

SOLAR THERMAL ENERGY

BARCELONA (Spain)

Although the quality of the equipment and the efficiency of thermal solar systems have improved greatly in recent years, this type of energy production has not yet achieved a significant share of the market. Thanks to the policies pursued by some cities, there are some good examples of thermal-solar systems in Europe. While solar energy is not very popular in Spain, it does have great potential. In that connection, the Barcelona City Council approved a Municipal Ordinance to promote the use of this renewable energy source and incorporate it into all kinds of buildings.

GENERAL ASPECTS

Barcelona, the capital of the region of Catalonia, has managed in recent years to invigorate its image thanks to large-scale projects such as the Olympic Games and the forthcoming Forum 2004 for culture. Barcelona is striving daily to keep its 1,508,800 inhabitants, and to reverse the trend of its falling population.

Climatic Data:

Yearly hours of sunshine	2,350
Average mean temperature	15.9 °C



CONTEXT

Barcelona is located on the Mediterranean coast and, thanks to its abundant sunshine, enjoys excellent conditions for the use of solar energy. In 1993, the city signed the Amsterdam Declaration and the Heidelberg Agreement in 1994, through which the city undertook to reduce by 2005 its CO₂ emissions to a level 20% less than those of 1987.

Many initiatives are being taken to make the city more environmentally sustainable and many groups and organizations are pooling their efforts to work in the same direction. These activities receive financial support from the city government, and in some cases the Regional Government also contributes.

The creation of BARNAGEL, Barcelona's local energy agency and source of information, has been used as a model by a number of municipalities that have based their activities on those of Barcelona in their promotion and application of a pioneer environmental policy that strives to set an example and encourage the use of renewable energies to render the city more livable in a sustainable fashion. Emphasis was placed on the use of solar energy, as well as on innovation and the drafting and adoption of the Thermal Solar Municipal Ordinance that encourages the installation of solar heat collectors in buildings. In this area, private sector initiatives are eligible for local and regional subsidies.

EXPERIENCE OF BARCELONA

A firm decision was made by the city of Barcelona to improve the quality of life of its inhabitants and to look to the future. A range of improvements were introduced to conserve energy in city buildings. These activities have meant a savings of 1,700,000 kWh per year that translates into a savings of € 243,500 per year. The following initiatives are part of the Municipal Action Plan, known by its initials in Catalan, PAM:

- ❑ replacement of incandescent lighting by low-energy lighting
- ❑ replacement of air-conditioning equipment by more efficient devices
- ❑ installation of solar heat collectors in school and university buildings, sports complexes and office buildings
- ❑ installation of photovoltaic panels in university and office buildings
- ❑ improvements in order to save water, gas and electricity in many city buildings

The BARNAMIL project

In terms of energy, Barcelona has given priority to the promotion of thermal solar energy. In that connection, the city drew up the BARNAMIL project which intended to install 1,000 m² of panels before the year 2000. The city did even better: more than 1,200 m² of panels had been installed by June, 1999. The creation of various groups to work on the Barnamil project in a coordinated fashion has played a vital and stimulating role for the project. These groups are:

- ❑ Barcelona Estalvia Energia (BEE): a group consisting of 17 different associations and organizations in Barcelona
- ❑ BARNAGEL a local energy agency for the metropolitan area, connected to other local and European organizations
- ❑ APERCA: a Catalan business association that works as a technical advisor on renewable energy sources
- ❑ the Barcelona City Council

The local authorities have been present in all these groups as a reference point and as a link amongst them.

The city of Barcelona promotes many initiatives to improve the lives of its inhabitants and to clean up the urban environment. Barcelona has been a pioneer in Europe with its Municipal Ordinance that regulates solar energy collection systems.

