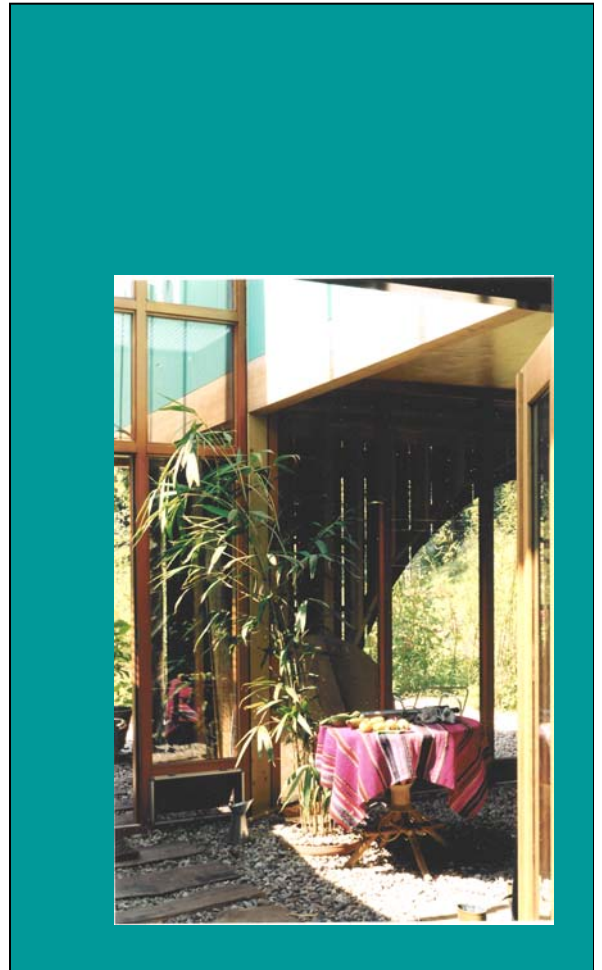
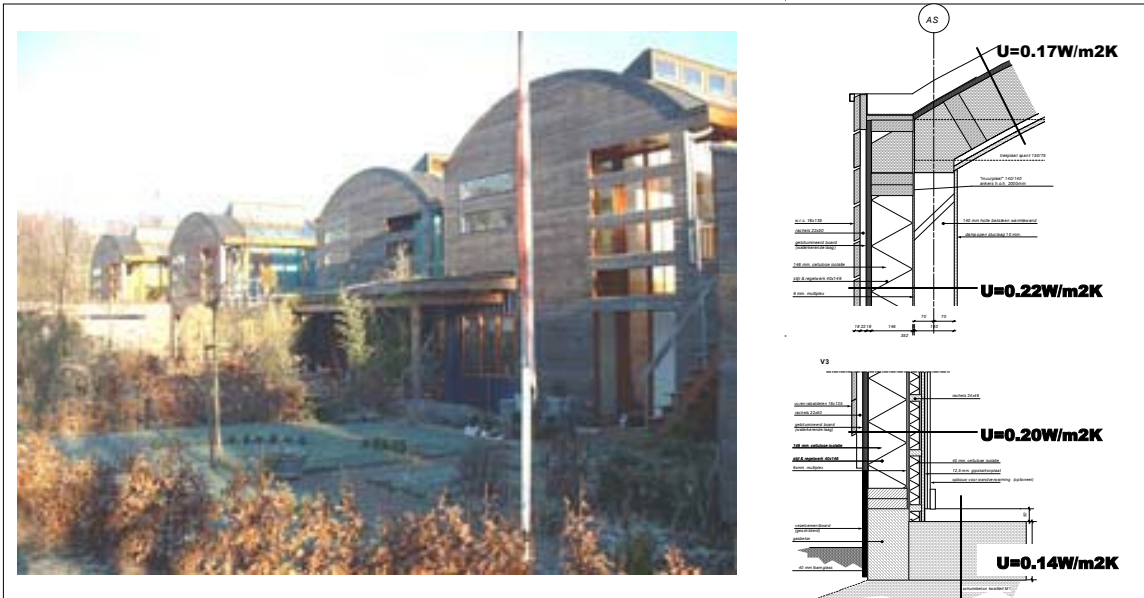


Casco-zonnewoningen Groenlo, the Netherlands





The project

The four buildings are designed as houses to live in and to work in. All four houses are different and could be partitioned to the inhabitants demands. The houses were designed to fit in perfectly in the landscape situated just outside the centre of the small Dutch town of Groenlo, near the German border. A great deal of attention was put into sustainable aspects. Mostly recyclable and natural materials were used. Untreated wood was used on the outside and untreated tree trunks are used as support structures. Vegetation grows in the garden on the ground floor, but also on first floor level. Sustainable energy is provided by 70 m² of solar cells, which forms the roof of the communal parking space. A sun space is located in each house. This area shelters the entrance from weather conditions and pre-heats ventilation air. DHW is generated through an exhaust-air heat pump. A communal condensing boiler supplies the hot water for the low-temperature wall heating system.

