>
HEATING SYSTEM	<p>The house has an electric surface heating system in the ceiling.</p>
VENTILATION	<p>The house has controlled fresh air injection in all rooms, and the ventilating unit is constructed to suck out air from bathroom, scullery and kitchen. In the winter the fresh air is admitted from the roof space and in the summer from the outside. The heat recovery from the exhaust air is effectuated in two stages, the first one by a heat recovery unit of the plate type and the second one by an air-air heat pump in such a way that the preheated fresh air is complementary to the surface heating.</p>
DOMESTIC HOT WATER	<p>The water for domestic use is supplied from an electric boiler with a heat pump unit to which fresh air is let separately from the roof space.</p>

Low-Energy House B

ROCKWOOL Ltd. (owner)
RUT SPEYER, architect
BIRCH & KROGBOE, consulting engineers



Low-Energy House C

SIZE, DESIGN

House C covers an area of 135 m². The living area in the ground floor is 121 m² (due to deduction of exterior walls). The house is prepared for extension through utilization of the roof space. The house has two roof surfaces sloping 45^o, one facing north and one facing south. Their ridges are at different levels, creating a vertical discontinuity along the dividing line.

CONSTRUCTIONS, INSULATION

The floor construction is a slab-on-ground construction insulated with 50 mm mineral wool and 250 mm expanded clay clinkers. The exterior walls are made as a construction of loadbearing posts and girders provided partly with a brick facing and partly with a covering of water resistant plywood. The wall is insulated with 240 mm mineral wool. The ceiling (storey partition) is insulated with 400 mm mineral wool.

WINDOWS

Stationary windows are fitted with a triple-glazed sealed unit on the inside and an opening frame with one layer of glass on the outside. Opening windows are fitted with a triple-glazed sealed unit.

HEATING SYSTEM

The house is heated by a low-temperature floor heating system with concreted plastic tubes. The system is electrically heated, complemented by a 20 m² solar collector placed on the roof facing south.

VENTILATION

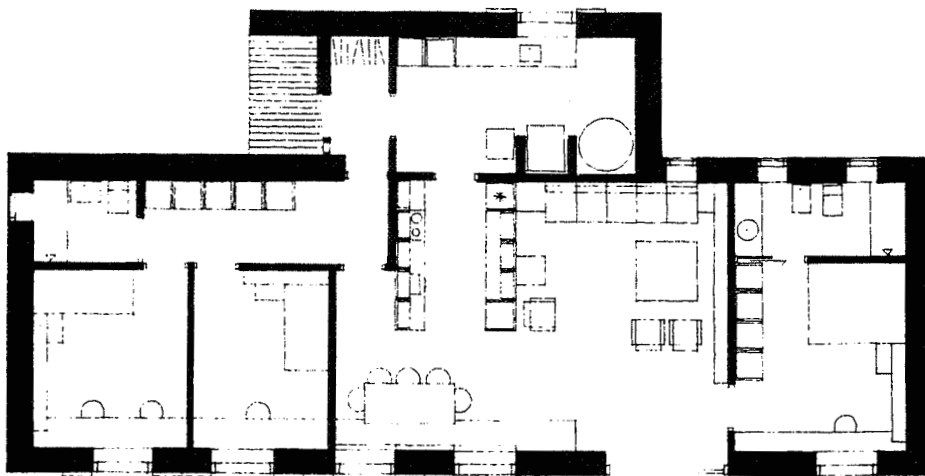
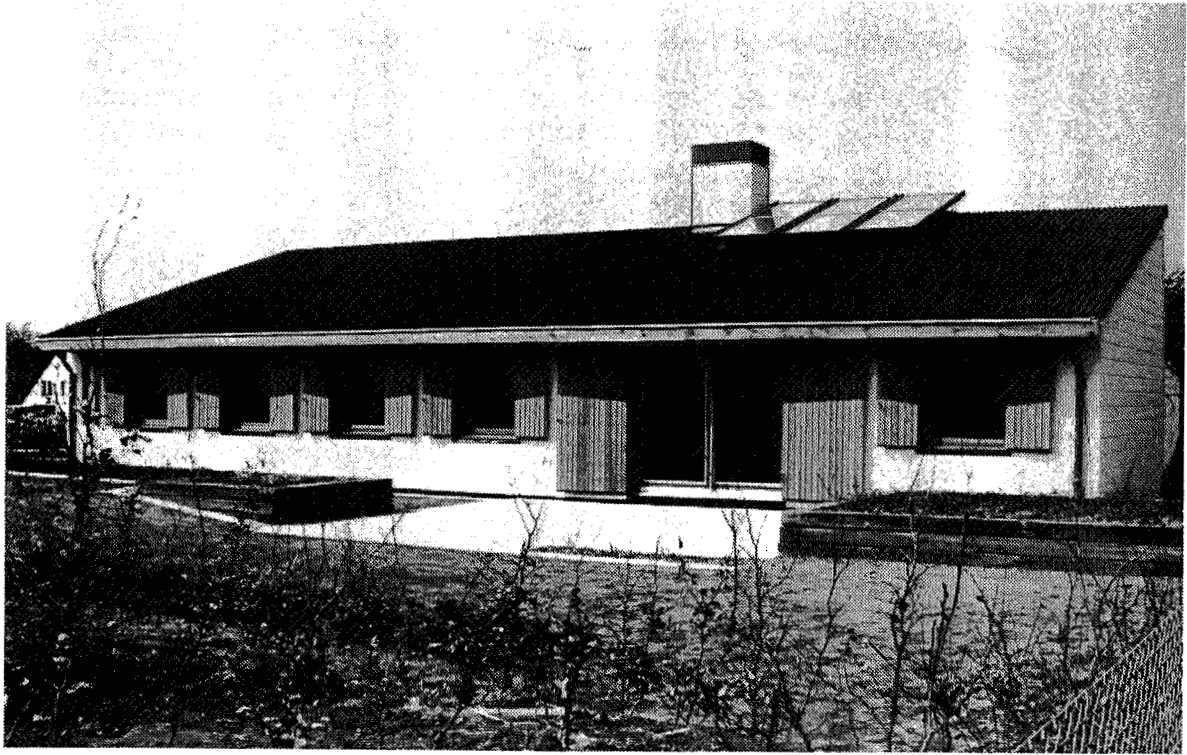
The house has controlled fresh air injection in all rooms, and the ventilation system is constructed to suck out air from scullery, bathroom and kitchen. The heat recovery from the exhaust air is effectuated in two stages, the first one by a heat recovery unit of the plate type and the second one by -----

