



Feasibility for SDH in Region Västra Götaland



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Acknowledgement

- **Survey of heating plants (wood) -
MSc Thesis Louise Thryssøe Ekström**
(Required use of several sources ..)
- **Survey supported by**



VÄSTRA
GÖTALANDSREGIONEN



SDH in Sweden . . .

Triggered by the
oil crises !!

- **First plants in end 70's**
- **Replace oil in DH ..**
- **Largest in the world until 2000**
- **Positive wood fuel developments ..!!
.. easily stored until winter ..**
- **1978-2016: 35 plants >500 m²**
- **Out of which 12 taken down**
- **Oldest in operation >30 years**

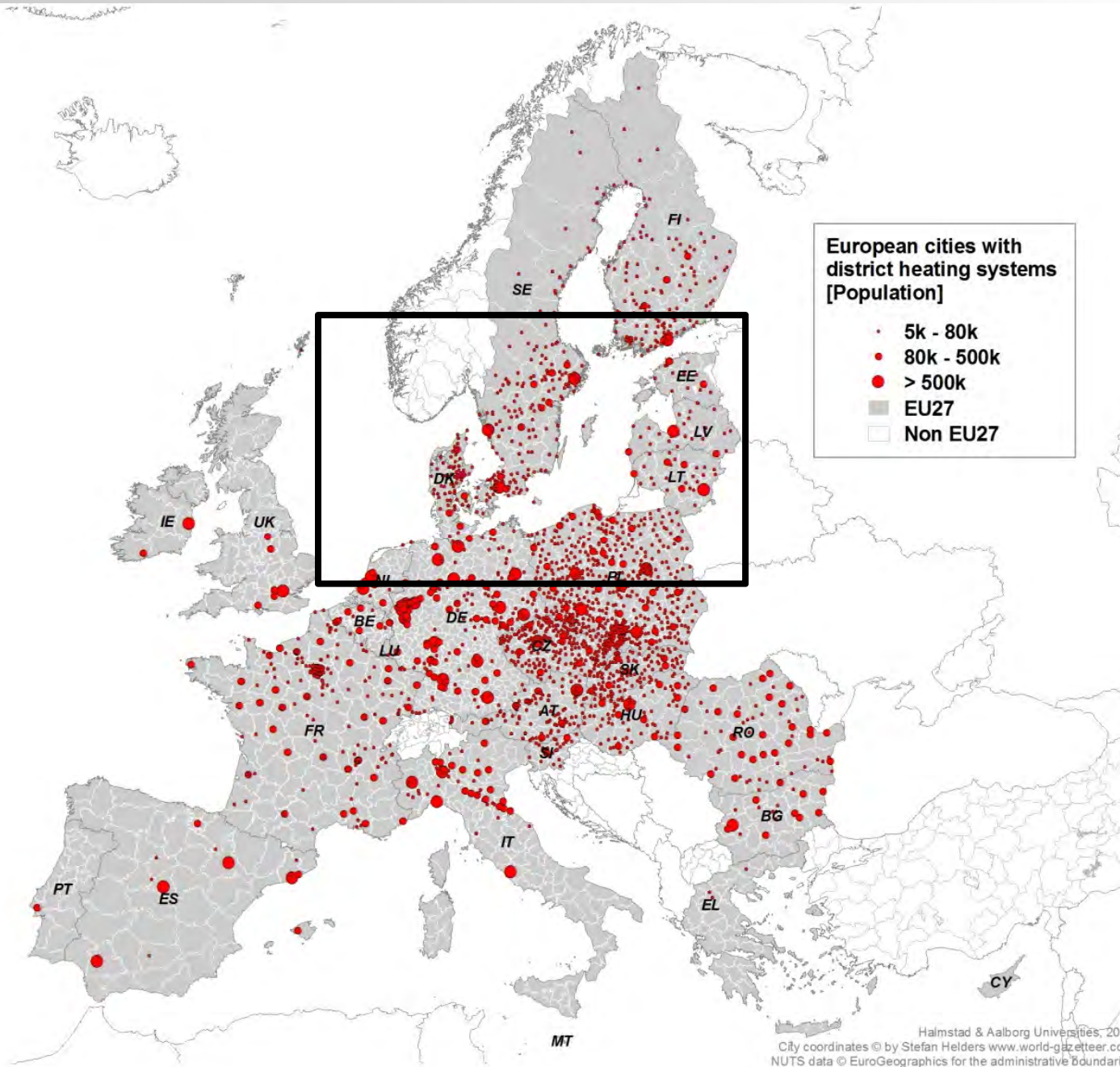


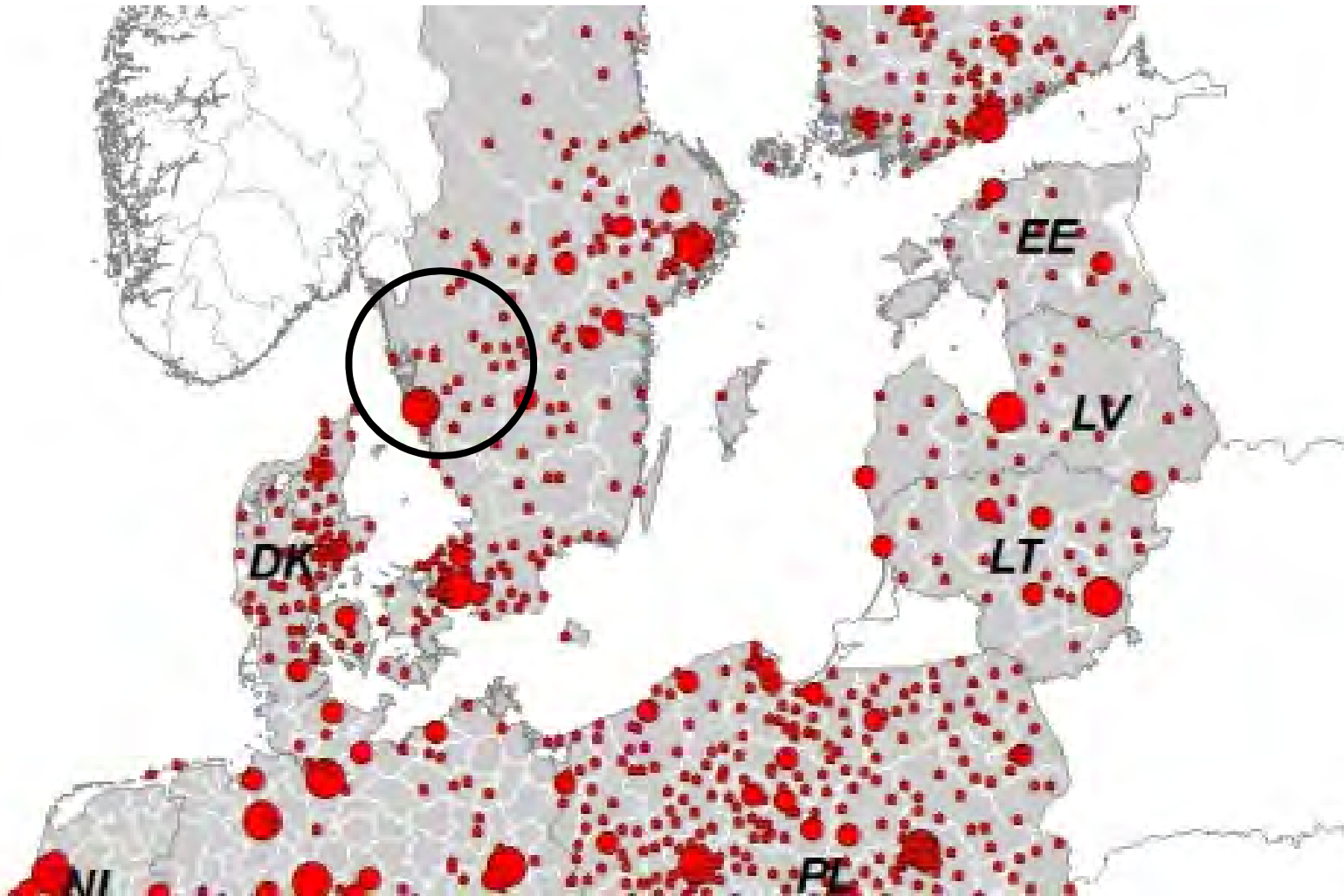
**Next to the 1st
SE wind power
plant 5 x 225 kW**



