

Brødstrup: Development and demonstration of a highly efficient and low CO₂ emission decentralised district heating system utilizing the flexible and intelligent energy system

In case of large (centralised) combined heat and power plants the primary energy factor can be lower than 0.5 due to a large usage of surplus heat from waste incineration, industry and efficient power production. Decentralised district heating plants on the contrary do have rather high primary energy factors due to a compulsory use of natural gas and the absence of surplus heat from industry and large-scale CHP production.

Brødstrup, Ring Søpark 1 will aim at developing and demonstrating a low resource system/concept, which with regards to low resource factors/primary energy factors will be at the same level as large central district heating plants. The entire district heat supply chain from production to use will be optimised and demonstrated. The project will include efficient heat production with renewable energy, optimising the district heating system (reducing heat loss by using extra insulated pipelines, optimising dimensions and length of the pipelines, better and more intelligent control systems), and involving the users.

District heating for Brødstrup, Ring Søpark 1

A project like this with decentralised solar energy placed at various sites in the area has never been done before. Similarly, CO₂ heat pumps inserted in a district heating system must be considered as innovation. The outlined district heating project is thus to a great extent a development project as no similar, optimised CO₂ neutral systems have ever been built before. Therefore the system can be characterised as 2nd generation of district heating. Consequently, a more detailed analysis is needed for development of technological and feasible solutions. Some of the components are well-known technology, but what is new is the combination and the interaction between them and the controlling system. This is innovation and necessitates an extra effort as a pilot project.

The district heating system developed in this phase will supply both existing building (60) and new buildings (100).

