Net-metering of heat in distributed solar plants
Sweden

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Model description
An increased number of building owners connected to district heating in Sweden have expressed an interest to use solar collectors on their buildings. A model based on net-metering of heat in distributed solar plants has been developed in a number of cases. According to this model the solar heating system is connected to the district heating main circuit and the district heating system is used to distribute excess solar heat to other buildings. A net-metering contract with the district heating provider is developed. The distributed plants are in principle operated on their own and are commonly designed based on the available space and the existing dimensions of the district heating branch on site, not the actual load in a specific building. The plants have no storage as they can utilize the district heating network (as long as they provide a small amount of heat in comparison to the total load in the district heating system).
The development of this kind of systems was pioneered by the municipal service building's owner and the district heating provider in Malmö (E.ON, former Sydkraft) in 2001 and has now resulted in a number of systems in other cities. The development of a prefabricated solar district heating sub-station (Fig. 1) in co-operation with an established system component company has been a major facilitator in this development as it provides common boundary conditions for the systems.

Fig. 1: Pre-fabricated solar district heating sub-station. Photo: Armatec

From June 2000 until January 2012 there were grants for supporting installations of solar heating systems. Based on the latest regulations SFS 2008:1247 [1] investment support is given from 2.50 SEK/kWh annual collector output up to 3 million SEK per project. This support was used in a number of projects based on net-metering model. With the new regulation SFS 2011:1105 [2], the support has been cancelled, due to the governmental opinion that solar heating is profitable anyway.

Roles of the different actors

There are two owner options for the decentralized solar DH systems: the housing facility owner or the utility.
For example in the case of housing facility as an owner, it is usually their first initial interest to apply solar heating system in their buildings. Initial discussions then lead to investigations concerning how the option of direct connection to the existing system using roof-integrated collectors on the roof can be applied. The housing company has already a contract with the utility for the district heating supply. A net-metering contract with the district heating provider is developed, where it is compared how much is bought from the district heating provider and how much heat is delivered to the district heating network by the housing company from the solar system. The housing company gets about 80 % of the district heating price bought from the utility. The net debiting can be done on monthly basis or sometimes also annual basis. The technical personnel of the housing company manage the solar system and are responsible for the continuous monitoring of its performance.
There is only one reference case where the owner is the utility and in this case the responsibility on managing the system lies completely on them. The utility has made a leasing contract with the property owner for the roof area. Additionally, there can be a price difference in the heat produced by the solar system and delivered to the houses and the additional heat delivered from the DH network. It is the utility who is responsible for the operation and maintenance of the solar system and they also take care of the billing to the customers.
Besides the (nine) systems owned and managed by E.ON in Malmö there are >10 systems owned by different housing companies or municipalities. Only a few of these have established cooperation between the system owner and the DH provider. There is however an ongoing evaluation (financed by the Swedish DH association) with the aim to improve system performance and cooperation between system owner and DH provider and to develop contract guidelines and templates.

Swot analysis

Strengths	Small and handy system. The plants have no storage as they can utilize the district heating network (as long as they provide a small amount of heat in comparison to the total load in the district heating system). Rather simple connection with the DH network with the prefabricated sub-station.
Weaknesses	Need appropriate design of the connection to the existing district network (pressure, temperatures, etc.) and the development of net-metering contracts. Need careful and competent commissioning and supervision. Few examples.
Opportunities	For building owners: Possibilities to use solar heat in combination with district heat. Possible to combine with roof renovation. DH providers: Possibilities to develop new business models as they can buy and sell solar heat. Possibilities to replicate on a wider scale.
Threats	Profitability can be very low with the CHP system for district heating, utilities may not be interested for additional heat supply to the grid at summer time. The selling price for the system owners will be therefore very low. Lack of knowledge among building owners, DH providers, planners, designers, contractors and commissioners.
Improvements/recommendations/lessons learned	The systems need a careful design. Lessons learned are related to the appropriate design of the connection to the existing district network (pressure, temperatures, etc.) and the development of net-metering contracts. The operation needs to be monitored and evaluated especially during first years of operation in order to detect faults and fix them immediately. There is a need to enhance knowledge among all involved actors.

Replication potential

This model can be replicable, when agreements with the utility company (DH provider) can be made for delivering heat to their heat distribution system under a net-metering contract. From an economic point of view the model is best applied in DH systems where there is not so much (cheap) waste heat available at summer time from for example CHP plants. From a technical point of view it is an advantage not to have too high temperatures in the heat distribution system.

Links

A report named “Kopplingsprinciper” by Svensk fjärrvärme [3] (in Swedish that may be translated to English) describing the systems layout.

References

[1] SFS 2008:1247, Förordning (2008:1247) om stöd för investeringar i solvärme
http://www.notisum.se/rnp/sls/lag/20081247.HTM
[2] SFS 2011:1105, Förordning om upphävande av förordningen (2008:1247) om stöd för investeringar i solvärme
http://www.lagboken.se/files/SFS/2011/111105.PDF
[3] Svensk fjärrvärme Rapport 2009:3, Fjärrvärmecentralen kopplingsprinciper
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