Implementing Art. 14.1 – The potential for CHP, DH and DC

The Swedish case

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Swedish Energy Agency

First results of a comprehensive assessment

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In Short

- The Swedish DH market is, on a whole, declining due to a diminishing heat demand but there is room for new deliveries.
- Since the DH market is largely developed its difficult to assess specific barriers (of large importance).
- Therefore the CBA consists of national modelling for production at lowest cost.
- Primary energy savings depend largely on the chosen calculation principle.
- DH companies have more knowledge of the market than we do but a mapping has been done with data from bransch organisations and statistical agencies.

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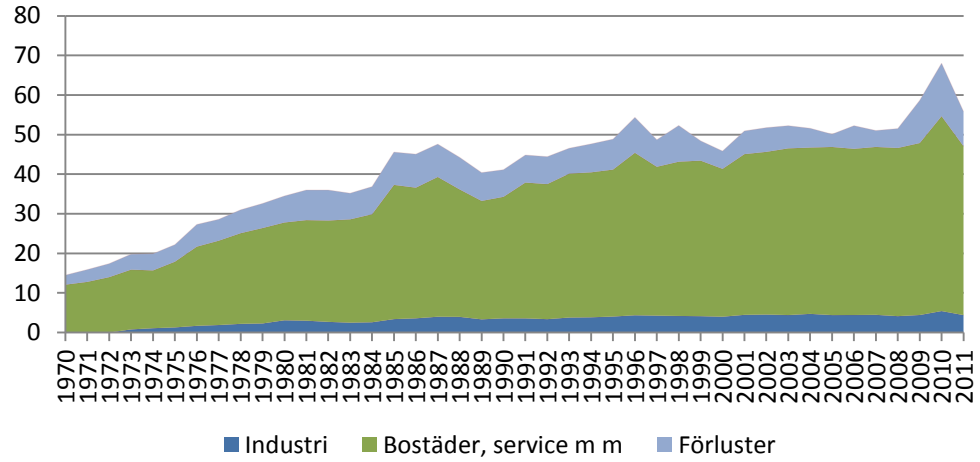
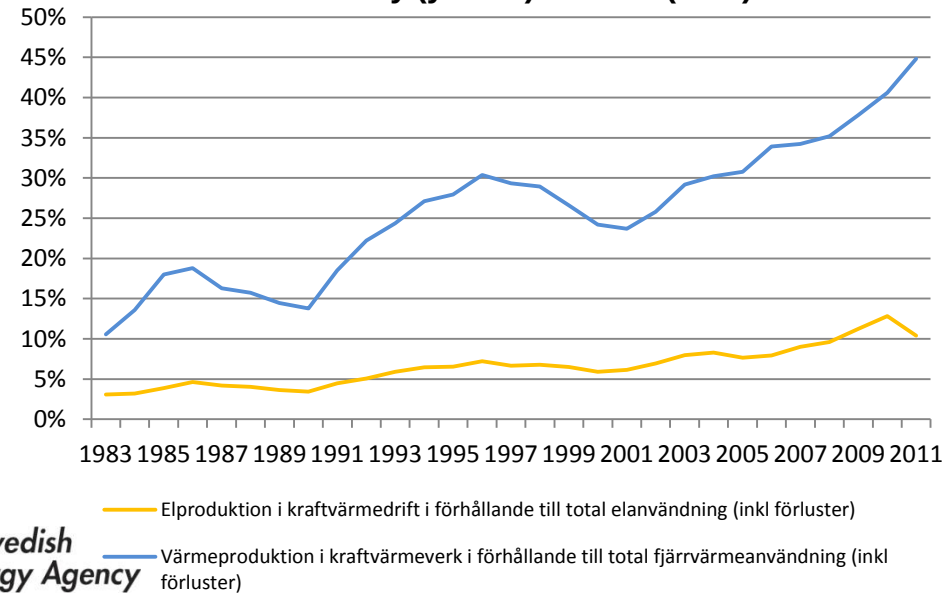
Background

District Heating to industry, housing and losses (light blue), TWh



- The DH market is largely built out.
- Losses are diminishing

CHP share of electricity (yellow) and DH (blue).



