Danish model for implementation of SDH in CHP-systems
Denmark

Contacts

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Model description

The Danish model for SDH implementation in CHP systems has been developed gradually since 2004.
The first step was a change in the feed in tariffs for CHP-plants where plants with more than 5 MW_{el} should change from a triple tariff to the Nordic electricity market. That meant that natural gas fired CHP-plants might stop in summer periods and heat would be produced by gas boilers.
The next step was calculations of the economical feasibility and the environmental consequences for a single utility. This was done for Braedstrup, one of the most efficient Danish plants, and the result was a lower heat production price and reduction in emissions. One reason for that is a very high tax on natural gas (app. 25 €/MWh at that time).
The third step was that the Danish Government in 2005 accepted to let a commission investigate the social economic consequences by integration of solar thermal in natural gas fired CHP-systems.
The commission with the Danish grid operator, Energinet.dk, in charge came up with a report in March 2006. The report was based on the calculations in Braedstrup and simulations (four scenarios) done by Energinet.dk, and the result was that SDH in natural gas fired CHP-plants, could be an economically and environmentally good solution for decentralised natural gas fired CHP-plants and the market was estimated to 300.000 m^2.
The fourth step was support from Energinet.dk to the first two full scale demonstration plants in Braedstrup and Strandby, both with 8000 m^2 ground mounted solar thermal collectors.
After that more district heating companies were interested and feasibility calculations showed that SDH-plants could be implemented without support. The reasons for that are:

- high tax on natural gas as earlier mentioned
- low return temperatures (30-40 ^oC) and thus high solar production in Danish district heating systems
- cheap financing (municipal guarantee for loans and real interest about 3%)

Besides that, natural gas fired CHP-plants are only allowed to change fuel to biomass if heat is coming from a biomass fired CHP-plant.
The fifth step has been to make systematically exchange of experiences by visits and telephone support to newcomers especially done by Marstal, Braedstrup and Strandby district heating and setting up

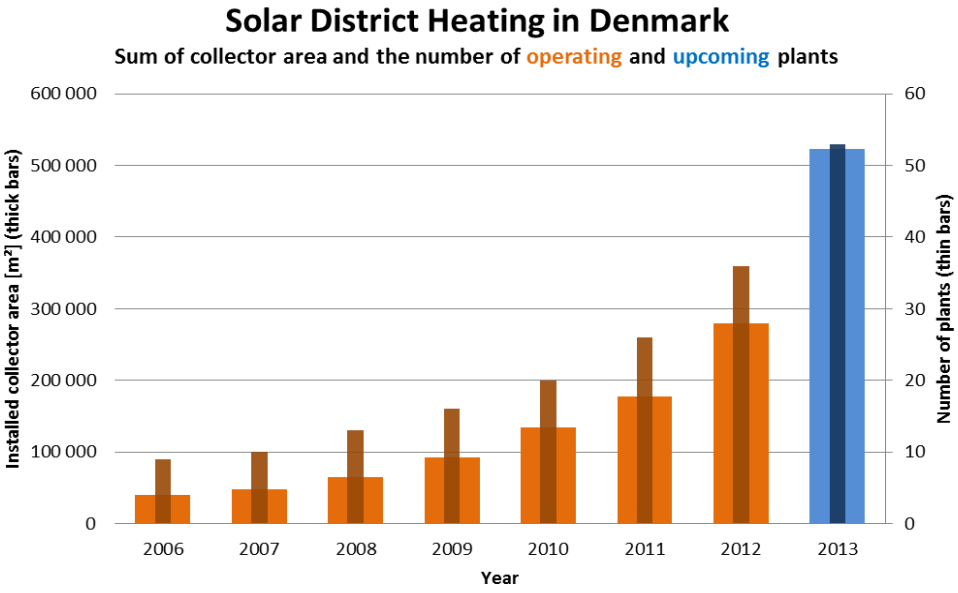
- “The solar heat group” for utilities under Danish District Heating Association (two meetings/year) and
- a network for large scale solar heating plants for utilities and suppliers (one meeting/year)

Since 2009 the district utilities have been forced to show fuel savings every year. Solar thermal counts as fuel saving and the first year production has a value of 35-45 €/MWh produced.

Roles of the different actors
Stakeholders involved in the model operation are

- the district heating utilities
- the municipalities
- consultants
- suppliers

The district heating utilities are decision makers and building owners. They are normally allied with an independent consultant, who takes care of the implementation process including authorities' permissions (local plan, permission according to the law about heat planning and environmental permissions), feasibility calculations and optimisation of plant size and water storage, tendering, contracts, supervision during implementation and commissioning.
An important cooperation partner during the implementation process is the municipalities, because they make the final decision according local planning, heat planning and environmental permissions.
The suppliers give their bids in the tendering process and guaranties for both the solar panels (usually 5 years) and the efficiency curve.
During the implementation process, meetings are held regularly. First with utility and consultant, later on with utility, consultant and all suppliers. During the implementation, meetings are typically held every second week. During the meetings technical and other problems are solved.
Below is seen the development in the number of SDH plants in Denmark and the total installed collector area, for the operating plants and the upcoming plants in 2013.



Real time production and historical production from several Danish plants can be found at www.solvarmedata.dk.

Swot analysis

Strengths	Not depending on limited economical support schemes. Visible non-polluting renewable energy plant.
Weaknesses	It's all capital costs. Depending on high fossil fuel taxes. Max 20-25% of heat production can be covered in a typical system setup (see opportunities). Sometimes has to compete against "free" heat from surplus heat from industry and heat from waste incineration.
Opportunities	Extend solar coverage by including long term storage. New district heating and cooling plants in Southern Europe.
Threats	Drop in fossil fuel prices or taxes. High land prices. It is linked to more district heating. Inappropriate restructuring of taxes; e.g. if the taxes were transferred from the fuel *consumption* to the *end use* without compensation, it will mean that there would be taxes on solar heat.
Improvements/recommendations/lessons learned	The concept works, but better price performance is continuously necessary.

Replication potential
The model can be replicated in other countries, but the framework conditions are never the same, so local adoption has to be part of the replication.
Key requirements are more district heating and cooling networks.

Links to web site and/or documents for more detailed information
www.solvarmedata.dk