DOMESTIC HOT WATER

----- a heat pump unit for domestic hot water. The 1800 l storage tank for the solar collector contains a 150 l water tank in which the water for domestic purposes is preheated.

Low-Energy House D

H+H INDUSTRI Ltd. (owner)
BERTEL UDSEN, architect m.a.a.
JOHS. JØRGENSEN Ltd., consulting engineers



Low-Energy House D

SIZE, DESIGN

House D is a one-floor house covering an area of 139 m².

CONSTRUCTIONS, INSULATION

The floor is a slab-on-ground construction insulated with 100 mm mineral wool and 200 mm expanded clay clinkers. The upper part of the foundation is designed as a sandwich construction of gas concrete insulated with 130 mm polyurethan foam. The exterior walls are constructed as gas concrete cavity walls (2 x 150 mm Poralet 500) with 200 mm mineral wool in the cavity. The walls have only few binders.

The sloping ceilings are insulated with 400 mm mineral wool.

WINDOWS

The windows are fitted with a double-glazed sealed unit and externally provided with sidehinged insulating night-shutters.

HEATING SYSTEM

The house is heated by an air heating system which receives heat from an oil burner boiler unit.

VENTILATION

The house has controlled air injection in all rooms and exhaustion from kitchen and the two bathrooms. The heat recovery from the exhaust air is effectuated by a heat recovery unit of the plate type.