There is some room for increasing the **share** of CHP in Electricity and DH.

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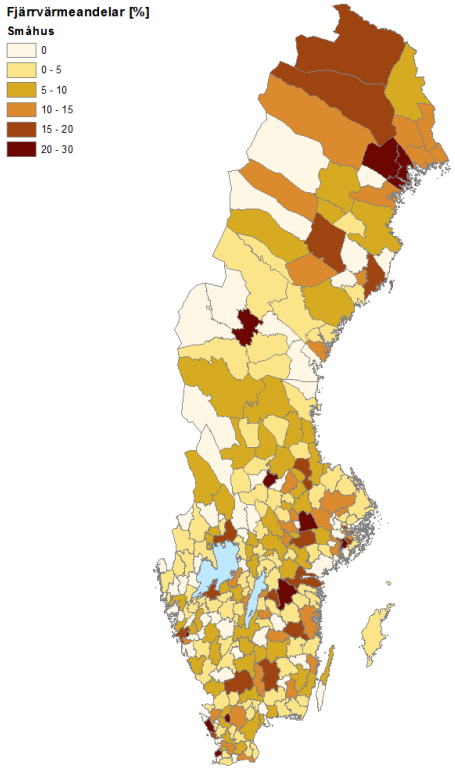
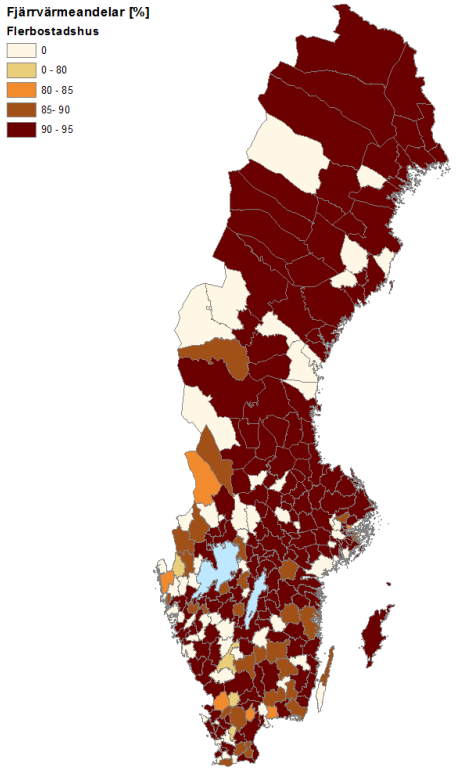
Market shares of DH in the heating market in Sweden

Houses (10 %)



Multidwelling houses (90 %)



Space heating / commercial premisses = ca 70 %

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Assumptions

- The potential for DH investigated is the potential for ”new” district heating connections. As a whole deliveries will decline.
- The DH is assumed to replace Heat Pumps - in the case of new buildings
- DH is assumed to replace electricity or Oil – in the case of existing buildings
- DC is assumed to replace electricity driven cooling.
- The potential for future cogeneration (in DH and industry) takes in to account the development of the diminishing heatload.
- Cogeneration is compared to seperate production of heating and cooling both with national alternatives and specific fuel-usage (as stated by the directive)

District heating prognosis for Sweden

District Heating 2011 -2030

- ca 10 TWh reduction of deliveries due to Energy efficiency measures.
- ca 3 TWh reduction as a result of partial convertion to Heat pumps.

  = From 55 TWh in 2011 to 42 TWh in 2030

- Method: Interviews with DH companies and datacollection at DH-companies as well as assessments of energyefficiency measures and conversions to heat pumps.

