

PHOTOVOLTAIC

MÜNCHEN (Germany)

Photovoltaic energy is not really a very new technology. Although its principle is known for many years now, quite a lot of obstacles hinder its full market penetration. One of the possible remedies (besides new developments making the technology cheaper) can be either large-scale fabrication of solar panels or innovative policies on urban level, trying to make this technology achievable for many more people than before. The City of München is trying to help innovative technologies, such as solar power, establish themselves, by means of subsidies, co-operation with the trades involved, and public relations work

GENERAL ASPECTS

München, founded in 1158, is today Germany's third-largest city, with 1,300,000 inhabitants, and the leading commercial centre of southern Germany. The capital of the State of Bavaria lies on the river Isar; it has precious historic monuments from the Baroque (Nymphenburg Palace) and Renaissance periods, as well as some of Europe's leading museums (German Museum of Science and Technology) and art collections. The electrical engineering and automotive industries are represented here.

Climatic data :

Hours of sun per year:	1,740
Solar radiation:	1,127 Wh/m ² a



CONTEXT

In München, the foundation stone of a committed municipal policy of promoting renewable sources of energy was laid in the late Eighties, when the energy savings concept was drawn up. As part of this concept, the technical potential for solar heat (380 GWh/a) and electricity (1,900 GWh/a) systems was determined. The City gave the municipal utility, Stadtwerke München, (SWM), which at the time was still a separate section of the city administration, the responsibility for implementing this. In early 1998, this enterprise was converted into a private limited company, so that SWM became more independent.

In 1997, an additional instrument was created, in the shape of the München Energy Agency (MEA), which has assumed an important role in implementing the energy-saving programme, in particular with regard to small and medium-sized enterprises. The focus of support activities in München was at first on solar thermal systems, which have been supported (pilot projects and widespread subsidies) since the early Nineties. Since 1995, photovoltaic systems are also the target of several subsidy measures.

EXPERIENCE OF MÜNCHEN

The “Photovoltaic Age” was initiated in 1995 with the project “Solarstrom München” [“München Solar Power”]. Some components of this programme, and other photovoltaic projects, are described briefly below, namely:

- München Solar Power
 - Assistance to residents by purchasing solar-panel kits wholesale and on-site advice
 - Full-cost compensation for solar electricity, of up to 1 Eur per kWh
 - Building systems with citizen financial participation
 - Supervising and quality control of private photovoltaic units
- München Solar Service
- Major photovoltaic project at the new Trade Fair Centre

München Solar Power

Wholesale purchase of solar-panel kits

In late 1995, the München city council decided to promote electricity generation from solar panels in a very special way. In order to obtain a very favourable price for individual residents, two hundred standard 1.1 kW_p units were purchased, and sold without any mark-up to private electricity customers of SWM in the course of the year. Because of the great interest, further wholesale purchases were made. From February to December, 1996, SWM advised 320 of their customers comprehensively and impartially on the installation of the kits. In on-site consultations, the location, energy yield to be expected, and integration into the existing system (reversing meter, earthing system for protection against overvoltage, etc.) were discussed. In order to make rapid and inexpensive installation possible, a special campaign was launched in co-operation with the München electrician’s guild, in which the customers were informed about interested and qualified electrician’s firms. Both the customers and the craftspeople profited from this co-operation, since the latter were able to improve their know-how in the field of solar power.



Solar electricity payment

The operators of the solar-panel units signed ten-year supply contracts with SWM, which specified a full-cost compensation of up to 1 Eur per kWh for solar power, among other things. The operators must be standard-rate electricity customers of SWM. The maximum size was limited to 5 kW_p. No more applications have been accepted for this subsidy programme, which was launched on 1 Jan. 1996, since 20 March 1999. The reason for this is the restructuring and more private-enterprise orientation of SWM. About 800 kW_p of small units were installed as part of this programme. When the larger shared



units and the 1-MW_p system on the new trade-fair buildings in Neu Riem are added, a total of more than 2 MW_p of solar panels have now been installed.

