

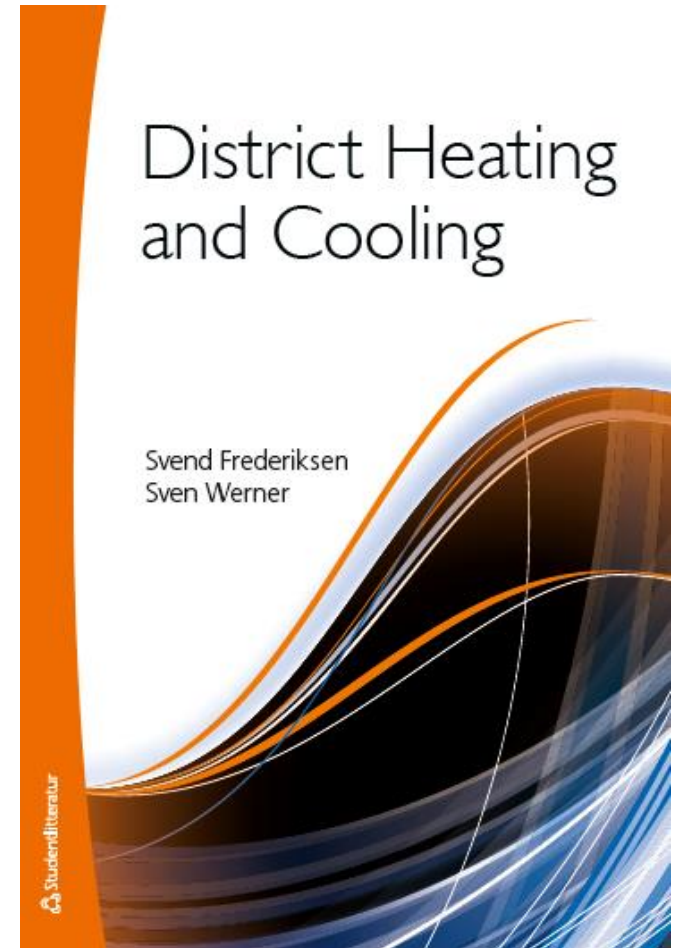
District Heating within the European Union

Dr Sven Werner

Professor in Energy Technology at
Halmstad University, Sweden

Who is Sven Werner?

- Professor in energy technology at Halmstad University since 2007.
- Been active with district heating research since 1978. PhD in 1984 with "The heat loads in district heating systems".
- Heads and participate in various projects concerning the future for district heating in Europe.
- Co-author of textbooks about district heating and cooling in 1993 and 2014 (Swedish versions) and 2013 (English version).



District heating systems are important in some dense cities in Europe?

How could these systems be further developed in the future?

This presentation contains some ideas about possible answers to this question?

