

THERMAL SOLAR ENERGY

ULM (Germany)

Although the quality of the equipment and the efficiency of thermal solar systems were improved a lot during the last years, this kind of energy production has not achieved an important share of the market. Due to the policy of cities there are couple of good examples for the diffusion of thermal solar systems in Europe. To help renewable sources of energy and innovative technologies establish themselves in the marketplace, the City of Ulm relies on subsidies, market impulses, and public relations. In addition, it has implemented numerous pilot projects of its own.

GENERAL ASPECTS

Ulm is located at the mouths of two tributaries of the Danube, the rivers Blau and Iller. It has 110,000 inhabitants, and is a regional economic centre of southern Germany. The city has gained an international reputation mainly through the automotive industry (Daimler-Benz); but its universities, research institutes, and medium-sized companies (mechanical engineering) also play a major role.

Climatic data:

| | |
|--------------------------|--------------------------|
| Hours of sun per year: | 1700 |
| Solar radiation: | 1100 Wh/m ² a |
| Annual mean temperature: | 8,5 °C |



CONTEXT

The Stadtwerke Ulm/Neu Ulm GmbH, wholly owned by the Cities of Ulm and Neu-Ulm, was restructured as of 1 Dec. 1998 into SWU Stadtwerke Ulm/Neu Ulm GmbH, an administrative holding company with two subsidiaries, SWU Energie GmbH and, for public transport, SWU Verkehr GmbH. Minimizing impacts on the air, soil, and water, and thus practising sustainable business, forms part of its corporate philosophy. Besides its own integrated municipal energy system, SWU has also implemented ones with other local authorities in the area, and shared in the costs. As a local energy supplier, SWU has set itself the goal of promoting and spreading renewable energy concepts. It is considered a matter of course to advise people on energy questions. For example, potentials for saving energy at home are pointed out in lectures and specially co-ordinated campaigns. Its own projects in the fields of solar cells and solar heat, which were partly subsidized with EU funds, and relatively high payments for solar electricity fed into the grid, illustrate SWU's commitment.

In the field of public transport, it tries to achieve a change in the behaviour of the public by a more attractive service, so as to obtain greater acceptance for local public transport, and thus make a substantial contribution to reducing pollution.

EXPERIENCE OF ULM

SWU tries to reach residents and encourage them to get involved in environmental protection by targeted programmes. Publicity brochures inform about energy-saving measures in general, and provide an overview of SWU's environmental-protection activities. Some of the programmes in the field of solar-energy utilization are described briefly below.

Solar thermal energy

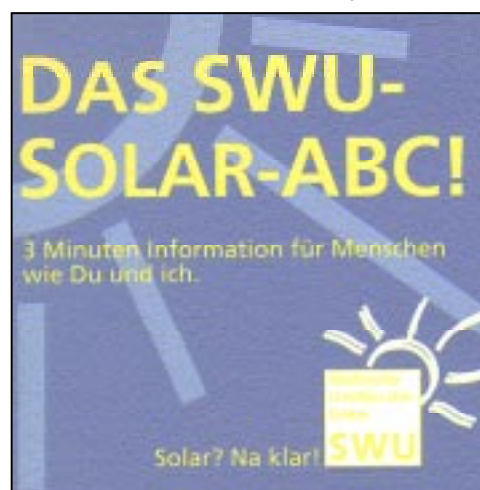
- Activities of the Solar Foundation
- Solar-assisted district-heating schemes

Solar cells

- Increased payment for solar power
- "Happy Electricity" – solar-cell array on the football stadium

EU-subsidized solar-heat and solar-cell systems

- Decorative cladding design (solar cells)
- GRS ("Guaranteed Results from Solar collectors")



GRS (Guaranteed Results from Solar collectors)

Since there was not much experience with solar collectors at first, and it was difficult to estimate the actual amount of heat that would be supplied, in 1993 several municipal utilities got together, co-ordinated by the ASEW¹ office, with experienced planners and well-known manufacturers to carry out solar-collector projects with "guaranteed results".

