The Small Earth

september 2000

General description

The national environmental-education centre De Kleine Aarde (DKA) in Boxtel (Noord-Brabant) is the oldest environmental institution in The Netherlands. The aims of DKA are to develop an energy saving technology, a building technology and biological nutrition. Since its formation the centre has become more professional and the information work is done within the national environmental policy.

Due to the increasing interest in the environment and in energy conscious building, DKA needed a bigger visitor's centre. This new centre will function as an educational object itself. The whole building, the construction, the heating and other installations have to show how to build in an ecological and energy-conscious way. The EC Thermie programme funds the project.

De Kleine Aarde
The Small Earth
Boxtel
The Netherlands
51°35' N, 5°20' E
alt. 7,5 m

Education building
Year of construction 1995
Floor area 840 m²
2 floors
Volume 3,100 m³
PV area 120 m²
PV power 7,9 kWp
Output 6,200 kWh/a

Pictures
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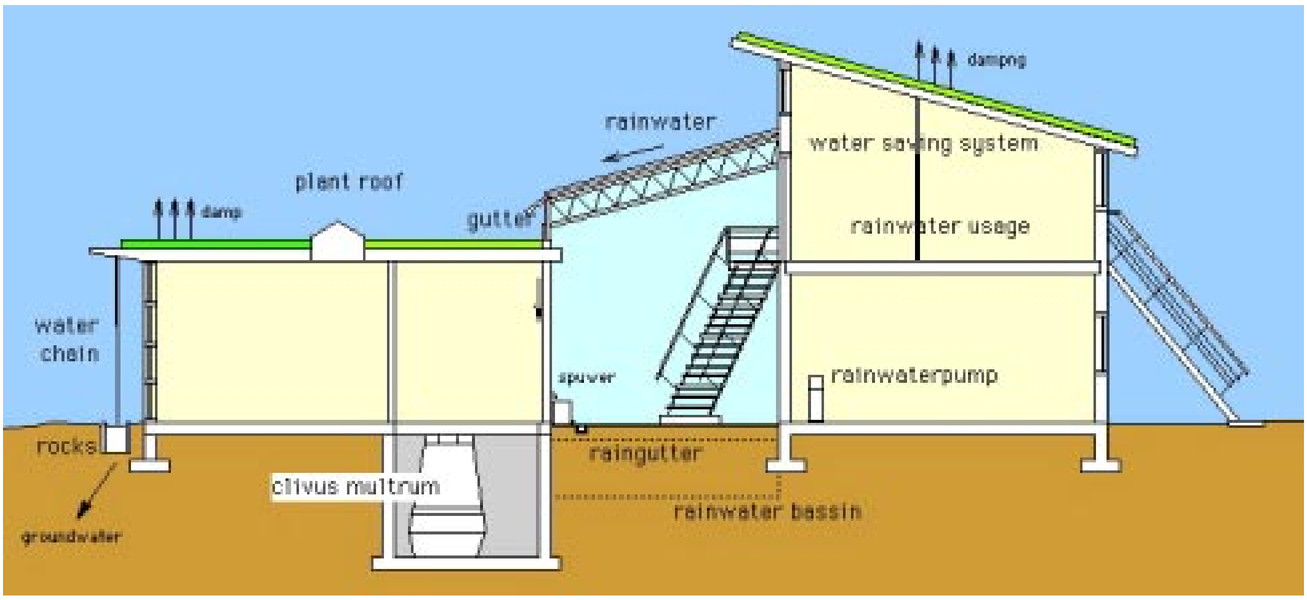
Design process

The starting points for the ecological oriented design were: compact building mass, utilising passive and active solar energy, functional and thermal zones, optimising daylighting, energy efficient artificial lighting, indoor air quality, stabilising corridor temperature with evaporating water and plants, solar ventilation, use of ecological materials and use of water saving systems.

The transparent laminates in the roof of the corridor give a diffuse lighting and make a sun shading system superfluous. Besides the PV systems produce electricity and, as surplus, heat which can be used for heating the corridor in winter. At this time of the year heating is also attained by the solar gain through the glass roof. No auxiliary heating is used, which can sometimes result in very low temperatures. Because of the solar gain and the energy-release from the adjacent building parts, the temperature in the corridor during the cold season will be over 7°C higher than outside. Preheated air from the corridor will be used to ventilate the visitor’s centre and office spaces.