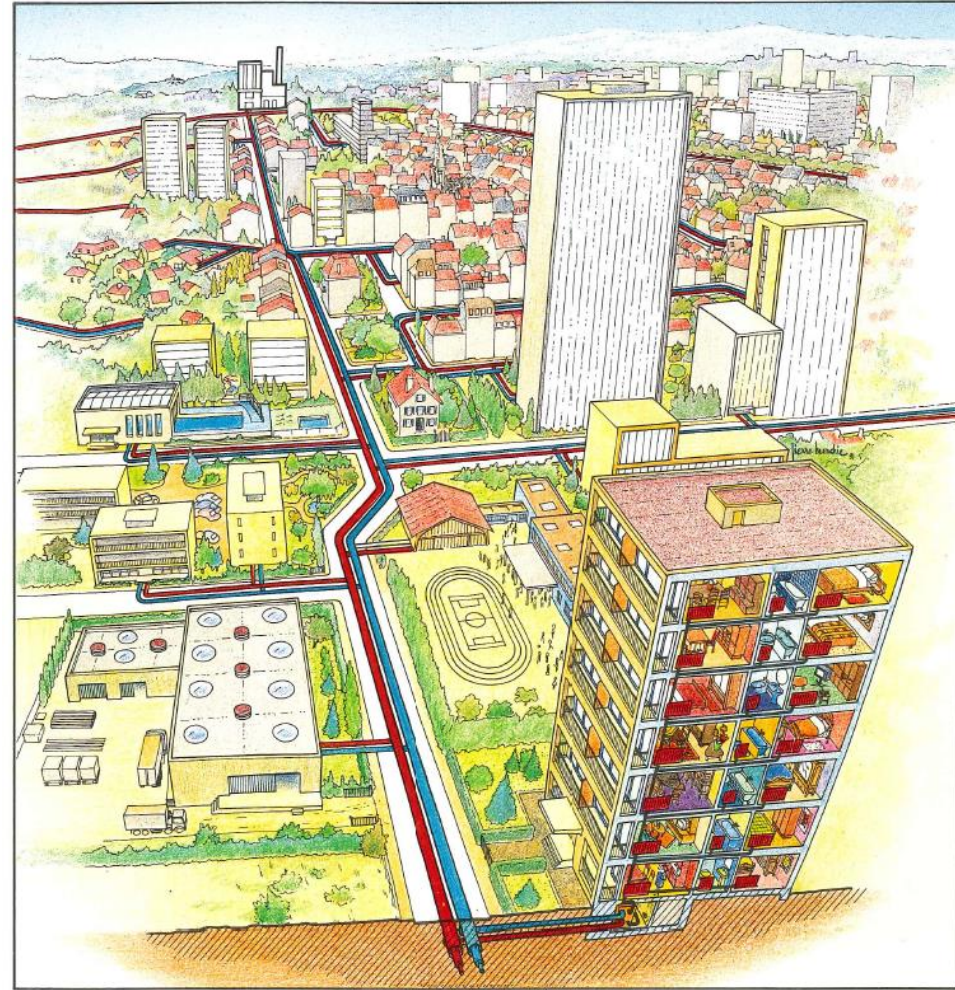


Figure 1.1. Overview drawing showing the basic parts of a district heating system. The picture was originally drawn by Pierre Merchie, France and originates from (AMFE 1991). Reprinted with permission.