**Falkenberg, SE - 1989
Wood chips DH plant – 8 MW_{th}
5 500 m² - ~4 MW_{th}
1 000 m³ water tank**

**Recycled 2008: 40t Al; 2t Cu;
1.4t Fe; glass; insulation ..**







Västra Götaland





Västra Götaland

- **1.6 million inhabitants**
- **24 000 km²** (0.56 Denmark)
- **66 inhabitants/km²** (EU average)
- **49 municipalities**
- **5 000 to 500 000 inhab./mun.**
- **District heating w. wood fuels
in all cities and urban areas**
(while there is NG all over DK !)

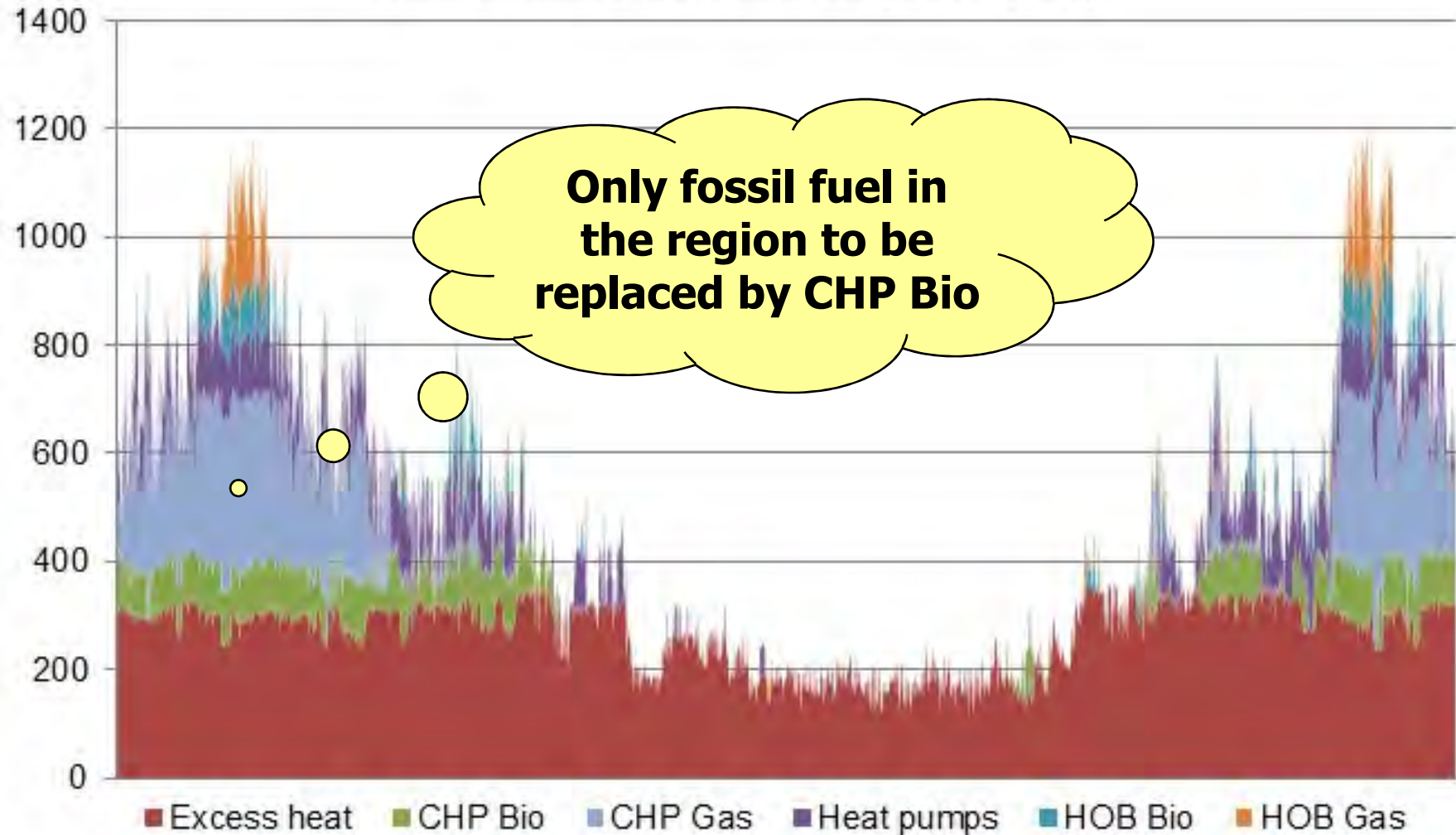


District heating

- **Solid wood fuels (local providers)**
- **Waste (incineration households) and waste heat (industries)**
- **Natural gas - 1 large CHP (GE) to be converted to CHP Bio**
- **A few heat pumps (sewage water)**
- **Oil (fossil and bio) for maintenance and peak loads**