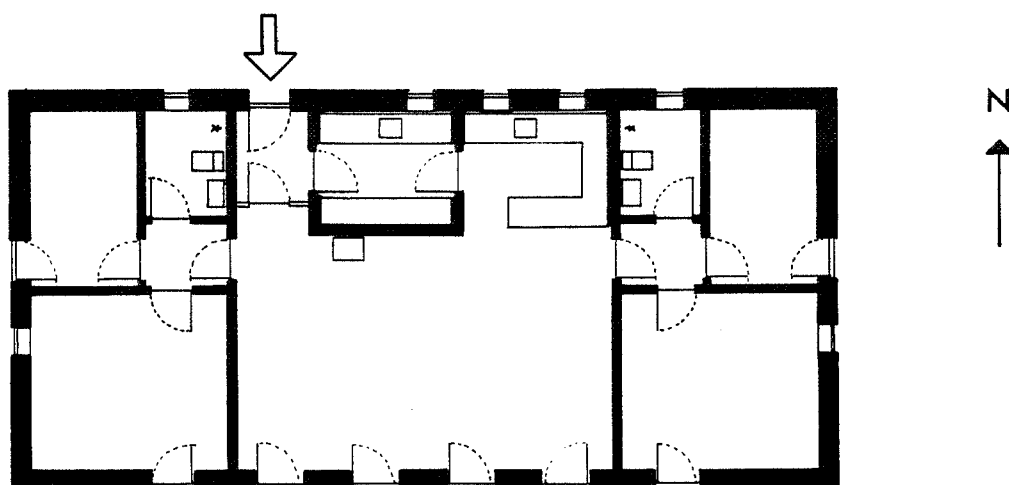
DOMESTIC HOT WATER

The hot water is supplied by the oil burner boiler unit. The water is preheated in a 500 l storage tank which is connected with a 9 m² solar collector placed on top of the roof. Actually, the domestic hot water is heated in three stages:

1. by heat exchange with the grey waste water,
2. by preheating in the storage tank,
3. if necessary, afterheated in the boiler unit.

Low-Energy House E

K.A.B. (owner)
FÆLLESTEGNESTUEN
DOMINIA Ltd.