1. District heating context: Basic energy flows

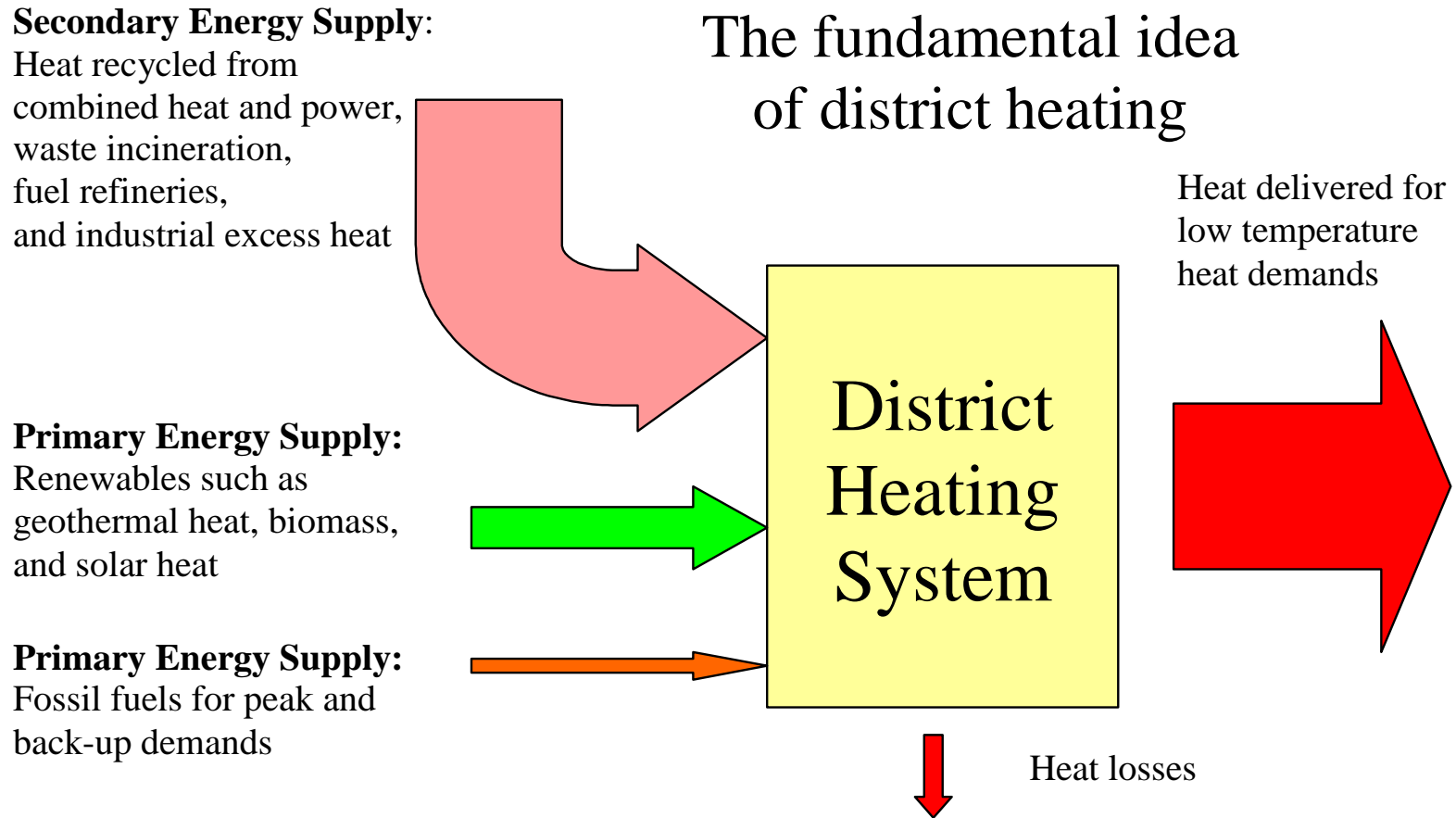


Figure 2-1. The basic energy flows in a district heating system designed according to the fundamental idea.