Heat Generation in Gothenburg 2012 [MW]





Solid wood fuels

- **Wood chips (wet and dry)**
- **Forest residues (stumps, twigs, etc)**
- **Wood industry residues (saw dust, cutter shavings, etc.)**
- **Recycled wood (timber, planks, boards, etc.)**
- **Wood briquettes & pellets**
- **1 straw boiler ..**



Municipalities - Heating plants (prio wood fuels)

Ale (GE)	-	Kungälv (GE)	4	Stenungsund	1
Alingsås	7	Lerum	4	Tanum	2
Bengtstors	5	Lidköping	4	Tibro	1
Bollebygd	1	Lilla Edet	1	Tidaholm	1
Borås	1	Lysekil	2	Tjörn	3
Dals-Ed	1	Mark	5	Tranemo	1
Essunga	1	Mariestad	2	Trollhättan	4
Falköping	5	Mellerud	1	Töreboda	1
Färgelanda	1	Munkedal	1	Uddevalla	4
Grästorp	1	Mölnadal (GE)	1	Ulricehamn	3
Gullspång	1	Orust	1	Vara	3
Göteborg (GE)	6	Partille (GE)	-	Vänersborg	1
Götene	4	Skara	7	Vårgårda	5
Herrljunga	2	Skövde	7	Åmål	2
Hjo	1	Sotenäs	-	Öckerö	-
Härryda	3	Strömstad	1		
Karlsborg	2	Svenljunga	1	Sum	>110



Wood chips, etc .. (1)

Alingsås	Sävelund	35.0	
Bollebygd	-	3.0	
Borås	Ryaverket	130.0	
Dals-Ed	-	1.7	(Agrovärme)
Essunga	Nossebro	6.0	
Falköping	Marjarp	25.0	
Färgelanda	-	-	Rör o. Värme AB
Grästorp	-	3.5	Agrovärme
Göteborg	Sävenäs	100.0	
Götene	Västerbyverket	25.0	
Herrljunga	Herrljunga EI	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	Munkegärde*	26.0	
Lerum	Aspedalen*	19.3	
	Floda	5.8	



Wood chips, etc .. (2)

Lidköping	Östra hamnen	30.0	
Mark	Assberg	26.8	
	Horred	2.0	Agrovärme
Mariestad	Katrinefors	64.7	
Mölnadal	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	14.0	
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



Wood pellets .. (1)

Alingsås	Hemsjö	0.2
	Sollebrunn	0.8
	(Tvätt VGR)	5.5
Bengtstors	Bengtsgården	3.0
	Industrigatan	2.0
	Bäckefors	1.0
	Dals Långed	3.0
Falköping	Stenstorp	1.5
Gullspång	-	1.0
Göteborg	Rya	100.0
	Skarvik	3.0
	Skepplanda	1.0
	Götene	Hällekis
Götene	Lundsbrunn	0.2
	Källby	0.2
	Kungälv	Stålkullen*
Lerum	Kärna	-
	Kode	-
	Stenkullen	1.0



Wood pellets .. (2)

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
Vårgårda	Lena skola	0.1	Solör (Rindi)
	Hols skola	0.1	Solör (Rindi)
	Närunga skola	0.1	Solör (Rindi)
Åmål	Svetsaren	0.4	



Wood briquettes ..