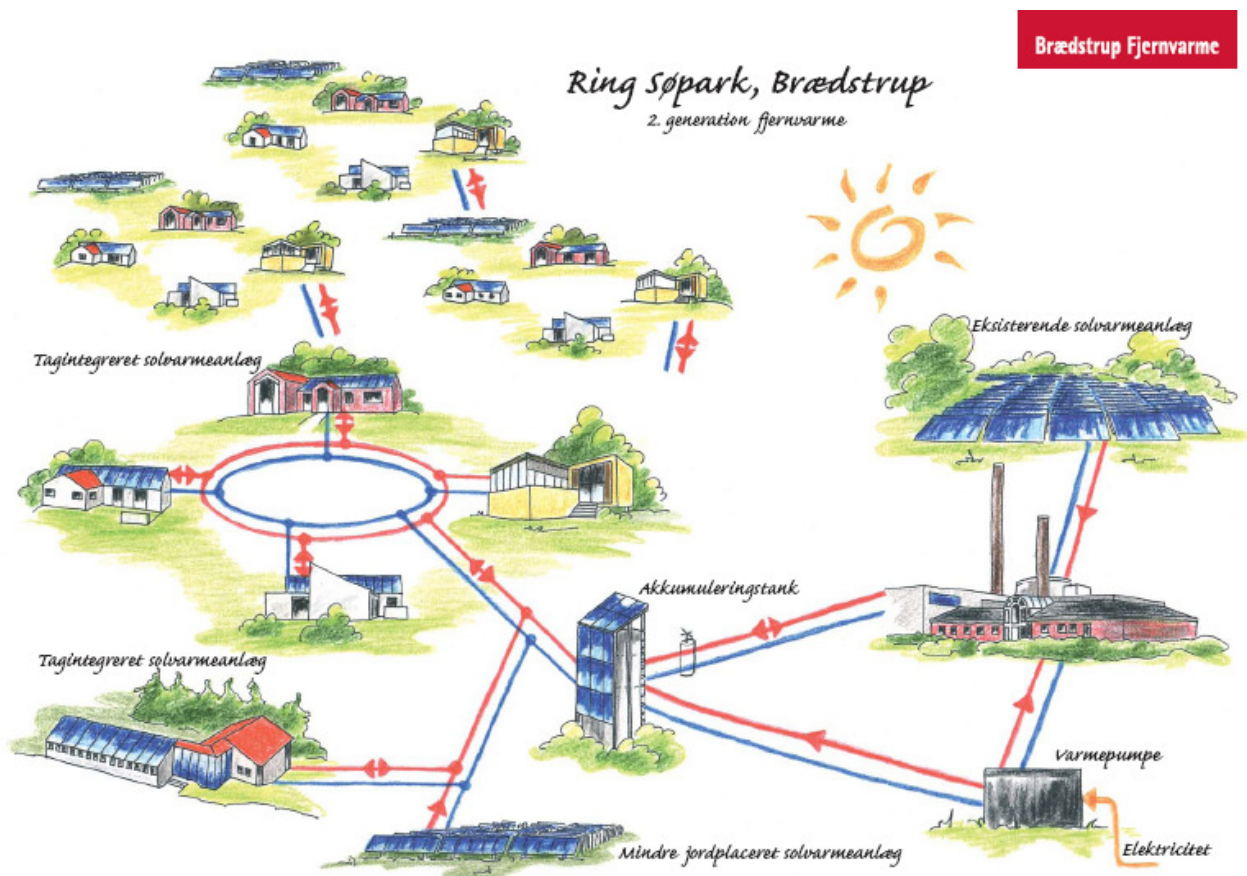


Figure 3: Illustration of the proposed low resource district heating system Brødstrup, Ring Søpark 1

It is emphasised that this part of the project is not only relevant for Brødstrup, the technique and methods can be applied everywhere in Denmark as well as internationally where district heating can be applied. Therefore the described project must be considered as highly significant because the results can be spread and used widely.

Bræstrup, Ring Søpark 1 will develop and demonstrate a highly efficient and low CO₂ emission decentralised district heating system. The results will be obtained by using renewable energy sources to an extent not yet seen in a decentralised district heating plant in Denmark, utilising and combining renewable energy solutions such as solar heating and heat pumps, also the district heating system and network will be optimised from production to consumer – altogether minimising the primary energy factor of marginally produced heat to a very minimum.

Typically major collective heat supply installations are many times more efficient than individual heat supply solutions (household solutions) compared to the necessary investments. A report made by Ramboll for Danish Energy Agency in 2005/2006 revealed that district heating of new housing areas built according to the latest Building Directive will be a far better solution from a socio-economic perspective than individual heating solutions based on fossil fuels, biomass fuel, solar energy, heat pumps or a combination hereof. Besides, in the actual study, no account was taken if the considerable optimisation possibilities in the district heating systems, which this project is to document.

Fact: Several theoretical studies show that district heating with renewable energy (e.g. solar heating) has large benefits.

[Demonstration to confirm the results of these studies is needed to support the development towards such low resource district heating systems]

In spring 2006 Energinet.dk was leading a working group who was to draw up a report on solar energy in district heating areas. Among others, the report concluded:

"The overall conclusion is that as well district heating consumers as the producers of energy and the environment will profit from solar energy. Solar energy in district heating areas with a high degree of environmentally friendly electricity from especially wind power, will contribute positively to the running of an electricity market where criteria for success are flexibility and ability to react on price fluctuations."

In 2006 the Danish Society of Engineers (IDA) prepared the "Energy Plan 2030". The basis of the plan was formed at about 40 seminars, meetings and conferences with a wide participation from more than 1600 engineers and other professionals from the energy sector.

The purposes of the Energy Plan were to show how the CO₂ emissions could be cut by the half, how exports of energy technologies could be multiplied and how the self-sufficiency rate could be maintained in 2030. On the background of wide-scale technical analyses of systems and socio-economical evaluations of the consequences, the Energy Plan explains how the goals can be achieved – with an important and very significant economic and environmental benefit to the society. In the Energy Plan the IDA writes among other:

"It is obvious to continue the development of large-scale solar heating facilities for district heating systems, which do not already have CO₂-free surplus heat during the summer as the district heating often has heat storage facilities, and since large facilities and heat storage facilities for district heating are more cost efficient than individual solar heat systems."