Introduction

Together with five developers the World Wildlife Fund (WWF, in Dutch WNF) build 200 dwellings in five municipalities (Almere, Nijkerk, Apeldoorn, Nieuwegein and Tilburg). By means of example projects the World Wildlife Fund wants to show that building of energy save and environmentally friendly is possible using existing techniques and measures. This can be done without high extra investments and without subsidies. It was also a goal to prove this high level of sustainability can be reached easily with a combination of existing methods and technology and that way push market parties and government to speed up the introduction of higher standards for energy performance of houses.

Energy Performance Law
The energy performance law in the Netherlands defines a performance coefficient for energy need and usage in housing and other buildings. It is a simple number based on standardised calculations. At the start of the WWF project the energy performance coefficient (EPC) was 1.40 for housing. This amounts to an energy consumption of about 1.200 m³ natural gas for space heating and domestic hot water for a single family house of ca. 80 m² with four occupants. The WWF houses with EPC=0.75 use 45% less energy (i.e. less then 500m³ gas). These are not experimental, futuristic or extremely small homes, but very standard, roomy and comfortable homes, suitable for the majority of the population. In 1998 the EP was set to 1.2 and in 2000 it was set to 1.0. The WWF projects were and are an important contribution to the ongoing discussion that the EPC standard should be lowered to 0.8.

In 1998, 40 dwellings were built the Oostervaardersbuurt in Almere-Buiten. The dwellings use 45% less energy compared to standard Dutch dwellings. The houses received a WWF-mark since WWF-criteria were met.

To receive a WWF-mark the dwellings have to fulfil 5 criteria:

1. A maximum energy performance coefficient of 0.75 (the National standard is 1.0 at this moment). At the time the dwellings in Almere were build the energy performance ratio was 1.4, WWF dwellings have a ratio of 0.75. This means that the dwellings use 45% less energy.
2. The dwellings should have a solar collector or a PV system. The dwellings in Almere all have a solar collector for daily hot water.
3. All fixed measures from the National Package Sustainable building should be taken, together with all cost-neutral flexible measures and a set a flexible measures with an extra investment of about € 1,350.
4. The use of wood with the Forest Steward Council trademark (FSC) is obligatory.
5. An external office checks both the design and construction on energy saving and quality.

Since the dwellings fulfil the WWF-criteria in principal the owners can apply for a Green Mortgage (0.5% less interest). This Green Mortgage is the only subsidy that is given on this project.

Design team

Contractor	*Moes Projectontwikkeling, Almere*
Owner	*Private*
Architects	*Architectenburo Pieter Weeda*
Eco consultants	*Ecofys*
Utility	*Nuon*
Contactperson	*Ms Eva van der Weiden WWF, the Netherlands,*

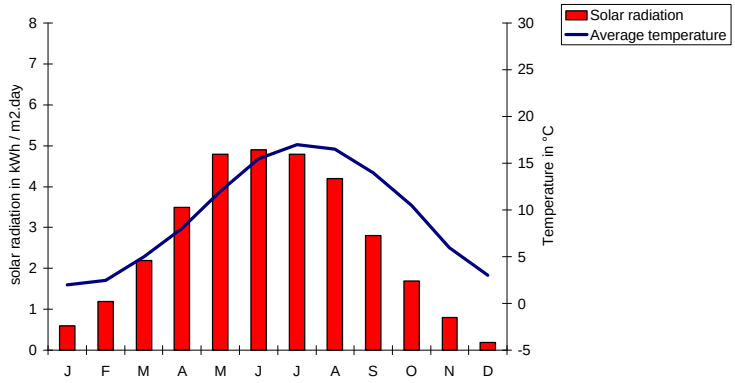
Additional information

Environmental assessment	*W/E Consultants Sustainable Building*
Publications	*- www.greenbuilding.ca (GBC2000)* *- Sustainable Building, issue 1-2001* *- www.wnf.nl/speer/klimaat/epc almere.htm*

Regional and Urban Context

Almere is a big and still fast growing residential satellite for Amsterdam. It is built in the Zuidelijke Flevopolder, the latest Dutch polder, so the land on which Almere is built on is only 30 years old. The urban planning and the type of housing is like most of the Dutch housing development in the 90s: Large residential area's with almost only 2½-story-family housing, mostly built for private ownership by development companies sale.