Although the PV cells reduce the solar transmittance of the glass roof, the corridor has to be well ventilated in summer to prevent overheating, as there is a temperature build up directly beneath the roof. This results in a chimney-effect that pushes the warm air at the highest point through two rows of windows, while cooler air (crossing the evaporating green roof) enters the corridor. Furthermore, the floormass and a water basin are used to accumulate heat. The offices and guestrooms are cooled with open air by cross-ventilation through the corridor. The measures also had to serve the educational purpose of the building.



Architecture

The design is based on the surrounding landscape. The corridor is part of a walkway through the area. The semi transparent PV system in the roof consolidates the ‘street-atmosphere’ in the corridor. It is the centre of the building, which both separates and connects the two sub-divisions of the building. Architectural expression with PV systems is ‘high tech’, due to the glittering blue coloured surface, the fact that they produce electricity and because they are usually mounted in aluminium frames. This image of the PV array fits in with the architectural style of the DKA building, despite the fact that the visitor’s

centre is built of ‘low tech’ (sustainable) materials. The contrast between the high tech image of the corridor and the warm appearance of the remainder of the building, which is made of wood, enhances the esthetical integration of the total building. On a smaller scale, the dimension of the PV system is incorporated in the modular grid of the building.

Energy strategy

Because of the educational purpose of the building, the energy strategy was an important guiding principle in the design process. The ecological aspects had to be clearly visible in DKA. At the same time, the design had to show that sustainable

thinking could result in a well integrated, balanced, aesthetically pleasing building. All ecological and solar energy aspects come together in the corridor. Walking through the corridor is an experience for all the senses and for the mind.

Sustainable aspects

The cyclical process was the starting point for the energy strategy. The chosen building materials put little strain on humans and the environment. In particular, these materials are sustainable and naturally degradable, such as wood, organic fibres, lining material, cellulose (wastepaper) insulation, cane, flax and linseed oil. The roof is covered with sedums that require little maintenance. At the same time, they protect the underlying waterproof film sustainably. In this project, water saving has been applied as a main topic. All toilets are water saving toilets that are mainly flushed with rooftop water.

IEA PVPS Task VII

The International Energy Agency (IEA), founded in November 1974, is an autonomous body within the framework of the Organisation for Economic co-Operation and Development (OECD) which carries out a comprehensive pro-gramme of energy co-operation amongst its 23 member countries. The European Commission also participates in the work of the Agency. The IEA Photovoltaic Power Systems Programme (PVPS) is one of the collaborative R&D agreements established within the IEA and since 1993 its participants have been conduct-ing a variety of joint projects concerned with the application of photovoltaic conversion of solar energy into electricity.
Within the PV Power Systems Programme, Task VII is a joint effort focusing on building integrated PV. The overall objective of Task 7 is to enhance the architectural quality, technical quality and economic viability of photovoltaic power systems in the built environment and to assess and remove non-technical barriers for their introduction as an energy-significant option.
More information on the activities and results of the Task can be fond on www.task7.org or www.iea-pvps.org.

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Technical aspects

The building is used every day throughout the year. Both during the week and at the weekends,the building is used for training purposes. The building related daily electricity demand is about 40 kWh. In April, 70% of the energy use was generated by the PV system. In total, more than 35% of all electricity used in the building was generated with PV. This includes electricity for refrigerators, freezer, lighting, etc. Allicon, a Dutch greenhouse builder, made the glass roof. The greenhouse technology uses very light aluminium profiles to maximise daylighting (thus growth) in the greenhouse. This technology could be applied because of the single glazing that is used in the glass roof of the corridor. The ventilation windows and the electrical equipment is also common in greenhouses. Allicon is responsible for the assembly of the PV laminates in the glass roof.

This ENERGIE publication is one of a series highlighting the potential for innovative non-nuclear energy technologies to become widely applied and contribute superior services to the citizen. European Commission strategies aim at influencing the scientific and engineering communities, policy makers and key market actors to create, encourage, acquire and apply cleaner, more efficient and more sustainable energy solutions for their own benefit and that of our wider society.
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