

FEASIBILITY FOR SDH IN REGION VÄSTRA GÖTALAND

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Abstract – Region Västra Götaland is associated to the EC project SDHp2m, which primarily has a focus on the implementation of solar district heating in three European regions: Styria (AT), Thuringia (DE) and Auvergne Rhone Alpes (FR). The aim here is to investigate the interest and the possibilities to complement existing block and district heating systems based on solid biofuels with a solar heating system within Region Västra Götaland. The paper summarises the first step of the project, a survey of existing plants. The survey comprises more than 110 heating plants, out of which about 40 plants based on wood chips, about 35 plants based on wood pellets and close to 10 plants based on wood briquettes. The initial experiences confirm that the implementation of solar heating plants rely on the possibilities to increase the interest although there is a large potential to improve the efficiency of existing plants.

1. INTRODUCTION

Region Västra Götaland comprises 1.6 million inhabitants on 24 000 km², i.e. 66 inhabitants per km², which is equal to the average population density within Europe. The region has 49 municipalities, the smallest with 5 000 inhabitants and the largest with 500 000 inhabitants (City of Gothenburg). All municipalities have one or more block and/or district heating plants using solid wood fuels. A couple of municipalities have one or more solar heating plants, e.g. Lerum and Orust.

Many heating plants using solid biofuels, especially wood chips, have often only one boiler that runs all year around, sometimes with sometimes without a buffer storage tank. This means in many cases that the boiler runs on very low power with low efficiency due to the low heat demand during the summer months. A combination with a storage and solar collectors makes it possible to run the boiler with a higher efficiency (and less emissions) and thereby save more wood fuels than the amount replaced by the solar heat. However, the low price for wood fuels together with lack of awareness about solar collectors, etc. creates small incentives to invest in a solar system.

2. PROJECT DESCRIPTION

Region Västra Götaland is associated to the EC-project SDHp2m which primarily has a focus on the implementation of solar district heating in three European regions: Styria (AT), Thuringia (DE) and Auvergne Rhone Alpes (FR). The aim here is to investigate the interest and the possibilities to complement existing block and district heating systems based on solid biofuels

with a solar heating system within Region Västra Götaland. The project will be carried out in three steps as described below.

First, a survey is initiated and evaluated. The survey will show the interest in the municipalities and potential plants that may be complemented with a solar system. A relevant number of plants will be selected for the next step.

Second, feasibility studies will be carried out during autumn 2016 for the plants identified in the first step. The most feasible plants (site and economics) will go on to a pre-design study and an application for co-financing if and when required, before the third step.

Third, individual or common calls for tenders will be prepared and communicated to interested contractors, with the aim to realize at least one plant during 2017-2018 that can be used as a demonstration plant for other interested actors.

3. SURVEY

3.1 Gathering data

There is not one single source that provides information about heating plants with biofuel boilers in Sweden, so data were gathered based on two main sources.

First, a questionnaire was developed and distributed to all municipalities asking for basic information about their heating plants, especially those with biofuel (wood) boilers larger with a nominal power of 200 kW or more.

Second, information available on the homepages of members of the Swedish District Heating Association Region Västra Götaland, was gathered.

Third, the above was evaluated for duplicates and complemented with data from some other sources.

Fourth, the result of the survey was communicated by e-mail and presented at a seminar in order to be as complete as possible, at least regarding heating plants using biofuels (primarily wood).

3.2 Heating plants

Table 1 shows the number of identified heating plants (>110) within the 49 municipalities in Region Västra Götaland. There are more heating plants, but the most important for the feasibility study are likely included.

Table 1. Identified heating plants

Municipality	Heating plants
Ale (GE)	-
Alingsås	7
Bengtsfors	5
Bollebygd	1
Borås	1
Dals-Ed	1
Essunga	1
Falköping	5
Färgelanda	1
Grästorp	1
Gullspång	1
Göteborg	6
Götene	4
Herrljunga	2
Hjo	1
Härryda	3
Karlsborg	2
Kungälv	4
Lerum	4
Lidköping	4
Lilla Edet	1
Lysekil	2
Mark	5
Mariestad	2
Mellerud	1
Munkedal	1
Möndal	1
Orust	1
Partille (GE)	-
Skara	7
Skövde	7
Sotenäs	-
Strömstad	1
Svenljunga	1
Stenungsund	1
Tanum	2
Tibro	1
Tidaholm	1
Tjörn	3
Tranemo	1
Trollhättan	4
Töreboda	1
Uddevalla	4
Ulricehamn	3
Vara	3
Vänersborg	1
Vårgårda	5
Åmål	2
Öckerö	-

The number of district heating systems is less than the number of heating plants as there may be several heating plants in one district heating system and the district heating systems in Ale and Partille are parts of the main district heating system in Göteborg. There are also connections between Göteborg, Kungälv and Möndal. Some of the municipalities have district heating from industries (e.g. Stenungsund, Vänersborg and Lilla Edet) and only two small municipalities lack district heating (Sotenäs and Öckerö).

3.3 Wood fuel boilers

The identified wood fuel boilers are listed in Table 2, 3 and 4. The tables include the name of the heating plant, the nominal power (MW) and if there is an owner other than the municipality.