Site description

The houses are situated in a semi-suburban setting. The location is just outside the centre of a small Dutch town, near the German border. The houses stand on a former agricultural plot and were designed to blend into its surroundings.

Building structure

The houses have a ground floor and a first floor. The entrance of the house is through a sun space covering the complete height of the building. The sun space serves as a wardrobe and provides in some houses access to the laboratories. Except in one house the kitchen and main living quarters are situated on the first floor. The bedrooms, bathroom and office are located on the ground floor.

Building construction

The foundations are made of foamed concrete. The façades are constructed with a wooden skeleton with 140 mm cellulose insulation and extra insulation of 40 mm cellulose on the inside. The outside finishing is done in deal and red cedar. The inner walls are made of hollow bricks, for their low mass and for the in-wall heating. The first-level floor is made of wood with a floating cover floor. The roof is constructed of wood. The flat roof has 195 mm cellulose insulation and the arched roof 220 mm cellulose insulation. Roof covering is EPDM. The flat roof has vegetation. Only European wood was used. Depending on the load, deal, pine or Oregon pine was used. Swedish natural paint was used for the pine on the façade.



Technical systems

Ventilation:

The houses have a natural inlet of air. The inlet to the living quarters is mainly through the sun space, whereas the inlet in the sleeping quarters can additionally be done through direct openings to the outside. There is an automatic exhaust. Exhaust air is utilised by a heat pump for DHW.

This system was chosen as in such "natural houses" a mechanical system is completely out of place. The sun space yields direct energetic gain because of the natural ventilation.

energy supply system

Heating through a low-temperature wall system fed by a common high-efficient boiler. The boiler runs on natural gas.

The heat distribution between the houses is via a small common medium-temperature grid.

DHW through an electric heat-pump on the exhaust air.

solar energy utilization

70 m² solar panels (4200Wp)

Sun space over two floors for pre-heating of ventilation air. Inlets very low and complete in the top of the sun-space to prevent over heating. Restriction of amount of sun by horizontal shutters.

The sun space can very efficiently be thermally isolated from the house.

Ample daylight in all living quarters.

Energy performance

Total energy demand per house:	73,2kWh/m ² y
Heating of space:	51.9kWh/m ² /y
Pumps	4kWh/m ² /y
Domestic hot water	
Ventilation	
Cooking	
Lighting and appliances:	17,3kWh/m ² /y

Costs

Aprox.€ 300,- ex VAT/m³

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

Dutch "EPN"-calculation: about 50% better than legal requirement

"New method 5000"

"Dywig" used only for the Novem report, see list of publications

Marketing strategy

The houses were developed in cooperation with the future inhabitants

Further information

The project, that is finished in 2001, is an example of an integral design of ecological living and working with emphasis on sustainability and energy efficiency. To preserve the special features of the environment, the houses were designed using a landscaping scheme.

The four coupled houses were completed with very few internal walls. The internal divisions are done by the inhabitants and can be changed easily in the future, because they are not load-bearing.

The houses have possibilities for extensions (on the flat roof).

The space surrounding the houses is divided in three levels with decreasing level of privacy. They are the roof-top garden, the private garden on the front of the house and a communal garden surrounding the buildings.

Because the houses have a living room on the top floor, the roof-top garden is very well accessible.

Innovative products

Ventilation and cooling

Heat recovery unit:

Stiebel Eltron www.stiebel-eltron.nl

Electricity

Solar PV:

stroomwerk www.stroomwerk.nl

Space heating and DHW

Heat pump:

Stiebel Eltron www.stiebel-eltron.nl

Design:

Architecture, landscape and installations:

Eva van Panhuys & Rob Bais architecten

Koninginneweg 10

2243HB Wassenaar NL

www.vanpanhuysbais.com

Construction:

Omnis Bouwadvies

Den Haag NL

Advice and coordination of the inhabitants:

Jaap van der Laan/ Stichting Ecologisch Bouwen

Bergambacht NL

Solar pv-system:

Stroomwerk

Deventer NL

Publications:

Novem report, januari 2004

Monitoring Casco serrewoningen in Groenlo by
moBius consult, Driebergen

Novem report, november 2003

Casco zonnewoningen een evaluatie by van Panhuys
& Bais architecten

Bouwwereld, nr.16 2002

Bouwwereld, nr.22 2002

Het houtblad, nr. 6 2002

Duurzaam Bouwen, nr. 8 2002

"Wohnbauten mit geringem Energieverbrauch", C. F.
Müller Verlag , Caroline Hoffmann e.a. 2004