The EU28 member states having 507 million citizens

Austria

Belgium

Bulgaria

Croatia

Cyprus

Czech Republic

Denmark

Estonia

Finland

France

Germany

Greece

Hungary

Ireland

Italy

Latvia

Lithuania

Luxembourg

Malta

Netherlands

Poland

Portugal

Romania

Slovak Republic

Slovenia

Spain

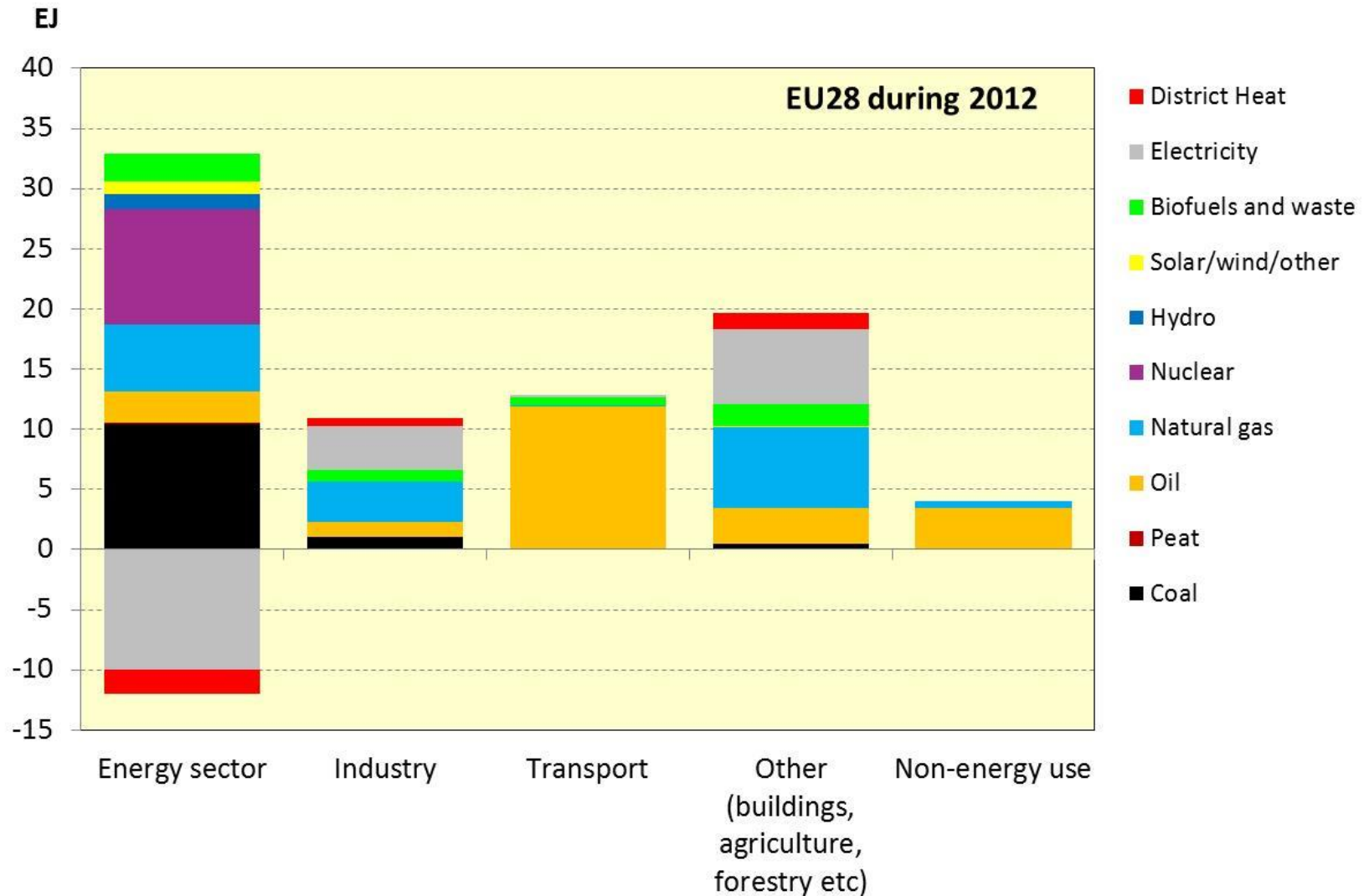
Sweden

United Kingdom

Outline

1. The EU-28 energy balance
2. Current heat market situation for buildings
3. Heat supply in district heating systems
4. Future market potential for district heating in Europe: The Heat Roadmap Europe Initiative
5. Conclusions

