

# SOLAR

## Thermal Energy

# EINDHOVEN

## (The Netherlands)

*Despite greatly improved equipment quality and higher system efficiency, solar thermal energy applications have not yet succeeded in capturing appreciable market shares in Europe. However, thanks in particular to local authorities and climate protection action plans and their implementation, there are now good examples at the local level. In Eindhoven in The Netherlands, the municipality has initiated several projects promoting and supporting implementations of thermal solar energy installations.*

## THE CITY

Eindhoven has a youthful dynamic aura, and a warm, country heart. With 200,000 residents, it is the fifth largest city in The Netherlands and the centre of a region with 700,000 inhabitants. Southeast Brabant has changed rapidly from an agricultural area to a highly industrialised region, with technology playing a leading role. This is reflected in Eindhoven where plants of the twenties and thirties standing alongside modern office towers. Eindhoven is an international centre of technology (University, Philips and many other high-tech business activities).

### Climatic data:

Degree days (Basis 18 °C): 2,750  
Annual mean temperature: 10.9 °C



## CONTEXT

In 1994, the municipality of Eindhoven developed an energy policy plan. The promotion and use of renewable energy sources is one of the most important activities in this plan. Over the last years, several projects have been executed, especially thermal solar energy projects for both existing and newly built homes. For existing homes (defined as buildings built before 1995) the municipality gives a subsidy of 160 Euro for each installation. On a very small scale there are some demonstration projects on PV-systems.

For a recently new built residential area called "Meerhoven", containing 7000 dwellings, a local district heating system has been developed. The energy source for this system is a gas engine, which produces both heat and electricity with high efficiency. Compared to the most common conventional system in The Netherlands (gas boilers in every single home, all connected to the extensive natural gas network) this results in a CO<sub>2</sub>-reduction of 40%. For the third phase of Meerhoven, which will be finished in 2005, the municipality is now carrying out research for a low temperature system of heat distribution. This system should make possible to use a heat pump or even a renewable energy source such as geothermal energy or large-scale solar energy. This is all subject to further investigation.

The municipality has a group in the planning department working with Agenda 21 questions and problems. Citizens in the municipality can get energy advice free of charge.

# EXPERIENCE OF EINDHOVEN

## Municipal involvement

In 1994, the municipality approved an energy policy plan where it is stressed that promotion of renewable energy resources is essential. Later in 1996, the municipality signed a statement which further stressed that the municipality would do everything within its power to promote the use of renewable energy. In 1997, the subsidy plan for thermal solar systems for existing homes was approved, and the campaign was then repeated during the years 2000-2002. The municipality puts effort into communicating these activities to the rest of the world. The idea is that the results and knowledge gained in Eindhoven could be used elsewhere.

In general terms, the political decision made by the City Council is that every newly built home should have a thermal solar system unless this is not possible for technical reasons. One other objective with the project is to build attractive residential areas and thereby stop the removal of citizens from the city of Eindhoven to the villages in the outer regions. The municipality of Eindhoven has been in charge of the solar heat projects as initiator and financial- and political supporter. Other organisations involved in these activities are:

- NV N.R.E. - regional energy company (technical and financial support)
- Milieudienst Regio Eindhoven - regional environmental department (project co-ordination)
- Research and consulting "Ecofys" (general and technical support).



## Project description

In 1998, two building locations have been developed called "Blixembosch 2", (in total 1,600 dwellings) and "Driehoeksbos", (in total 400 dwellings), respectively. The municipality in Eindhoven decided that all new homes on these locations should have a thermal solar system for the production of domestic hot water (not space heating). In both locations, the most common houses are single family houses suitable for 2 to 5 people. The average heated area per house is scattered between 250 and 400 m<sup>2</sup>.