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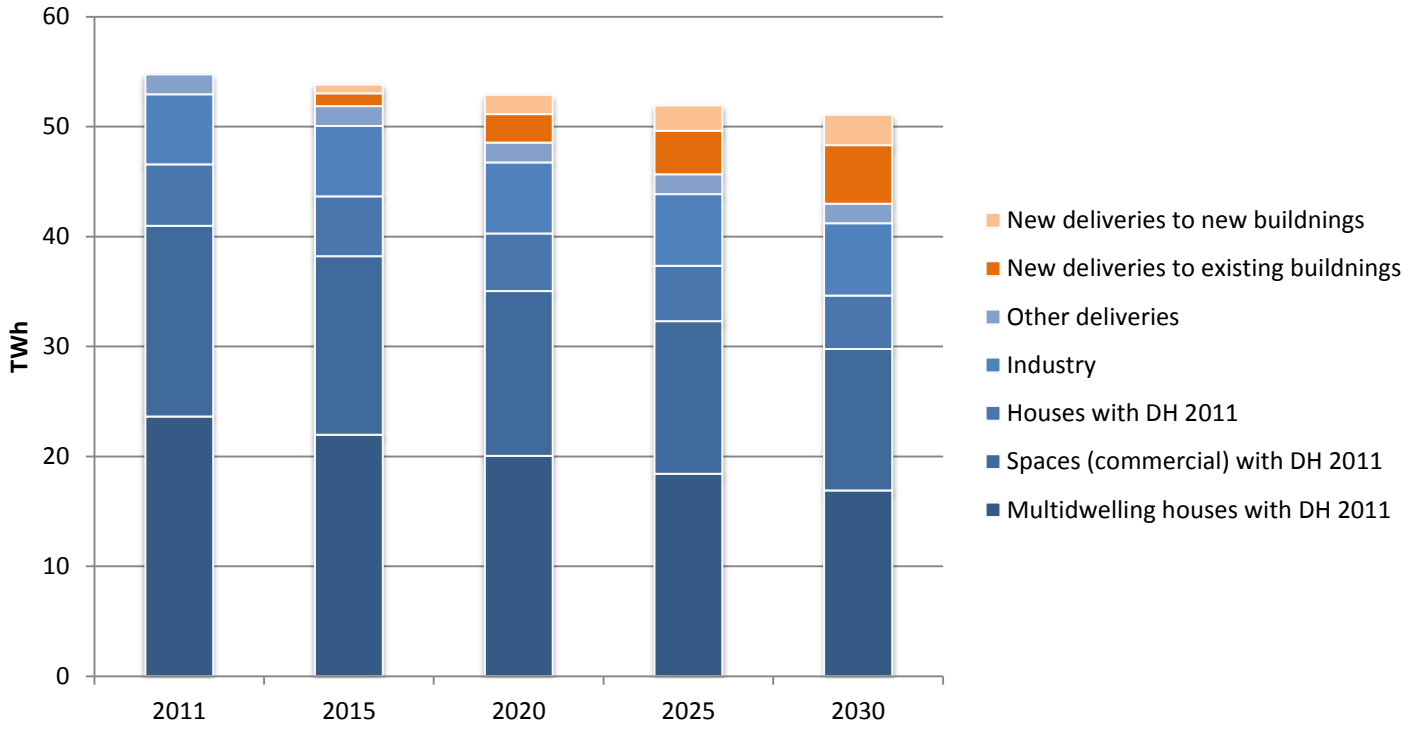
Assessment of the district heating development