In GRS projects, the annual amount of heat supplied by a solar collector is guaranteed by the manufacturer. This makes it possible to perform precise cost-benefit calculations, and to plan customized systems by means of recognized simulation programs. On-site measurements and empirical data complete the estimate of the heat yield from the thermal solar unit.

In case the actual heat yield should fall below the guaranteed value, a modus for compensating the operator or investor for the shortfall is agreed. This exact planning largely eliminates overdimensioning, so that the solar rate of coverage increases, and the costs for the complete system are reduced.

In 1994, the Ulmer Wohnungs- und Siedlungsgenossenschaft mbH (UWS), a local housing association, had a service-water unit with 120 m² collector area set up in the Heilmeyersteige. This unit, which has a rate of coverage of 70%, supplies 38 residential units, having about 80 residents, with hot water. The unit has a 12 m³ buffer-storage tank and a 1.5-m³ large stand-by section reheated with a gas burner.

Solar-assisted small-scale district heating

In Ulm-Jungingen, 150 m² of flat collectors assist a district-heating scheme that supplies heat for heating and hot water to a residential area with 86 residential units. Although the majority of the heat demand is covered by a combined-heat-and-power plant controlled by heat demand, the heat obtained from the solar collectors always has priority. The three storage tanks connected in series are filled according to the existing heat conditions. They have a total volume of 6 m³, and are insulated with bulk biomass material (spelt husks). The condensing boiler is connected in parallel to the buffer-storage tanks, and covers peaks of heat demand. The CHP-plant and the condensing boiler are natural-gas-fired.

¹ An association of municipal utilities

Payment for solar power

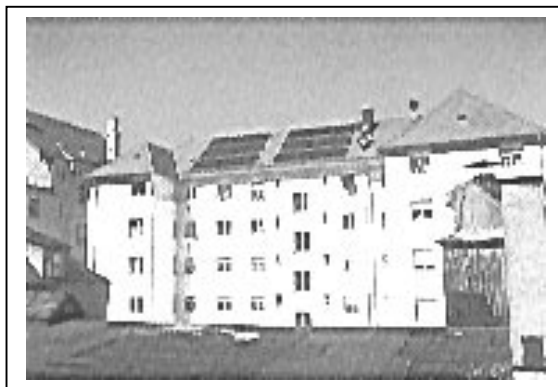
In its electricity service area, SWU subsidizes solar-cell units by paying up to 0.9 Eur per kWh for electricity fed into its mains. The supplying customer receives a free consultation and a secured contract for the electricity input. The specific high price for solar power is due to the high capital costs of solar-cell systems. The full-cost compensation permits cost-oriented operation of the unit with a modest interest yield on the capital invested.

By agreement with the State regulatory authority, SWU may apportion the increased expenditures for purchasing solar power among its standard-tariff customers (max. 0.3 pfennigs per kWh). In order to reduce the capital costs, the operator must claim any government subsidies available. These are deducted in determining the full-cost compensation.

Solar Foundation

In order to promote renewable sources of energy, the cities of Ulm and Neu-Ulm and SWU founded the Ulm & Neu-Ulm Solar Foundation [*"Solarstiftung Ulm/Neu-Ulm"*] in 1996. From the interest earned by the foundation's capital, and an annual contribution of 150,000 Eur by SWU, there are about 230,000 Eur of grant money available each year for solar-energy projects. In 1998, expenditures on subsidies for the purposes of the foundation came to about 210,000 Eur. The focal points of the foundation's work include:

- Introducing solar thermal units in practice
- Consciousness-raising among planners, craftsmen, and users, as well in schools
- Market-oriented development of photovoltaic applications
- Development of integrated energy concepts
- Supporting firms and institutions of the solar-power industry located in the region



"Happy Power" – solar-cell array on a football stadium

SWU has thought up a special concept for financing the more expensive electricity generated with solar energy or water power. Instead of installing a solar-power unit themselves, environmentally aware residents can purchase electricity which is generated in the solar-power system of the Donaustadion [*"Danube Stadium"*] or in the hydroelectric plants on the Danube and Iller, for example. They can choose between:

