

LARGE SOLAR THERMAL SYSTEMS - DEVELOPMENT AND PERSPECTIVES



With existing and future national and European goals and obligations for use of renewable energy for heating (and cooling), large-scale solar heating is an interesting option in future district heating in Europe. Studies show that based on the policy development there is a growing potential for solar heating in district heating. And Denmark is at the forefront both in regards to operational systems (sites) and production facilities (ARCON A/S).

The major strengths of solar heat are: it is renewable, it is available everywhere, it does not smell or make noise, and – not least – it is environmentally friendly with low CO₂ emissions. And with growing oil prices, solar thermal district heat production has also become a very cost effective solution.

BACKGROUND

Large-scale solar heating systems were introduced in the late 1970's due to the interest in developing solar heating systems with seasonal storage. Together with Sweden and the Netherlands, Denmark had a leading role in the early demonstrations. In the 1990's, the interest in large-scale solar heating increased in Germany and Austria, and about 100 new plants with more than 500 m² of solar collectors have been put into operation since the mid-90'es. At present there are about 120 plants with more than 500 m² of solar collectors in operation in Europe. Out of these, 10 are placed in Denmark.



Solar heating plant of Brædstrup

The Danish large-scale solar heating plants are used in small district heating systems and all collectors are ground mounted. The first Danish plant, 1,000 m² of ground mounted collectors, was built in 1987. And today 20 years later the plant still produces heating for the citizens. In 1995 Marstal Fjernvarme decided to establish about 8,000 m² solar collectors and a 2,100 m³ water storage tank to cover up to 15% of their heating load. The plant is now extended to 18,300 m² (12.8 MW(th)) and so far is the largest solar heating plant in the world. More have joined since then; a recent one being Brædstrup with 8,000 m² delivering 4 MW a year.



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MARKET DEVELOPMENT DENMARK

As seen in figure 1, the market for large solar thermal systems has been up and down for the last 20 years. Right now, however, the market seems to take off - at least in Denmark.

SYSTEMS LARGER THAN 1.4 MW (2000 M²) INSTALLED CAPACITY / MW

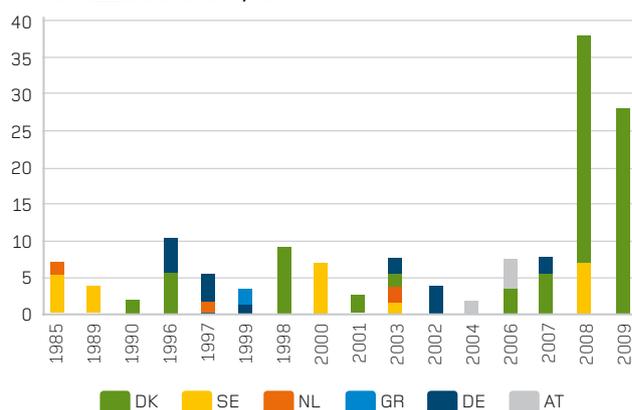


Figure 1. Installed large systems (only systems larger than 4 MW (2,000 m²) included.

Most of the capacity (90%) shown in fig. 1 is installed in central district heating systems.

There is a substantial number of new systems in the pipeline in Denmark. In 2008 44,000 m² (30.8 MW) is planned, distributed the following way:

Location	Output MW	Size (m ²)
Copenhagen (VEKS)	14.0	20,000
Gram	7.0	10,000
Strandby	5.6	8,000
Hillerød	2.1	3,000
Sønderborg	2.1	3,000

In 2009 a very large system will most likely materialise in the town Dronninglund consisting of 40,000 m² (28.0 MW).



DANISH AND EUROPEAN PERSPECTIVES

DANISH PERSPECTIVES

In the official "Strategy for solar thermal" by the Danish Energy Agency, a vision is to cover 10% of the district heating load by solar thermal in 2030. This corresponds to 2.7 TWh (10 PJ), requiring an installed capacity of approx. 3.2 GW (4.5 mill m² of collectors). To reach this capacity an annual growth of 12-13 % from the 30.8 MW in 2008 is needed - on an average more than 150 MW / 220,000 m² must be installed per year to reach the vision.

Looking another 20 years ahead: in 2050, the potential solar thermal district heat production is estimated to be close to 40% of the district heating load, corresponding to 7 TWh (25 PJ) from 10 mill. M² of collectors.

EUROPEAN PERSPECTIVES

The European Solar Thermal Technology Platform was established in 2006. One of the working groups is dealing specifically with district heating and cooling. This group "2E" is right now making a study on the potential solar thermal contribution to the district heating production in Europe.

In the draft document, so far released from the working group, a long-term target of at least 5% contribution from solar is given. This corresponds to 28 TWh (100 PJ).

Not all of the abovementioned systems are decided upon yet, but the chances are high that all of them will be established in the coming years. And it will only be the beginning: we will see even more systems in the coming years - see "Danish and European Perspectives".

The background for this expected positive market development is the increasing fossil fuel energy prices and the decreasing solar energy prices: While the price of fossil fuels and biomass has increased dramatically lately, the costs for heat delivered from large solar thermal systems have been reduced by 30% during the last 10 years. The result is that solar thermal district heat production is now - in many cases - very cost effective. Furthermore, the use of solar offers flexibility in a system with combined power and heat production contribution, having a high fraction of wind generated power .

DANISH KNOW-HOW

One of the major players in this market is the Danish company Arcon, which was acquired by SolarCAP A/S, owned by VKR Holding, in 2007 and is a world leader in large solar heating systems. The company was founded in 1974 and is located in Skørping.

Arcon is among the top three companies in the world in regards to knowledge about projecting and building large system for central heating purposes. The annual production capacity is more than 50,000 m² and by the end of 2008 the capacity will exceed 100,000 m².

ARCON estimates that the Danish market for large-scale solar heating is more than 5 mill m². So the expectation for 2008 is only the beginning of a fast growing market.

The owners of the decentralised central heating plants have become more aware of the benefits from solar thermal as part of their plant. It provides the citizen with cheaper heating and reduces the pollution, particularly from CO₂.

The growing demand combined with the political awareness creates a good framework for potential growth. But it is important that we make sure that no regulations obstruct the development. The Barcelona Agreement, the coming EU RESHC Directive and national policies point in one direction: we have to use more renewable energy - also for heating purposes.

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The Climate Summit (COP15), which is to be held in Copenhagen in 2009, is a major opportunity to show the world that we are focusing on and fully committed to solar heating – a small niche where Denmark is still dominating the market. There is a huge potential based on our long tradition for central district heating and the use of renewable energy sources.

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CITY OF BRÆDSTRUP

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- 8000 m² (641 collectors)
- Large scale benefits in regards to investment
- Delivers 4 mio. kWh a year
- Price for 1 kWh solar heating 17.5 øre (0,02 EUR)
- Annual savings consumer 675 DKK (91 EUR)
- Expected life time of system exceeds 20 years
- Saves the environment for 4,500 tons of CO₂ a year

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Development of power producing companies is an integral part of BWSC's activities, and BWSC is part owner of a number of international power production companies also undertaking long-term Operation & Maintenance Contracts.

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