+ 8 TWh new DH by 2030

-12 TWh in total



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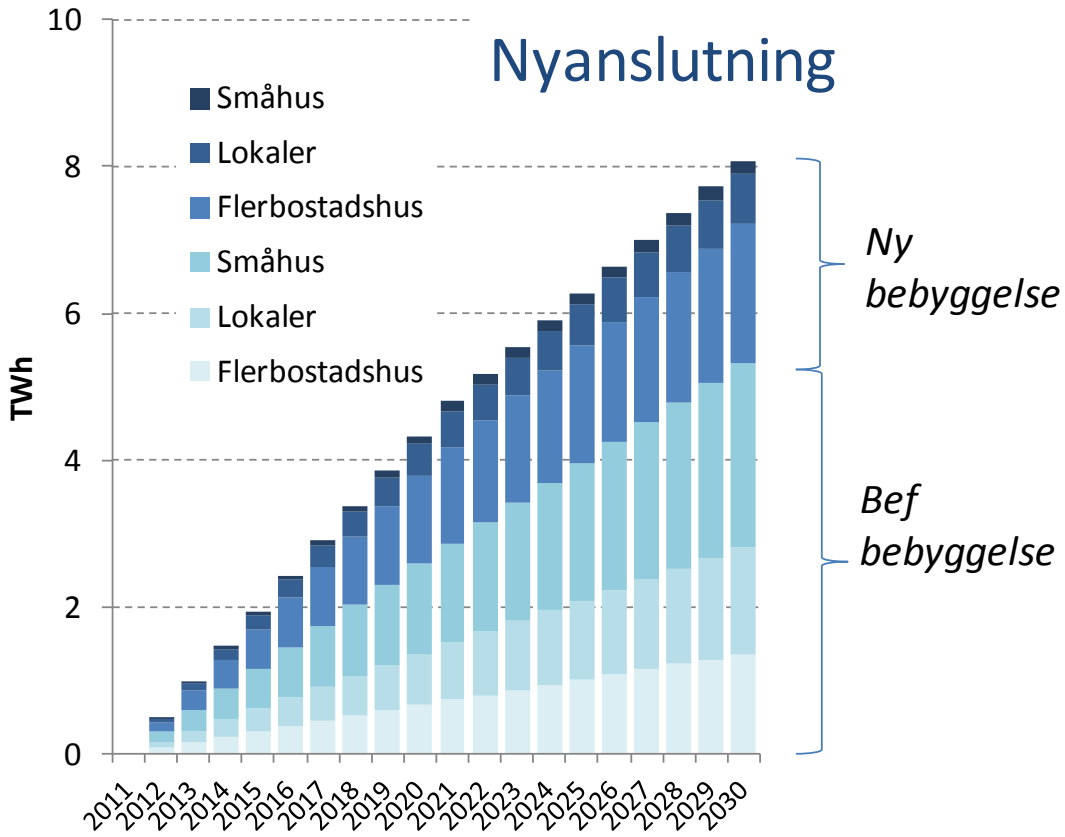
The potential for District Heating expansion



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Cost Benefit Analysis

- The CBA is made on a national level
- A multitude of reports and studies assuming different in-data.
- Markal (Market allokation) : Optimisation model satisfies, at the least possible cost, the demand for energy. Energy- and CO 2- taxes, Emission allowance units, Green certificates etc. Heating demand in 80 sectors in ”*Marcal-Nordic”.*

  Net present Value is used for evaluation,

  Discount rate at 7 %,

  Heat pumps and DH life expectancy at 21 years.

  Hydropower at 42 years and nuclear at 35 years.
- Martes: Calculations of 15 representative district heating systems. What is the optimal production-type for building new capacity? (Bio, Waste, Gas etc.)

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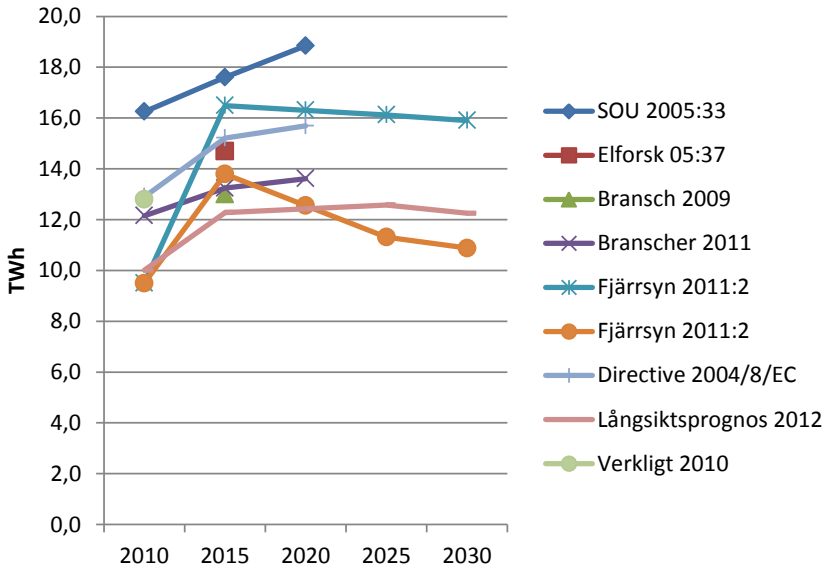
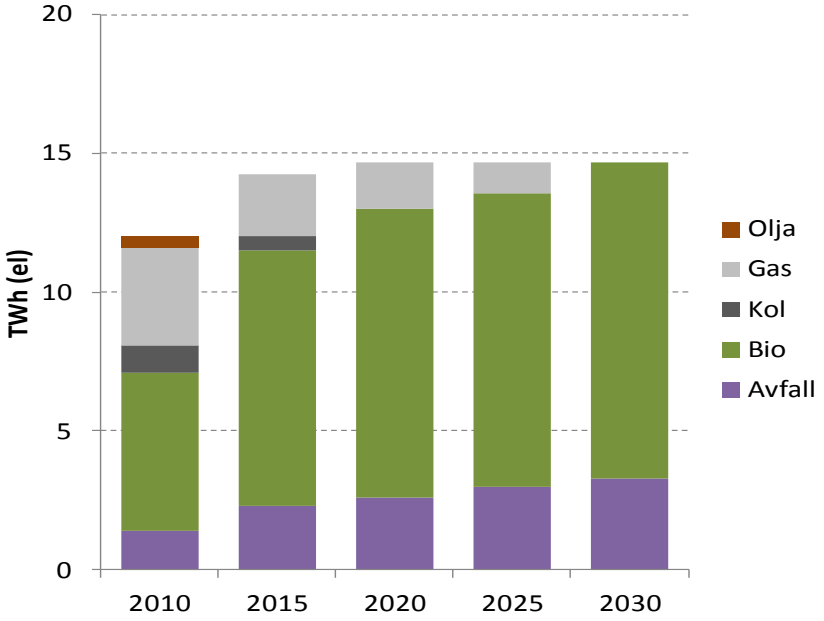
…CBA