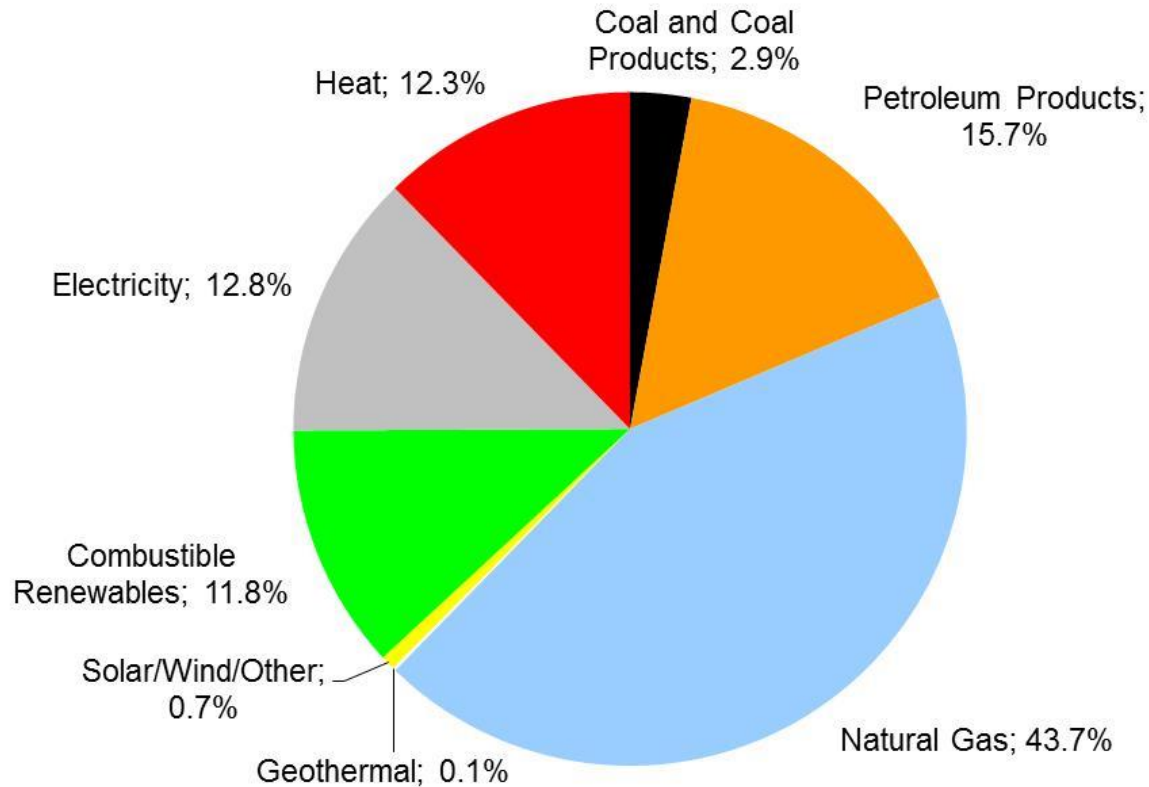
1. The EU-28 energy balance



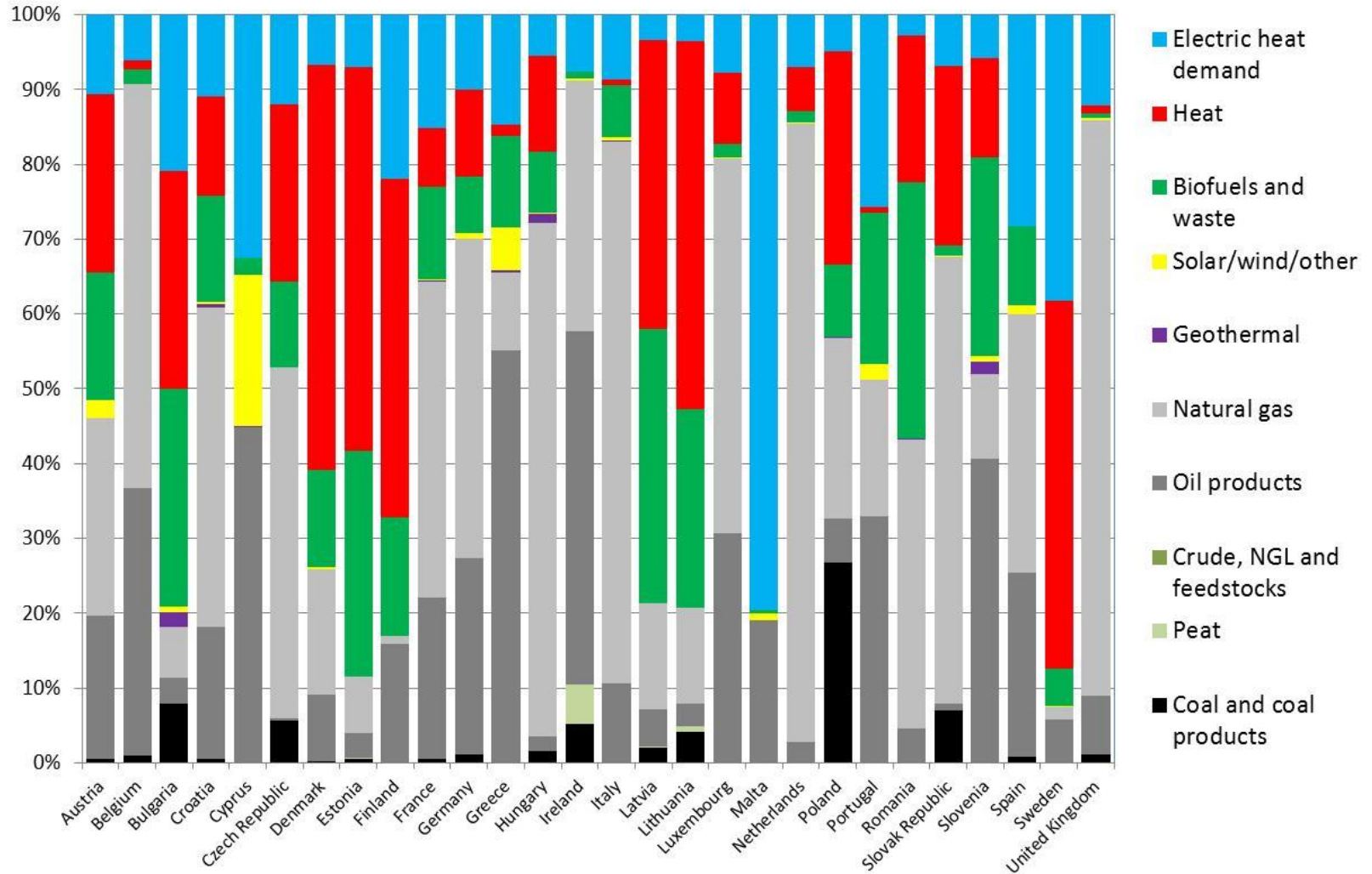
2. Current heat market situation

EU28 during 2012, Proportions of heat supply for heat demands in residential and service sector buildings