The project has resulted in 476 solar systems in these two sites (covering about 80% of all homes in both districts). The rest are expected to install similar solar collectors in the near future. The picture above shows a standard roof with two solar collectors, each with an area of 2.75 m<sup>2</sup>. This is sufficient to cover the demand for domestic hot water for one family during the summer and major parts of the spring and autumn. (Equals approximately 50% of the annual demand).

### Technical data of the installations

All installations are "AGPO/ZEN Aqua Sol LB-100" with the following characteristics:

- size of the water container: 900 × 510 × 510 mm
- contains: 90 litres
- weight (empty): 35 kg
- material: stainless steel
- position: hanging on the wall
- collector area: 2.75 m<sup>2</sup>
- annual heat prod.: 1,200 kWh
- collector weight: 53 kg or more (depending on model)
- material collector: aluminium and copper

These Aqua-Sol solar boilers can be connected to almost every central gas heater and is therefore suitable anywhere. The principle of supplying the heat demands partly with clean solar heat and partly with natural gas is suitable for a North European climate like the Dutch one, where it is unwise to depend 100% on the sun.

On hot summer days, when the heat demand is not sufficient to cool the solar collectors, the system uses a so-called drain back system. When the temperature in the vessel reaches 90 °C, the control unit switches off the pump and the water in the collector circuit drains from the collector inside the house. The drain back system also prevents the system from freezing in wintertime. Also, the systems are dimensioned with a moveable solar coverage factor of about 50%; overheating in summer is therefore limited.

Total number of installations:	476
Saved energy, yearly:	150-170 Nm <sup>3</sup> natural gas (per solar system)
Corresponding CO <sub>2</sub> -reduction <sup>1</sup> :	330 kg

The saved energy (natural gas) and the produced energy are not the same figure. This is due to the efficiency of the back-up boiler. The energy produced by the solar installations is "end use" energy while the saved amount of gas is energy input to the gas boiler. The price for one Nm<sup>3</sup> of natural gas in the Netherlands is approximately Euro 0.32 (including Euro 0.011 in taxes).

### Financial aspects

AGPO/ZEN Aqua Sol LB-100 system <sup>2</sup> :	1.110 Euro
Subsidy of national government:	295 Euro
Subsidy of energy company:	160 Euro

Costs to be paid by the house owner: 655 Euro

The simple pay back time is expected to be approximately 12 years, which is remarkably low for this kind of installation. This has been possible because it is not really a commercial project. The private company, Ecofys took part in this project and initiated these large projects where the objective is to open the market for solar heat installations. In this way it is possible to obtain



<sup>1</sup> If it is assumed that the solar heat is replacing heat based on natural gas.

<sup>2</sup> Taxes on 17.5% included.

very interesting offers from manufactures and installers. There are today many similar projects going on in The Netherlands, and in the rest of Europe.

It should be remarked that the installation cost is not included in the expenses mentioned above. This cost is around 450 Euro and the pay back time is influenced accordingly.

## EVALUATION AND OUTLOOK

In these kind of renewable energy projects, a strong effort must be put into knowledge transfer, to and from the participants in the project. The strong policy from the municipality has been quite helpful in this matter. Also, support from the project team concerning tendering, completion of subsidies and technical support with the integration of the systems in the plans is very important.

The project has had a positive influence on the employment in the area. The municipality put an effort into including local SME in the project.

The Eindhoven's effort in solar energy promotion led to its election as "Zonneboilerstad" city. The election is the result of a national contest in which one out of three nominated Dutch municipality can be chosen as "Zonneboilerstad". As a result of the context Eindhoven participated to a promotional campaign together with several renewable energy companies.

The municipality of Eindhoven is developing a new project, called "Zonnestroomstad", which objective is to install 400 m<sup>2</sup> of PV systems by 2005. In general, the promotion of thermal solar energy systems will be continued by means of awareness raising campaigns, training courses and financial support. Finally, the energy supply of the housing estate Meerhoven by the earlier mentioned low temperature heat distribution system is under investigation.



## FURTHER INFORMATION

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