The design of the 40 WWF-dwellings and the site Oostvaardersbuurt (1974 houses) are both typical for this development. The dwellings are designated to a 4-person family and privately owned.



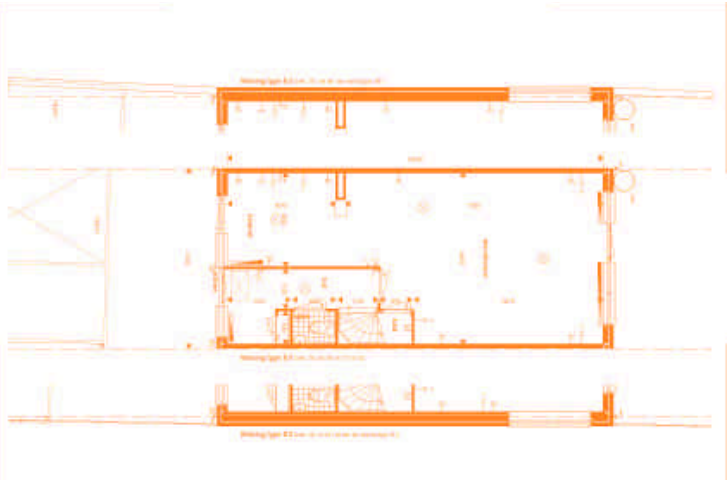
Climate data:

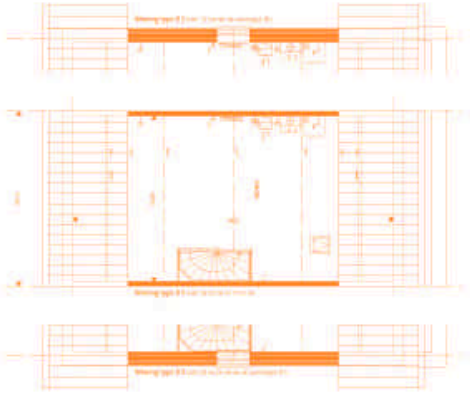
Type of climate	*mild, sea climate*
Altitude (m)	*-1.5*
Latitude	*52°18'*
Longitude	*4°46'*
Average ambient temp	*9.5*
January	*2.4*
July	*16,6*
Degree days (base 18°C)	*3,054*
Global irradiation (kWh/m²)	*950*
Sunshine hours (h)	*1,524*

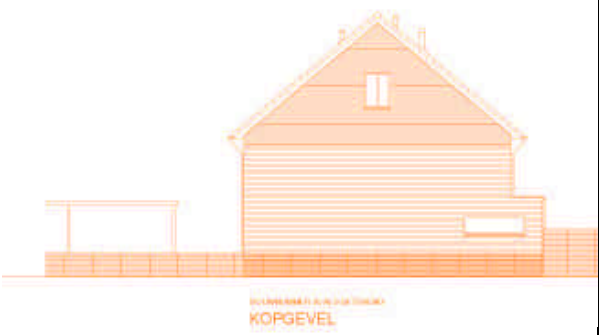
The map on the left shows the other locations where dwellings with the WWF mark are realised (green) en will be build (black).

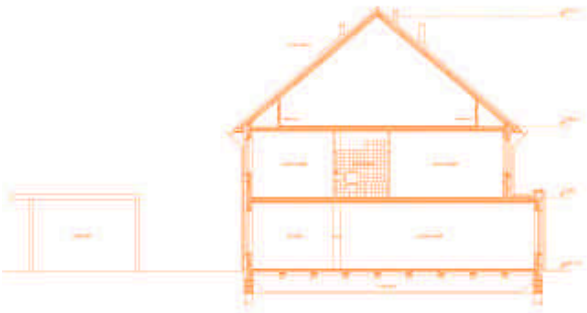
There are also many projects that resemble the WWF specifications. The scale of the WWF projects themselves is increasing. A project "De Landerijen" in Lelystad has started in 2000 with a minimum of 900 and a maximum of 1,800 houses.