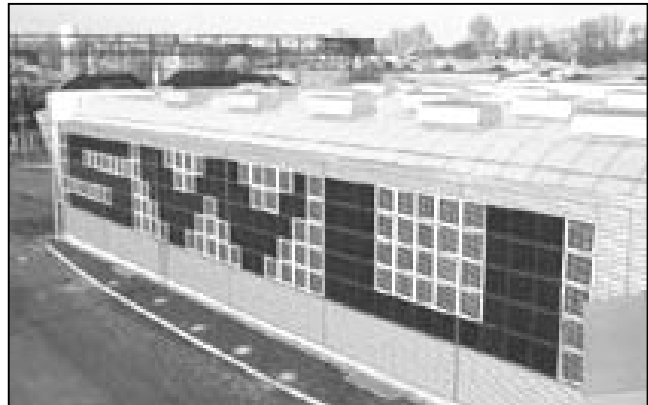
- partial use of Happy Power [*"Glücklicher Strom"*] in units of 34.5 to 138 kWh, at a price of 2.5 to 10 Eur per month for solar electricity,
- or complete use of Happy Power, with a surcharge of 7.5 pfennigs per kWh, which amounts to about 140 Eur per year for an average electricity consumption of 3,750 kWh.

Since this electricity is generated directly in the vicinity of Ulm, every user is making a contribution to improving the quality of life in the region. 12,000 kWh are generated annually in the Donaustadion. The amount of "Happy Power" available will be multiplied when the hydroelectric station planned for the Danube barrage at Ersing comes on line (450,000 kWh). Thus, if the people participate, local energy producers will be given the possibility of using environmentally compatible sources of energy such as solar or wind power.



Decorative cladding design

An aspect of the use of solar cells that has been largely neglected to date is their use for advertising purposes when designing building cladding. By using solar-cell modules of different colours, it is possible to reproduce a company name, for example. At present, the modules can be supplied in red, green, golden, and blue shades. A particularly notable example is the solar cladding of the new operating centre of SWU Verkehr. Steel-blue and dark-blue modules were used, which harmonize best with the aluminium cladding. The design and erection of the installation, which is a first in Europe, was financed to 40% with grants from the European Union's Thermie programme. The purpose of the project was to test the technical feasibility and the service life of a photovoltaic façade, and the reliability of photovoltaic systems by direct coupling to the direct-current network for the tram lines.



EVALUATION AND PERSPECTIVES

The approach of the City of Ulm and/or of the SWU group of companies features a combination of subsidy-oriented services (increased payment for solar power, government assistance for solar thermal collectors) and market-oriented ones (Guaranteed Results from Solar collectors, one-stop solar thermal systems, marketing of electricity from renewable sources of energy). Both serve to speed up the introduction of solar energy use onto the market in Ulm, so as to contribute to a significant reduction in environmental impacts.

The application of both elements, and the willingness of the SWU group to invest in new, innovative technologies, such as the use of coloured solar cells, demonstrate a way in which cities or municipal power utilities can promote solar energy.

FOR FURTHER INFORMATION

STADT Ulm
 Fachbereich Stadtentwicklung und Umwelt
 Herr Popp
 Postfach
 D - 89070 ULM
 Tel: +49 731 161- 60 82
 Fax: +49 731 161- 16 89
 E-mail: Solarstiftung.Ulm_Neu-Ulm@t-online.de

SWU Energie GmbH
 Herr Walter Engelke
 Karlstraße 1
 D - 89073 ULM
 Tel: + 49 731 166-1530
 Fax: + 49 731 166-1509
 E-mail: info@swu.de

This case study was prepared by Energie-Cités in co-operation with the municipality of Ulm/Neu Ulm and SWU Energie GmbH. It received funding from the ALTENER Programme of DGXVII of the European Commission.