- Existing steering measures are sufficient as they dont cause a barrier to developing the DH market.
- Externalities are assumed to be internalised by prices (on CO_2, etc.)
- The DH-market in Sweden is to a large extent already developed, existing barriers are ”natural barriers” i.e. declining heat-base.
- The CBA is in form of assumptions of prices and taxes etc. going in to the models. The models produce the expansion with the lowest cost. Lowest market cost = assumed to be Lowest socioeconomical cost.
- Complemented with a discussion concerning socioeconomical factors

The potential for CHP (electricity) in the DH system





14,7 TWh 2020 and 2030 due to declining DH-market (Martes)

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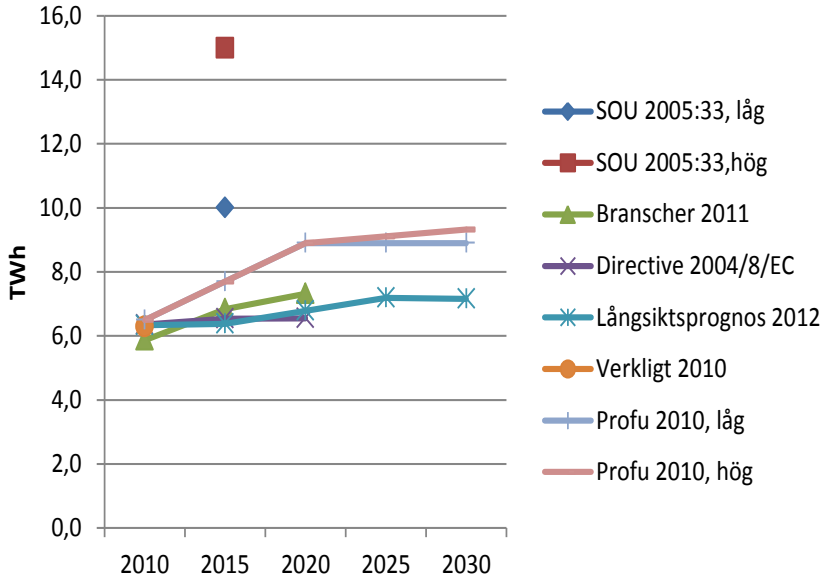
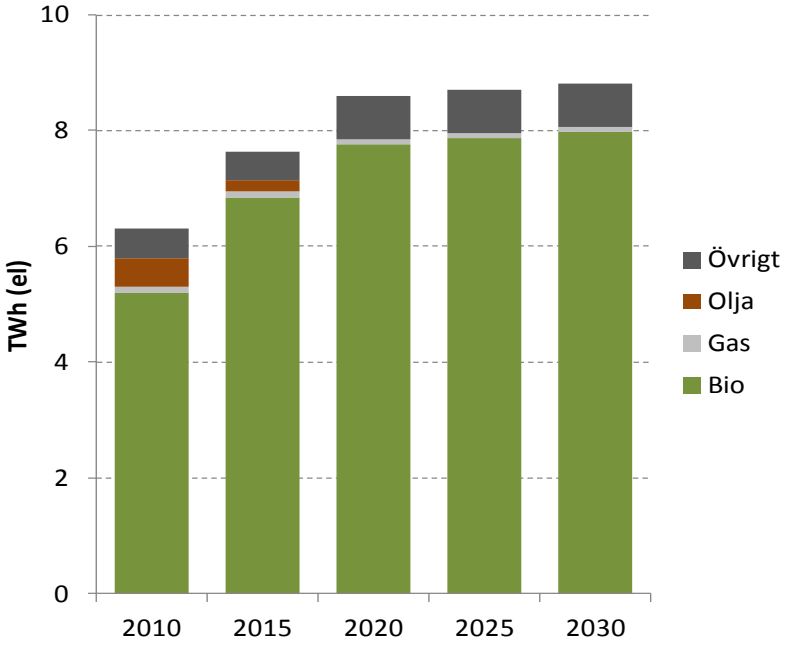
The potential for CHP electricity in industry