Bengtsfors	Billingsfors	1.2	
Falköping	Dotorp	9.0	
	Floby	4.5	
	Jättene	3.5	(+Pellet 1.5)
Lerum	Gråbo	6.0	
Mariestad	Lyrestad	1.4	
Munkedal	Långedalsverket	3.0	
Skövde	Skultorp	-	
Uddevalla	Arödsverket	1,5	



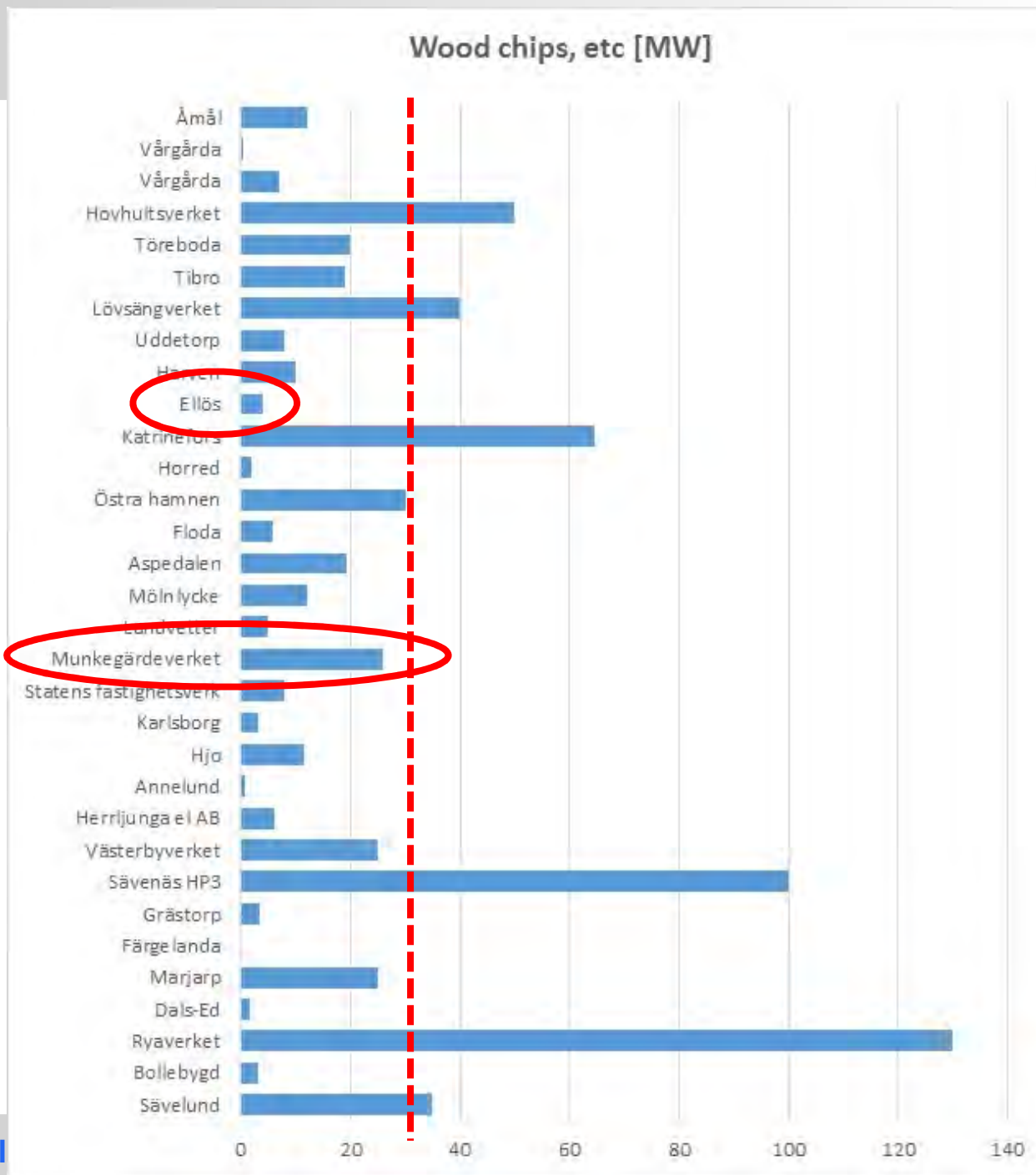
Wood fuel plants

- **Some large CHP plants**
- **Large and small heat only boilers**
- **Large boilers have heat recovery on combustion (exhaust) gases ..**
- **Most boilers can be controlled down to 20% of design power**
(.. only some have buffer storages !?)
- **Not suitable for on/off ..**
(.. except for pellet boilers ..)



