Central Solar (District) Heating Plants

Heller, Alfred; Sørensen, Per Alex

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Alfred Heller ¹) Per Alex Sørensen ²)
¹) Civil Engineering Department, Technical University of Denmark
²) PlanEnergi Denmark

Introduction

Denmark has a leading tradition for large-scale solar heating connected to district heating, short CSHP. Such plants can include any type and size of seasonal storage, whereas the pit water storage seems to be the cheapest and most promising thermal storage technology for large-scale applications.

In 2012 a first full scale demonstration was presented in Marstal, Denmark. Today the plant is grown to over 33,000 m² of solar collector and a storage capacity of over 85,000 m³ pit water storage.

District Heating in Denmark

In Denmark, DH has been actively promoted as an important component in the national strategic energy planning. Denmark has 670 CHP plants and 77% of total DH and 55% of electricity come from CHP plants (Fig. 2). Over 50% of total heating supply in Denmark comes from DH and around 62% of residential buildings connect with DH.

The overall plant schema

The basic configuration of central solar heating systems and its connection to the district heating is shown in (Fig. 3)

The collector field involving anti-freeze liquids. Hence a heat exchanger is necessary to deliver the heat to the district heating loop and the storage loop.

The heat store

World largest pit water storage is present at the Marstal:
- Built 2011-12
- Size: 75,000 m³ water
- Price: 2.65 mio. € excl. transmission pipe or 35.5 €/m³ or 0.38 €/kWh
- Temperatures: 10 – 90°C
- Capacity: 6,960 MWh
- Charge and discharge capacity: 10.5 MW
- Calculated heat loss: 2,475 MWh/year

The Heat Pump

There are involved 2 heat pumps as shown in (Fig. 7)

Energy balance for the year 2013 monitored. The solar share is 34% even with a large-scale seasonal storage. Flexibility opportunities are very large.

Further Information

A European Cooperation with web site: http://www.solar-district-heating.eu
Project Sunstore 4: http://sunstore4.eu/newsroom/events-presentations/
Web Blog: http://centralsolarheating.wordpress.com/

Contact Information

Alfred Heller
Assoc. Prof., Ph.D.
Vice Centre Manager, CITIES

Civil Engineering Department
Technical University of Denmark
Denmark

T: 45 4525 5025
E: alfh@byg.dtu.dk
W: http://www.byg.dtu.dk/