Total heat supply was 11.0 EJ for 507 million inhabitants, not including indirect heat supply from all indoor electricity use

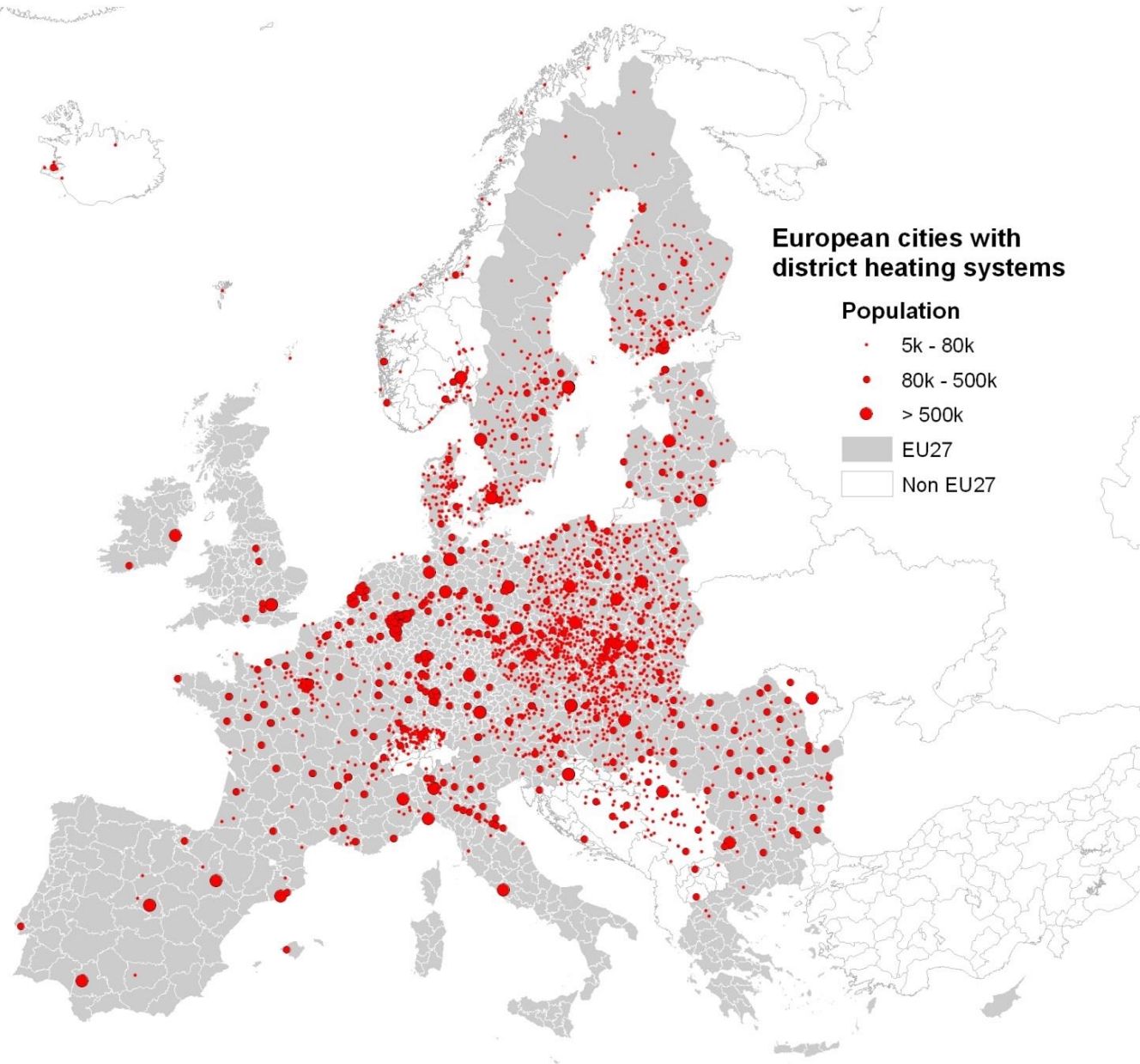


2. Current heat market situation



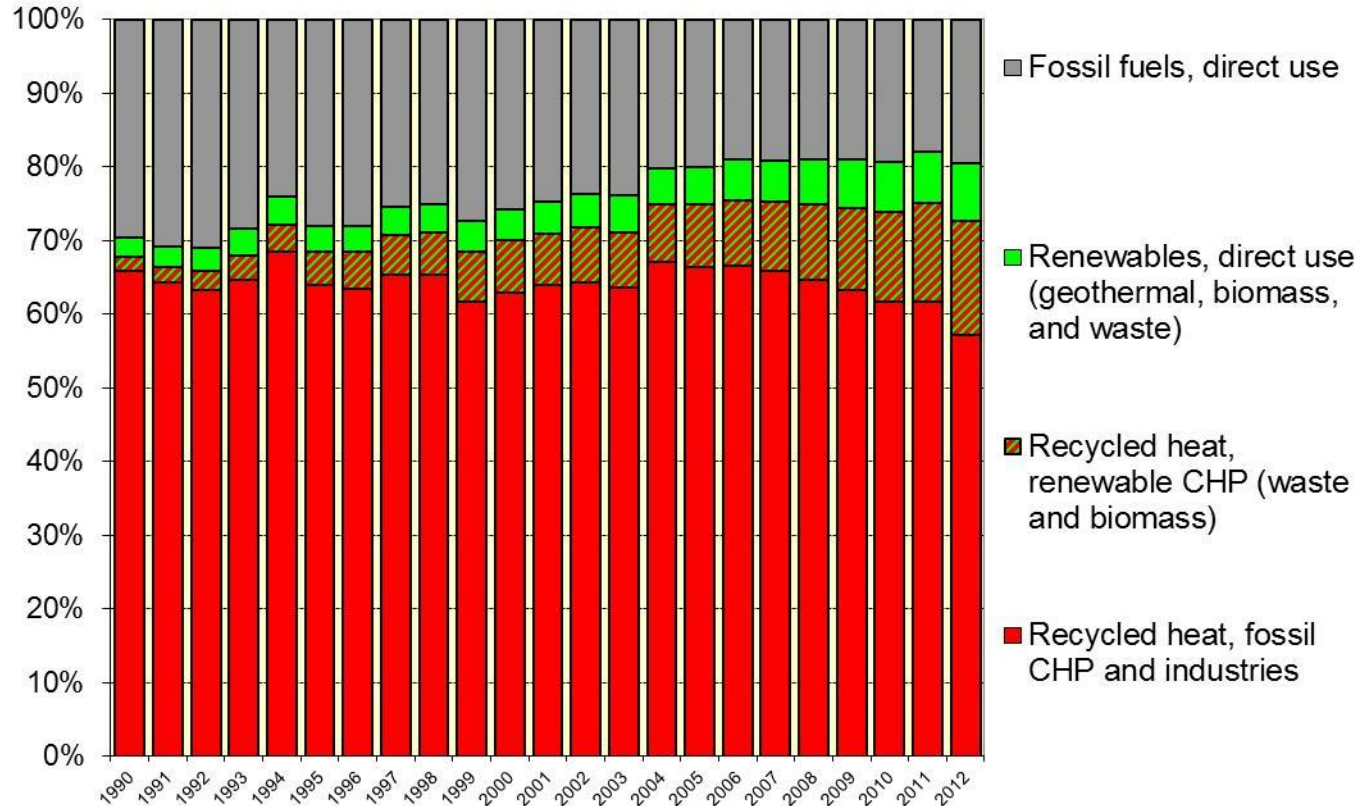
1. Current heat market situation

Figure 12-2. Map showing district heating systems in Europe in 2011. Systems have identified in 2779 cities and towns having more than 5000 inhabitants. Further 1395 district heating systems have been found in smaller towns and villages, mostly in Denmark, Sweden, Switzerland, Austria, the Czech Republic, and the Slovak Republic. According to national statistics, further about 1500 systems are in operation. Source: The European DHC database at Halmstad University (Urban Persson).