Block and Building



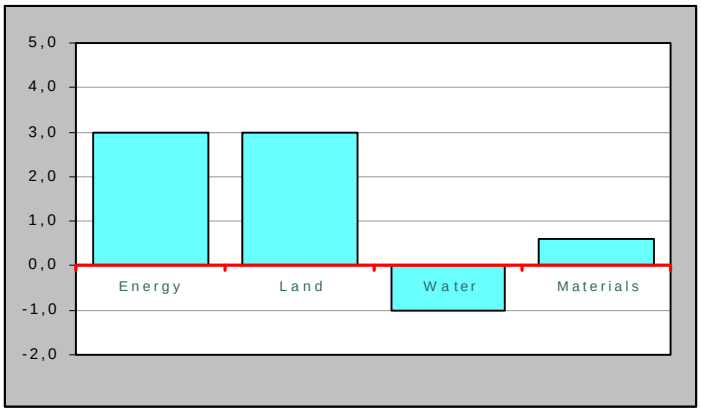






The architectural design of the houses is comparable to other large-scale housing projects in the Netherlands. Special measures stimulated by WWF are taken, for example:

- Concrete contains at least 20% used granular cover material.
- A lot of fibreboard is used.
- Interior walls are made of gypsum.
- No materials contain asbestos or formaldehyde.
- Balanced ventilation provides clean air: due to the balanced ventilation comfort is high, while energy costs are low.



The project has been assessed with GBTool. It has a high score on energy saving which was one of the main goals of WWF. No special attention is paid to materials, except for the use of FSC-marked wood. So this score is average. It also scores very good on indoor environmental quality, which was also a point of attention.

Project Data	Project case		reference dwelling	
Construction	*1998*			
Construction costs per dwelling (€)	*68,067 = 532 /m2*			
Urban plan				
Area (ha)	*148*			
Floor Area (m^2 gross floor area)	*127.9*			
Floor Area Ratio (m^2 gross floor area)	*0.85*			
Transport				
Distance to car park	*private carport*			
Distance to public transport	*bus: 200m, railway now:1500m, future 500m*			
Frequency of public transport	*train/bus every 15 minutes*			
Bicycle storage	*garage*			
Telecommunication				
Waste separation				
Construction and demolition waste	*at least 5 fractions*			
Household waste	*same*		*paper, fruit/vegetables/garden waste, chemical waste*	
Design for deconstruction	*recyclable concrete*			
Building Materials				
Construction				
Facades	*bricks*		*bricks*	
Roof	*FSC wood*		*wood*	
Window frames	*FSC wood*		*wood*	
Internal walls	*gypsum*			
Recycled materials	*at least 20% used granular cover material*			
Insulation	**area (m^2)**	**U-value (W/m^2K)**	**area (m^2)**	**U-value (W/m^2K)**
Ground floor area (m^2/bldg)	*51.8*	*0.235*		*0.4*
Roof area (m^2/bldg)	*63.69*	*0.252*		*0.4*
External wall area (m^2/bldg)	*35.36*	*0.193*		*0.4*
Window area total (m^2/bldg)	*18.58*	*1.6*		*2.8*
South (m^2/bldg)	*8.4*	*1.6*		*2.8*
Ventilation system				
Infiltration	*mechanical (balanced)*			
Exhaust	*mechanical (balanced)*			
Heat recovery	*yes*			
Air exchange rate, heating season				
Back-up systems	**system**	**energy source**	**system**	**energy source**
Space heating	*water based radiators*	*gas*	*same*	*gas*
Domestic hot water	*solar collector*			
Cooling	*no*		*no*	
Electricity production	*grid*		*traditional*	
Ventilation				
Energy data	**(kWh/m²)**		**(kWh/m²)**	
Space heating	*84.7*		*166.7*	
Space cooling				
Domestic hot water				
Electricity (total)				
Lighting				
Fans + pumps				
Small power				
Solar systems				
Passive				
Active	*2.8 m^2*			
PV	*no*			
Water				
Supply:				
Toilet system (4, 6, 9 litres)	*6*		*drinking water (6 l)*	
Shower			*standard shower head*	
Bath	*yes*			
Sewage				
Rainwater collection	*no*		*no*	
Grey water system	*no*		*no*	