Table 2. Wood ships boilers (MW)

Municip	Plant	Power	Owner
Alingsås	Sävelund	35.0	
Bollebygd	-	3.0	
Borås	Ryaverket	130	
Dals-Ed	-	1.7	(Agrovärme)
Essunga	Nossebro	6.0	
Falköping	Marjarp	25	
Färgelanda	-	-	Rör o. Värme AB
Grästorp	-	3.5	Agrovärme
Göteborg	Sävenäs	100	
Götene	Västerbyverket	25.0	
Herrljunga	Herrljunga El	6.0	
	Annelund	0.8	
Hjo	-	11.5	
Härryda	Landvetter	5.0	Solör
	Mölnlycke	12.0	Solör
Karlsborg	-	3.0	
	SFV	8.0	Government
Kungälv	Munkegårde*	26.0	
Lerum	Aspedalen*	19.3	
	Floda	5.8	
Lidköping	Östra hamnen	30.0	
Mark	Assberg	26.8	
	Horred	2.0	Agrovärme
Mariestad	Katrinefors	64.7	
Möndal	Riskulla	91.0	
Orust	Ellös*	4.0	
Skara	Harven	10.0	
	Uddetorp	8.0	
Skövde	Lövsängverket	40.0	
Svenljunga	-	-	Solör
Tibro	-	19.0	Neova
Tidaholm	Eldaren	15.0	
Trollhättan	Stallbacken	44.0	
	Kronogården	8.0	
	Lextorp	17.0	
Töreboda	-	20.0	
Uddevalla	Hovhultsverket	50.0	
Vara	-	10.0	
Vårgårda	Industry	7.0	Solör (Rindi)
	Biogas	0.5	Solör (Rindi)
Åmål	-	12.0	Statkraft

Table 3. Wood pellets boilers (MW)

Municip.	Plant	Power	Owner
Alingsås	Hemsjö	0.2	
	Sollebrunn	0.8	
	(Tvätt VGR)	5.5	
Bengtsfors	Bengtsgården	3.0	
	Industrigatan	2.0	
	Bäckefors	1.0	
	Dals Långed	3.0	
Falköping	Stenstorp	1.5	
Gullspång	-	1.0	
Göteborg	Rya	100	
	Skarvik	3.0	
Götene	Skepplanda	1.0	
	Hällekis	0.8	
	Lundsbrunn	0.2	
Kungälv	Källby	0.2	
	Stålkullen*	0.5	
	Kärna	-	
	Kode	-	
Lerum	Stenkullen	1.0	
Skara	Ardala	0.4	
	Varnhemskolan	0.2	
	Axvall	-	
Skövde	Stöpen	-	
	Tidan	-	
	Timmersdala	1.8	
Strömstad	Tången	1.0	
Tjörn	Skärhamn	0.4	
	Källekärr	1.2	
Ulricehamn	Timmele	0.6	
	Gällstad	0.7	
	Simhallen	2.5	
Vara	Kvänum	3.0	Agrovärme
Värgårda	Lena skola	0.1	Solör (Rindi)
	Hols skola	0.1	Solör (Rindi)
	Nårunga skola	0.1	Solör (Rindi)
Åmål	Svetsaren	0.4	

Table 4. Wood briquettes boilers (MW)

Municip.	Plant	Power	Owner
Bengtsfors	Billingsfors	1.2	
Falköping	Dotorp	9.0	
	Floby	4.5	
	Jättene	3.5	
Lerum	Gråbo	6.0	
Mariestad	Lyrestad	1.4	
Munkedal	Långedalsverket	3.0	
Skövde	Skultorp	-	
Uddevalla	Arödsverket	1,5	

There are >40 identified wood chips boilers, out of which >25 are owned by the municipalities and the rest are owned by ESCO's (Table 2).

There are >35 identified wood pellets boilers, out of which about 30 are owned by the municipalities and the rest are owned by ESCO's (Table 3).

There are <10 identified wood briquettes boilers, all owned by the municipalities (Table 4).

There are four plants with solar heating plants marked *.

The sizes of the wood chips boilers vary from a few MW up to 130 MW (often for combined heat and power), the sizes of the wood briquettes boilers vary between 1 and 10 MW, while the sizes of the wood pellet boilers, with one exception (100 MW), vary from 100 kW up to a couple of MW.

3.4 Ownership

The fact that there are not only municipalities, but also ESCO's (e.g. Agrovärme) that operate heating plants was known, but maybe not there are a couple of rather new operators. Besides the municipalities a couple of the ESCO's also seem to be interested in this early stage of the project.

3.5 Available space

One of the prerequisites to complement an existing heating plant with solar heating is that there is some place where the collector array, and possibly also a storage tank, can be mounted. Therefore, the location of the heating plant has been identified in order to rank them from a feasibility point of view. The information required to evaluate the possibility to connect distributed collector arrays, i.e. available areas and buildings in connection to the district heating networks, has not been gathered at this early stage.

4. FEASIBILITY STUDIES

4.1 Initial scanning

The survey and the connected info about SDH triggered the interest to have more information about the possibilities to complement existing plants with solar heating systems only in a few cases.

Thus, the initial scanning of potential plants has mainly been based on previous knowledge about existing plants and maps on internet together the interest shown on the first project seminar.

4.2 Feasibility studies

The aim is to get the first impression about the possibilities to complement small wood chips plants (from 4 up to about 30 MW) with a solar collector array. This approach is based on the fact that small wood chips plants have a large potential to improve the system efficiency (poor part load efficiency). It is further not likely to be able to build very large demonstration plants.

Wood briquettes boilers may also be interesting, while pellet boilers are less interesting as they usually have a higher efficiency at varying load conditions. Local conditions and the interest for solar heating expressed by the plant owners might however change that situation.

The feasibility studies will cover the possibilities to lower the return temperatures, place collector arrays and a storage tank. The studies will also consider planned boiler replacements and extensions of the district heating networks.

