

# Waaldijk, Dalem The Netherlands





### The project

Because of the river water coming down from the Rhine, the river dikes almost collapsed in 1995. So a special law was accepted to strengthen and raise the Dutch river dikes. Because of this, the inhabitants of an old house in Dalem, on the inside hang of the dike, lost their nice view over the Waal river, an old castle and the little old town on the other side. In the end they decided to build a new more comfortable private house on the same location, to give them back their magnificent view.

Besides this, due to a visit to a few passive solar houses in Germany, the new house had to be based on passive house technology. Because of the limited building volume ( $544 \text{ m}^3$ ), the new house was built (2000) on piles in the dike.

### Objectives

This had to be a house for the future, with easy access for elderly people, a so called lifecycle resistant dwelling, where they could live as long as possible in a comfortable and healthy way in combination with low costs for energy consumption and maintenance based on the energy efficient PassiveHouse technology.

### Building construction

The light weight concrete main structure of the extended walls is covered with 300 mm EPS insulation and finished with a mineral plaster ( $u=0,115 \text{ W/m}^2\text{K}$ ); insulated window frames, windows and doors ( $u=0,68 \text{ W/m}^2\text{K}$ ), together with integrated sun shading systems in the large south and west facing windows; 300 mm EPS roof insulation ( $u=0,116 \text{ W/m}^2\text{K}$ ) on the roof and 300 mm EPS insulation on the floor ( $u=0,113 \text{ W/m}^2\text{K}$ ) make a perfect insulated envelope around the living areas of this passive house of which the exterior building connections are designed to avoid thermal bridges.

The living room, kitchen, bathroom and main bedroom are connected with the main entrance, which can be reached by a long walkway from the road on top of the dike. The living room and the kitchen have access to a transparent balcony and a steel and wood terrace structure; underneath the overhang of the main floor is space for car parking.

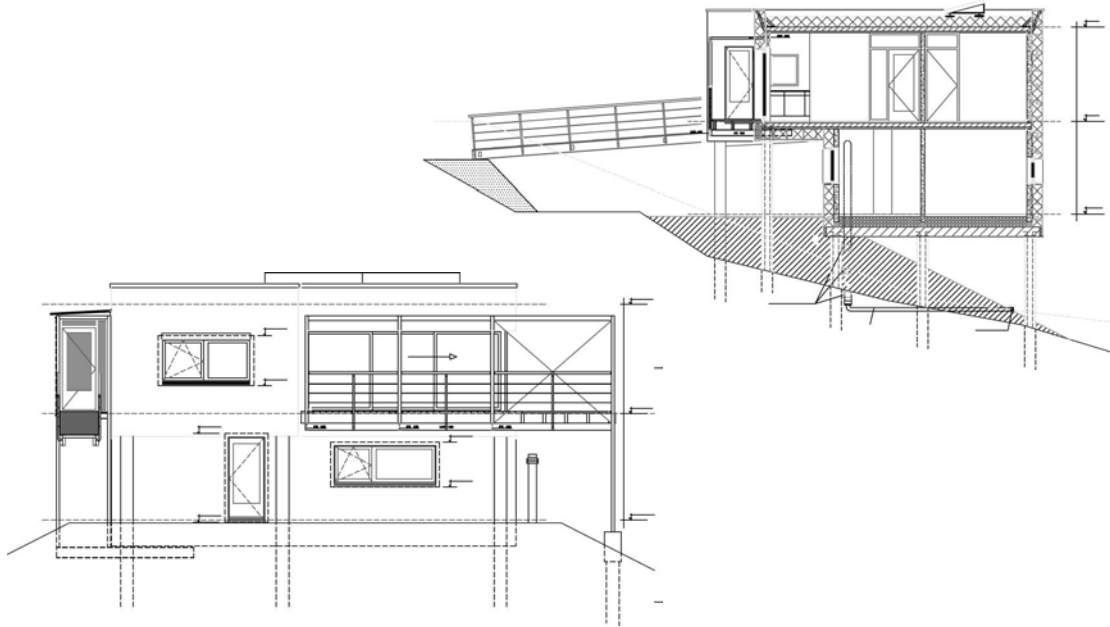
### Technical systems

Through a horizontal earth heat exchanger of about 30 meters in the dike, fresh air flows into the ventilation and heating system which easily covers the total energy needed for space heating.

