

# SOLAR LOCAL DISTRICT HEATING

# Kungälv Sweden

*Despite greatly improved equipment quality and higher system efficiencies, solar thermal energy applications have not yet succeeded in capturing appreciable market shares in Europe. However, thanks in particular to local authority energy and climate protection action plans and their implementation, there are now good examples at the local level. The town of Kungälv has already been working since 1980 to utilize solar energy for heating purposes, but the real breakthrough only came in 2000. The town is now successfully operating a local district heating plant comprising a biomass unit and the largest solar thermal facility in Europe.*

## THE TOWN

Kungälv (15,000 inhabitants) is located on the west coast of Sweden to the north of Göteborg, on the Nordreälv river in the Bohuslän region. Kungälv has a thousand-year history and is of great art history interest.

The industrial estate of the town has attracted automotive accessory, tobacco processing and chemical industries.

### Climatic data:

Annual solar radiation: 1200 kWh/m<sup>2</sup>

Annual mean temperature: 8°C



## CONTEXT

Kungälv is a member of the Ecocities association to which some 60 Swedish municipalities belong. The main purpose of this association is to intensify cooperation among local authorities on environmental and energy issues. Many municipalities in Scandinavia have already been operating environmentally oriented energy policies since the 1980s, and Kungälv is no exception. A new energy plan was developed in 1998 setting targets for the year 2005, and the town is confident that this will yield even more vigour and implementation successes. Goals include a general reduction in energy demand and an intensified use of renewable energy sources, and also a more balanced electric demand, no use of electricity for heating purposes, and a reduction of environmentally hazardous substances. From 1995 baseline values, the following targets have been set for 2005:

- > Emissions reductions of 20% for CO<sub>2</sub>, 30% for NO<sub>x</sub> and 50% for SO<sub>2</sub>,
- > 50% reduction of oil consumption for heating purposes and 10% reduction of total electricity requirement (industry excluded),
- > petrol and diesel fuel consumption are not to increase, and
- > electricity generation from wind energy is to be increased by 30%.

## EXPERIENCE IN KUNGÄLV

Kungälv planned a solar thermal project for the first time in 1980; in that scheme, the heat was to be stored in the mountains. However, that project failed due to a lack of financial support. In the mid-1980s, a renewed effort was made to analyse the opportunities for intensive solar thermal use, this time in combination with a biomass-fired heating plant to supply local district heat to the town. A long and troublesome path to implementation remained. Initial planning work for the 10,000 m<sup>2</sup> solar facility realized today then started in 1993. In 1996, the town administration decided to first construct the Munkegårde biomass heating plant while at the same time establishing the local heat supply system, which finally commenced operation in autumn 1997, replacing 38 local oil-fired systems. This biomass facility was erected without government support. It comprises a 13 MW wood-chip-fired boiler (including exhaust heat recovery), two 12 MW oil-fired boilers and a 1,000 m<sup>3</sup> buffer storage. In winter, the wood chips produced from forestry residues are supplied daily to a storage facility close to the heating plant from distances of up to 50 or 60 km. One-year contracts are awarded to suppliers on the basis of an annual call for tenders. The ash arising from the heating plant is strewn in the surrounding forests.



CIT Energy Management AB (a subsidiary of Chalmers Industriteknik CIT, a foundation of Chalmers technical university), ARCON Solvarme A/S and Sunstrip AB (a manufacturer of solar collectors) erected the biomass heating plant in conjunction with the 10,000 m<sup>2</sup> solar thermal facility, with CIT Energy Management AB coordinating the project. The goals of the solar facility are to increase the capacity of the local district heat system and to contribute to implementing Kungälv's energy plan. A further decisive motivation was the wish to create a PR and demonstration project for innovative technologies (~8% improved efficiency due to antireflection coating of the glass and sputtered absorber) and for the ISES Solar World Congress due in 2003 in Göteborg.



Kungälv Energi AB (Kungälv's municipal energy supplier) installed and operates the facility in its capacity as owner. The plant is currently (September 2001) the largest solar thermal facility in Europe. Although it was originally planned to start up in April 2001 the facility already commenced operation in August 2000. In order to improve the recording of energy flows from the collectors and heating boilers to the storage tank and from there to the consumers, an energy measurement system was set up for the district heat. All heat flows are thus measured continuously by the control unit of the plant.

In a second construction phase of the local district heat system, the piping network has now been expanded and a second pellet-fired boiler installed at a site in Ytterby/Stålkullen. This heating plant also includes a solar thermal facility which, however, with a surface area of 700 m<sup>2</sup>, appears small compared to the facility in Munkegärde. The Ytterby facility was completed in August 2001.

The investment costs of the 10,000 m<sup>2</sup> solar facility figured Euro 2.218 million, to which the Swedish government and the European Union provided a total of Euro 0.79 million in grant support.

## EVALUATION AND OUTLOOK

Kungälv's local district heat system currently provides about 50% of the energy required in Kungälv for space heating and hot water heating. Some 200 single-family houses and 200 further buildings including schools, industrial buildings and residential apartment blocks had been connected to the local district heat network by autumn 2001. The heat supplied by the local district heating plant in Munkegärde figured 84.4 GWh in the year 2000, of which 67 GWh (ca. 80%) came from wood chips, 17.2 GWh from oil and 0.2 GWh from solar energy. 2001 is the first year in which the plant will have been fully completed and in operation for a full year. In that year, 4 GWh are to be produced from solar energy – a target that appeared achievable when the last figures were available in mid-2001. For the facility in Ytterby/Stålkullen, simulation figures indicate that 1.3 GWh heat will be produced in the first year of operation, of which 20% will come from solar energy.



The public response to the local district heat supply system and the technologies utilized has been positive throughout – within one year more than 500 visitors have come to take a tour of the solar facility.

## FOR FURTHER INFORMATION

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This case study was prepared by Energie-Cités in co-operation with the City of Kungälv. It received funding from the ALTENER Programme of DG Transport and Energy of the European Commission.