The Municipal Ordinance for the installation of solar heat collectors in buildings

This ordinance is the most innovative aspect of the city's environmental policy. It defines the rules and conditions for the installation of solar collectors and the use of low-temperature solar energy for the production of hot water for household and office use. The ordinance stipulates the following:

- ❑ New and remodelled public and private buildings are concerned by the ordinance
- ❑ The best available technology must be used and compliance with the ordinance must be substantiated with figures and data. The rate of coverage of energy needs via the use of collectors must be 60%



- ❑ The parameters used for the calculations of hot water consumption are: minimum temperature of 45°C for 140 liters per household, which is equal to approximately 6 MJ per day per standard household. These parameters vary depending on the type of housing and its use.
- ❑ The panels must be inclined in order to maximize their efficiency and should face south with a tolerance of more or less 25°, although this may be changed in the event adjacent buildings or trees cause shade.
- ❑ In order to avoid unsightly installations, the design of the projects must integrate the panels into the overall design of the building
- ❑ all the installations must have measurement systems for checking its functioning and collection of data.
- ❑ Various exemptions are being considered in cases where it is technically impossible to cover 60% of energy requirements via a solar system. A technical study must be drawn up justifying such an exemption.
- ❑ The projects that infringe the Municipal Ordinance will be liable to sanctions. Fines will range from € 6,000 to € 60,000.

Barcelona's Municipal Ordinance was approved by the city government on July 16, 1999. The first drafts were drawn up from 1995 to 1997 in the wake of the Berlin Ordinance. In fact it was not until June of 1998 that it was decided by the *Tabla Cívica de Energía* to work on a similar document for Barcelona and to present it to the plenary of the City Government. It was discussed by the interested parties involved, trade associations, architects, engineers, installers, developers, etc. as well as all the political parties. The main difficulties encountered were in changing people's attitudes and the reluctance that persists concerning renewable energy sources. Housing developers are the most hesitant to draw up projects and calculate profitability figures that are not required of other buildings and to realize that costs arising from lifts and lighting for parking installations can be fully defrayed.

An installation in a municipal sports hall

The aim of the city government is to incorporate renewable energy in all installations where it is feasible and where satisfactory output is possible. The Guinardó district sports hall is one example. It was finalized in September, 1997, and has been approved under the Ordinance and will facilitate the accreditation of new installations in the future.



The building has 45 solar collectors, covering an area of 76.5 m² and 3 storage tanks holding 2,000 liters each, for the production of hot water for individual use. It has a gas-fired boiler that is used as a back up system. The energy produced is enough to heat 5,000 liters per day to a temperature of 45° C. Energy meters have been installed for purposes of monitoring the performance of the system. Thanks to this installation, 12 tons of CO₂ are not released into the atmosphere and 5,300 Nm³ of natural gas are conserved. The developer of the installation was the city of Barcelona, more particularly the Technical Department of the Horta-Guinardó

district, which funded the total cost of € 54,200, of which € 17,000 was spent on the solar collectors, made up of 45 panels at a cost of €375 per unit measuring 1.7 m².

EVALUATION AND PERSPECTIVES

Similar to any other public ordinance, there were a number of amendments tabled for this particular Municipal Ordinance before it was finally adopted. Some amendments were adopted and others were overridden. One of the proposed amendments that was accepted was presented by a group of organizations whose aim was to postpone the Ordinance's compulsory nature for one year. It must be said that many buildings under construction already comply with the Ordinance, in particular all the housing units being built by the Municipal Housing Board that acted as a forerunner in the sense that when the Ordinance was being drafted, the city had already been considering its application. The result was that the 460 housing units that were recently delivered already have the aforementioned installation for the production of hot water for household use, using solar collectors that comply with the requirements of the Municipal Ordinance.

Today Barcelona is participating in a Take-off Partnership devised by the European Union, along with other local authorities, municipalities, regions and the private sector, for the development of a 50,000 m² collection installation. The campaign will identify 100 communities that are striving to meet 100% of their energy needs from renewable sources, preferably using a combination of different technologies, such as solar, wind power, etc. An urban community could be defined as a group of buildings or a neighbourhood of a city. The projects that meet these characteristics will be eligible to be proposed for the ALTENER programme.

FOR FURTHER INFORMATION

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