A system with heat recovery and auxiliary space heating using a water to air heat exchanger applied to the fresh air intake. And also the use of renewable solar energy for domestic hot water heating demands.

A special, insulated body shaped, bath lowers the demand for domestic hot water energy, that is mainly collected by  $4,23 \text{ m}^2$  of flat solar collectors on the roof. There are only two small radiators, one in the basement and one in the north west facing bathroom.

This house was built as a pilot project by the Dutch Foundation of Passive House Holland. This foundation was formed to encourage the development and realization in Holland of the so-called 'Zonhuizen', special solar houses based on the passive house technology (already in use mainly in Germany and Austria) as one of the most promising energy concepts for the future.



The foundation was formed in 1998 by 8 companies in the building sector: 5 manufacturers, 1 installation company, 1 consultant in installations and building physics and 1 architect. After having completed two pilot-projects – ‘Heilig Huisje’ in Sliedrecht and this dike house in Dalem – the first major passive house project in the Netherlands is at this moment being built in Sliedrecht, for sale in the open market.

### Energy performance

Because of the little compact shape of the house and the relative large exterior surface, due to being built on piles, this project didn't quite reach the passive house targets; and energy performances (current Dutch standards).

Reference calculations based on the EPC calculations, including assumption appliances:

#### EPC 1,0 (NL)

- Heating of space and ventilation air	89 kWh/m <sup>2</sup> a
- Domestic hot water	30
- Fans and pumps	15
- Lighting and appliances	79,7
Total primary energy demand	213,7kWh/m <sup>2</sup> a

#### EPC 0,47 (NL)

The annual primary energy demand based on EPC calculating:

- Heating of space and ventilation air	12,9 kWh/m <sup>2</sup> a
- Domestic hot water	13,4
- Fans and pumps	15
- Lighting and appliances (assumption)	79,7
Total primary energy demand	121,-kWh/m <sup>2</sup> a

#### PHPP (D)

The following calculations are based on the spread sheet calculation test for the passive house planning package (PHPP). These very detailed calculations and assumptions from the PH Institute in Darmstadt are more in harmony with this passive house technology for very low energy consumption and the annual energy demand:

- Heating of space and ventilation air	25kWh/m <sup>2</sup> a
- Domestic hot water (solar energy covers 55% of the demand)	15,1
- Fans and pumps	18,9
- Lighting	11,7
- Appliances	48,0
Total primary energy demand	118,7kWh/m <sup>2</sup> a

First monitoring results 2001 – 2002, Passief Huis Dalem (BEC 13-01-03):

- Heating and space / vent.air 31 kWh/m<sup>2</sup>
- High appreciation, especially of the indoor climate conditions, by the occupants

### Costs and benefits

Net building costs, including taxes: € 190.000,-, this makes the house, as compared to the reference standard of conventional houses, competitively priced. This first home in Holland based on the PassiveHouse technology was built without any financial support. The monitoring was financed by NOVEM (the Dutch national institute for energy and environment).

### Project data

- net floor area 127m<sup>2</sup>
- heating volume 323m<sup>3</sup>
- building volume 544m<sup>3</sup>
- u-values
  - exterior walls 0,115 (W/m<sup>2</sup>K) 300 EPS 20
  - ground floor 0,113 " 300 EPS 20
  - roof construction 0,116 " 300 EPS 20
  - windows wood 0,68 " (insulated)
  - glazing triple Argon 0,60 "
- design 1998 – 1999
- realization 2000
- monitoring 2002 – 2004

### Information and contactperson

Private principal - Mrs. v.Duyvenbode and Mrs. M. Ploegmakes

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Groot-Ammers

### List of publications

- De Dordtenaar febr. 2001
- Bouwwereld nr. 4 / 01
- Tijdschrift leefomgeving nr. 1 / 01
- Home juni 2001

This house was one of the five, and the only privately owned, projects nominated for the prestigious national award for inspiring principals 2003 for the stimulation of architecture in the Netherlands.