Differences are due to assumptions of industry development, electricity and fuel prices, green certificate prices etc. m.m.

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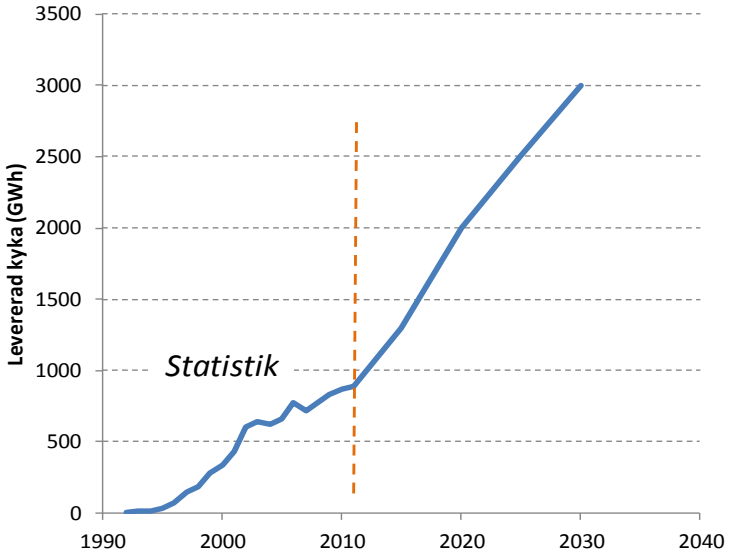
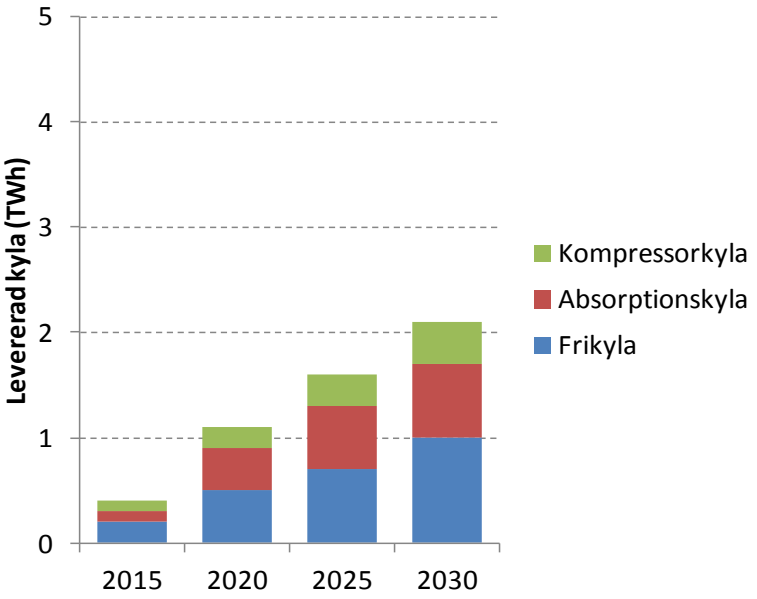
8,6 TWh electricity 2020 and 8,8 TWh år 2030