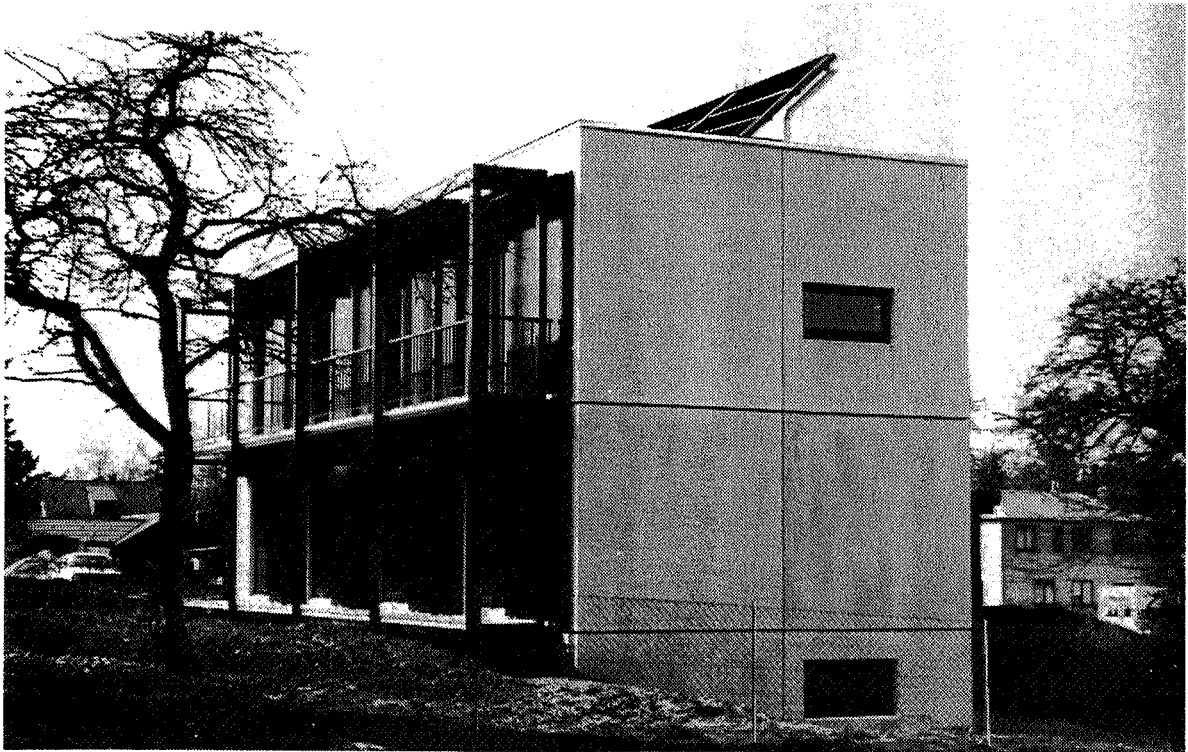


Low-Energy House E

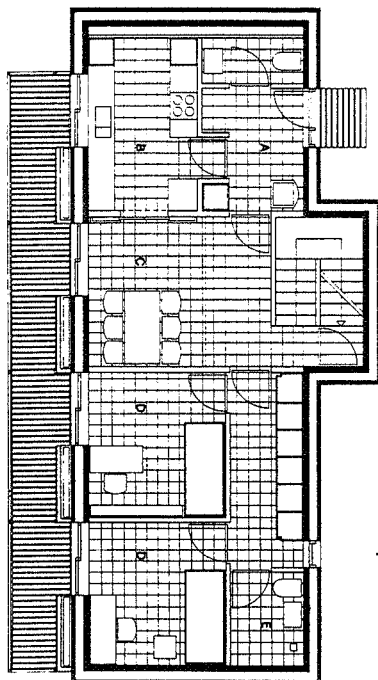
SIZE, DESIGN	<p>House E is a one-floor house covering an area of 130 m². A 10 m³ rock heat storage is situated in a basement section under the centre of the house.</p>
CONSTRUCTIONS, INSULATION	<p>The floor under the rest of the house is a slab-on-ground construction insulated with 300 mm mineral wool. The exterior walls are made as a construction of loadbearing posts and girders provided with a wooden facing. On the inside the walls are covered with two layers of plaster boards. The exterior walls are insulated with 300 mm mineral wool. The sloping ceilings are insulated with 400 mm mineral wool.</p>
WINDOWS	<p>The windows facing north are small while the windows facing east, south and west are constructed as opening doors with a maximum area of glass. All windows are fitted with a double-glazed sealed unit with reduced heat transmission, and externally provided with sidehinged insulating night-shutters.</p>
HEATING SYSTEM	<p>The house is heated by an air heating system with electric air heaters, complemented by the heat that is accumulated in the rock heat storage, i.e. heat coming from solar radiation through the windows.</p>
VENTILATION	<p>The house has controlled fresh air injection in all rooms and exhaustion from scullery, bathrooms and kitchen. The heat recovery from the exhaust air is effectuated by a heat recovery unit of the plate type.</p>
DOMESTIC HOT WATER	<p>The domestic hot water is supplied from an electric boiler.</p>

Low-Energy House F

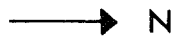
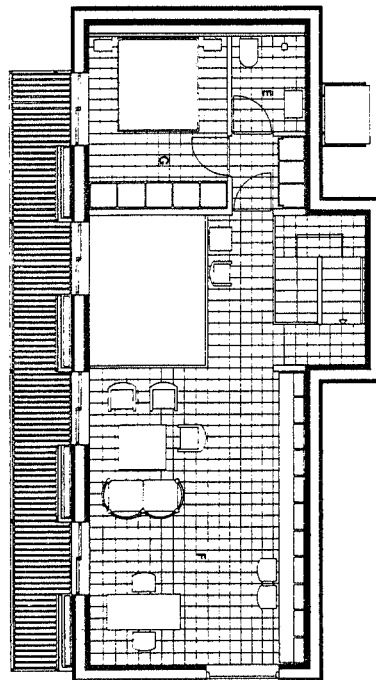
HØJGAARD & SCHULTZ Ltd. (owner)
AALBORG PORTLAND
INSTITUTE OF BUILDING DESIGN
COWICONSULT, consulting engineers Ltd.



Ground floor



First floor



Low-Energy House F

- SIZE, DESIGN** House F is a two-storey house with a full basement covering a ground area of 88 m².
- CONSTRUCTIONS, INSULATION** The house is a heavy one built of precast concrete panels.
The exterior walls are made as a sandwich construction with 80 mm concrete facing, 200 mm mineral wool and 120 mm concrete inner leaf.
The basement floor is insulated with 200 mm mineral wool.
The house has a flat roof insulated with 300 mm mineral wool.
- WINDOWS** Nearly all the windows are facing south and built as doors with a stationary and an opening part. Plast profiles have been used fitted with triple-glazed sealed units. On the outside the windows are fitted with insulating automatically sliding night-shutters.
- HEATING SYSTEM** The house is heated by a low-temperature floor heating system with concreted plastic tubes. The system is supplied from a boiler unit with a gas furnace. A 20 m² solar collector placed on the roof of the house as an independent construction with a slope of 45° is complementary to the furnace.
- VENTILATION** The house has controlled fresh air injection in all rooms and exhaustion from bathrooms, kitchen, scullery and basement. The heat recovery from the exhaust air is effectuated by a heat recovery unit of the plate type.
- DOMESTIC HOT WATER** The domestic hot water is supplied by the gas furnace boiler unit. The 1500 l storage tank for the solar collector contains a 200 l water tank, in which the water for domestic purposes is preheated.