Feasibility studies

- **Focus on wood chips boiler plants
design power 4 - 30 MW_{th}
(> 1 MW - 1 400 m² collector area ..)**
- **Lowering DH return temperature ?**
- **Suitable placing of collector array**
- **Suitable placing of storage tank**
- **Suitable system design that allows
"optimal" operation solar + boiler**





Ellös, SE .. 2010

New DH system
Wood chips - 4 MW
1 000 (2 000) m²
200 m³ water tank





Convincing message ?

- **Several (new) plants in DK ..**
(visits, share experiences, etc.)
- **Imprived collectors and systems**
(i.e. in comparison to the 80`s and 90`s)
- **Advantages to combine solid wood fuels and solar collectors + storage ..**
(improved system efficiency, less transports)
- **Competitive costs ..**
(maybe demo investment support?)



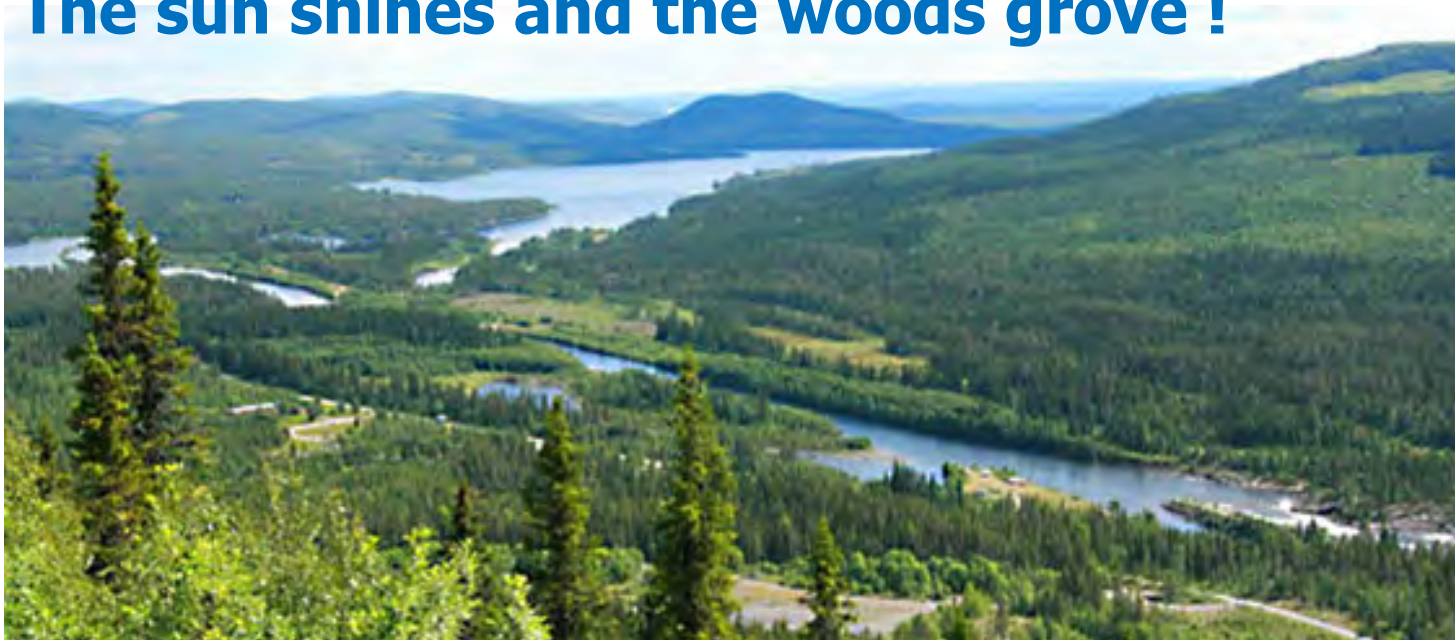
Experiences

- **We don't replace any fossil fuels !**
- **We don't need to promote DH !**
- **We need to explain solar system operation to some extent ..**
- **We need to show reliable system designs .. (Don't touch my plant!)**
- **We need to show feasible investment costs .. (Too expensive!)**



More info in due time !

The sun shines and the woods grove !



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www.solar-district-heating.se