Potential for District Cooling

Total increases, GWh



Increases compared to 2010, TWh



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Primary Energy method

- The directive opens up for interpretations of primary energy method
- Primary energy not the same as energy content in a fuel
- The choice has a large impact on primary energy savings

	Fossils	Peat	Biomass	Waste	Electricity	District heating
"Environment method"	~ 1	~ 1	~ 1	~ 0,6	1,7/2,6	1
"Heat market method"	~ 1	~ 1	~ 0	~ 0	1,9	0,3
"Change principle method"	~ 1	~ 1	~ 0	~ 0	2,9/2,3	0,7/0,6

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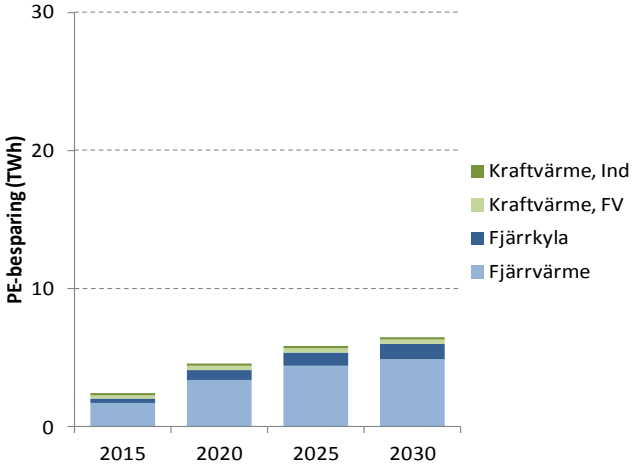
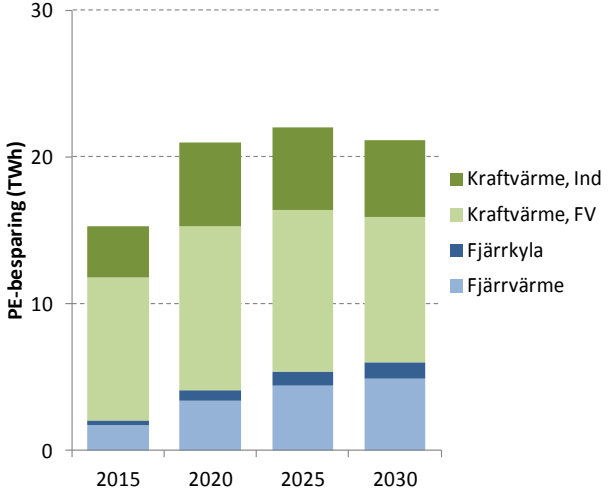
Primary energy savings using ”the change principle method” and the fuel specific production approach, EED, (left) and a Swedish systems approach (right)

As prescribed by the directive



Considering ”realistic” alternative production



	2015	2020	2025	2030
CHP, Industry	0,10	0,15	0,16	0,17
CHP, -DH	0,27	0,33	0,33	0,33
DH	1,74	3,38	4,44	4,91
DC	0,28	0,68	0,89	1,06
SUMMA:	**2,39**	**4,54**	**5,82**	**6,47**

Utilising e.g. ”the environment method” would yield higher savings as bio would have a PEF of close to 1.