Financial participation by residents

In the autumn of 1997, SWM planned, built and financed a 37-kW_p solar-panel unit in the course of the renovation of the roofs of the Pasinger Fabrik culture centre. Electricity customers of SWM were able to purchase shares of 250 W_p at a price of about 1,970 Eur. The shareholder is paid roughly 1 Eur per kilowatt-hour generated; but about 7% of this is retained for insurance, reserves for repairs, and for maintenance. For the shareholder, this means that the price of the share will be repaid in ten years, with 3% interest, for annual generation of 850 kWh per kW capacity. After that, SWM will pay the shareholders the statutory rates for supply then in force for another five years. All the shares of the Pasinger Fabrik solar array were sold within a relatively short time. Because of the success of this project, a second one is planned.

Supervising and quality control of private photovoltaic systems

As part of this programme, a bachelor's thesis was commissioned, which was to include quality control to monitor the efficiency, and a study of the effects of solar-panel units operating in parallel with the network on SWM's electricity supply. Good systems are published in SWM's customer magazine for comparison.

München Solar Service

In addition to photovoltaic systems, SWM has been promoting the use of thermal solar energy actively for several years. Only the "Solar Service" is considered here. This Solar Service is offered to home-owners, landlords, housing associations, and municipal establishments. SWM handles the entire project management, from consulting to completion, including customized financing arrangements. In the case of single-family and two-family houses, SWM provides advance financing of the solar unit, with the procurement costs being repaid in monthly instalments over up to eight years. In co-operation with the crafts guilds, SWM offers a solar-energy package comprising 6 m² of flat collector and a 400-litre water storage tank. The purchase costs are about 5,000 Eur; depending on the availability of other subsidies, the home owners pay a total of 3,300 to 4,100 Eur. The München Solar Service guarantees the amount of heat provided by the solar collector. And the services provided also include regular maintenance and immediate correction of malfunctions during the contract period.



Major solar-cell project

SWM are providing 14% of the costs of the 1,016 kW_p solar-cell installation of the new München Trade Fair Centre, whose roughly 1 GWh annual output of electricity covers 4% of the Centre's energy consumption, and eliminates about 1,000 tons of CO₂ emissions per year. New solar-cell modules with extremely high resistance make it possible to feed all the electrical energy into a central converter and convert it into alternating current. Costs of the entire project are estimated at 7 million Eur; 20% of this will be borne by the Bavarian Ministry of Commerce, and 10% by the Federal Ministry of Research. The regional power utility, Bayernwerk, holds 72%, and Siemens and SWM are the other main shareholders.

Public relations

In München, great importance is attached to public relations work. This includes such things as the München Solar Days, which are held each May in locations such as the Marienplatz in front of the historic Town Hall. They consist of an exhibition, lectures, a trade fair, and cultural activities. Public relations in München also include work with school (the "Sun in School" campaign), and advertising (folders and press releases), as well as small symbolic examples of thoroughgoing use of solar energy. For example, in München the timetable displays of the public transport system are lighted at night by means of solar energy stored in batteries during the daytime.

EVALUATION UND PERSPEKTIVEN

The objective of the wholesale purchase of solar-cell modules by the municipal utility was to help this relatively new technology establish itself on the market rapidly by inexpensive prices. In 1991, the erection of a unit still cost 12,500 to 14,500 Eur per installed kW_p on average, while in the first year of the "München Solar Power" programme this dropped to about 7,500 Eur.

The "München Solar Power" programme is a great success. Including the shared installations and the 1-MW_p installation on the exhibition halls of the Trade Fair Centre in Neu Riem, over 2 MW_p of solar-cell systems are now installed. The solar-cell market in München is well established, thanks to the subsidizing of solar-cell arrays of up to r kW_p by means of full-cost compensation of up to 1 Eur per kWh supplied to the grid. Long-term sales perspectives have been created for suppliers in this market. Numerous customers run both a solar-cell array and a solar heat collector for providing hot water.

In the future, promotion of market penetration by renewable sources of energy will have to be undertaken by the city administration itself. Due to the liberalization of electricity markets, SWM is orienting itself more to commercial criteria again, and therefore reducing its subsidy measures sharply. The city is going to expand its promotion of solar cells, and has set aside about 380,000 Eur for this purpose in its budget for 2000.

FOR FURTHER INFORMATION

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