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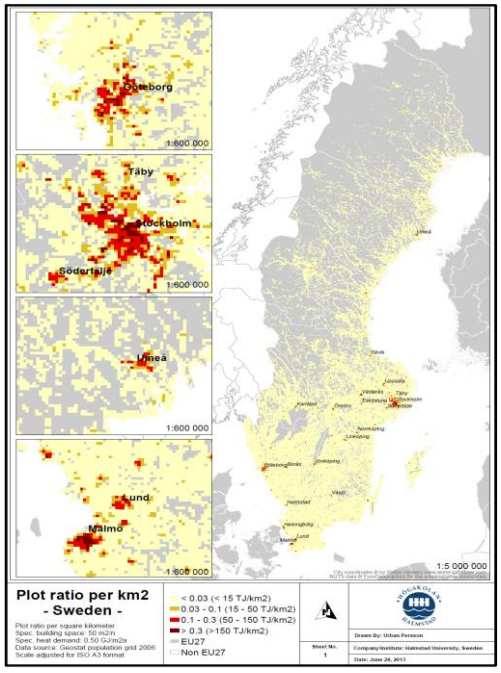
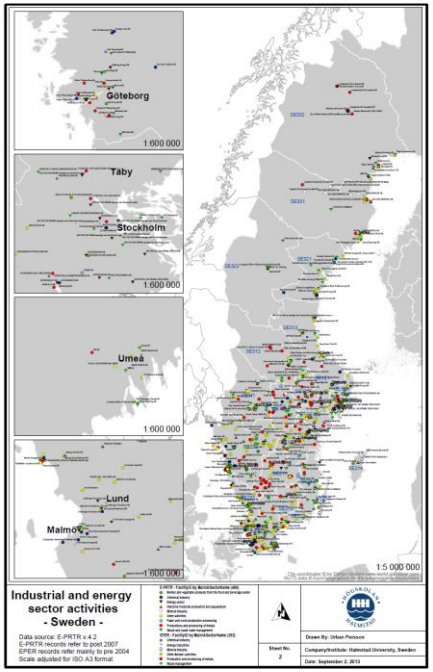
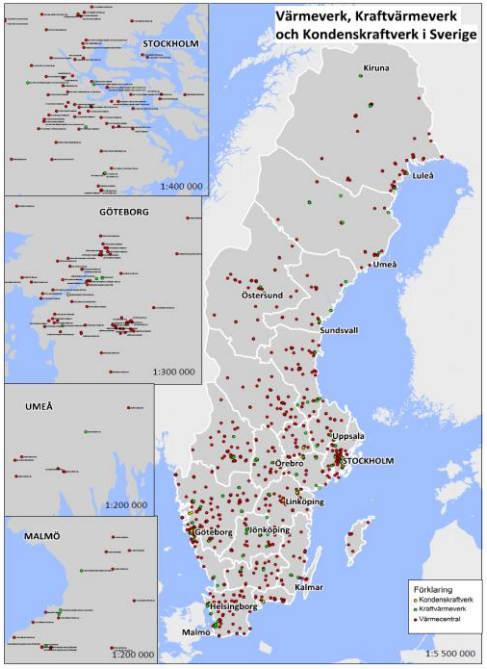
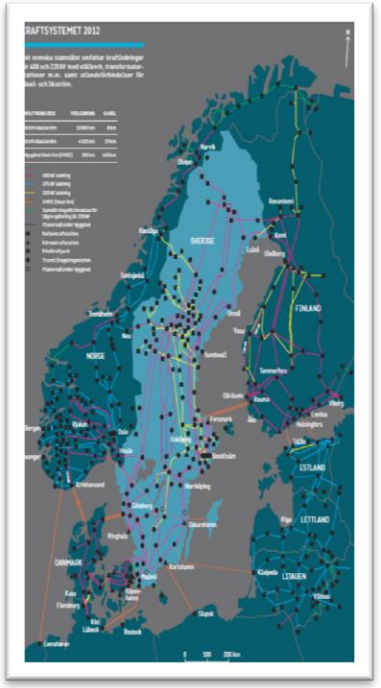
Heat Map

- Data from ”Lantmäteriet’s” real property register contains 3,2 million objects and consists of information about Sweden’s real property, e.g. taxation values and deeds of title.
- Branch organisation SVEBIO have data on all Bio-CHP and Waste CHP plants
- Industry data collected from the reporting to the **European Pollutant Release and Transfer Register (E-PRTR).**
- Electricity grid and production facility data from the **Swedish national grid**
- Heat demand plot ratio of 0,3 from (heat demand per building space) Lantmäteriet (NUTS data)









Thanks for Your Attention!

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