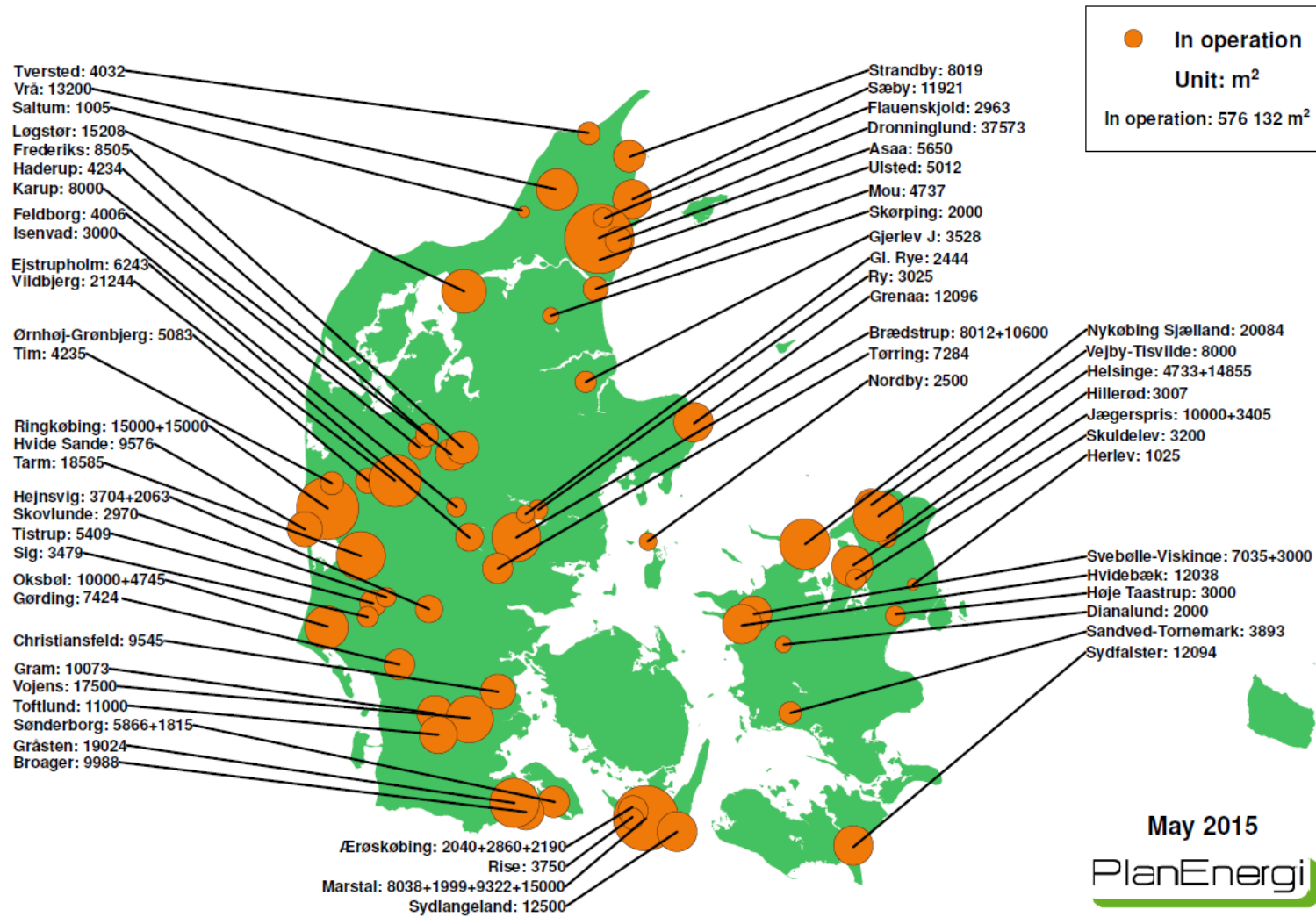
2. Heat supply for district heating

EU28 - Heat sources for district heating etc



Average annual growth rates 2002-2012, within district heating systems.
Biofuels : 9 %, Waste : 6 %, Geothermal : 15 %, and Solar : 28 %.

2. Solar district heating in Denmark



2. Solar district heating in Denmark

Two examples with solar district heating combined with biomass boilers and large pit heat storages.



Marstal



Vojens

2. The Heat Roadmap Europe Initiative

- **What is the future market for district heating in Europe?**
- Heat Roadmap Europe, prestudy 1 (2012) concerning business-as-usual scenario with current heat demands
- Heat Roadmap Europe, prestudy 2 (2013) concerning a high energy efficiency scenario



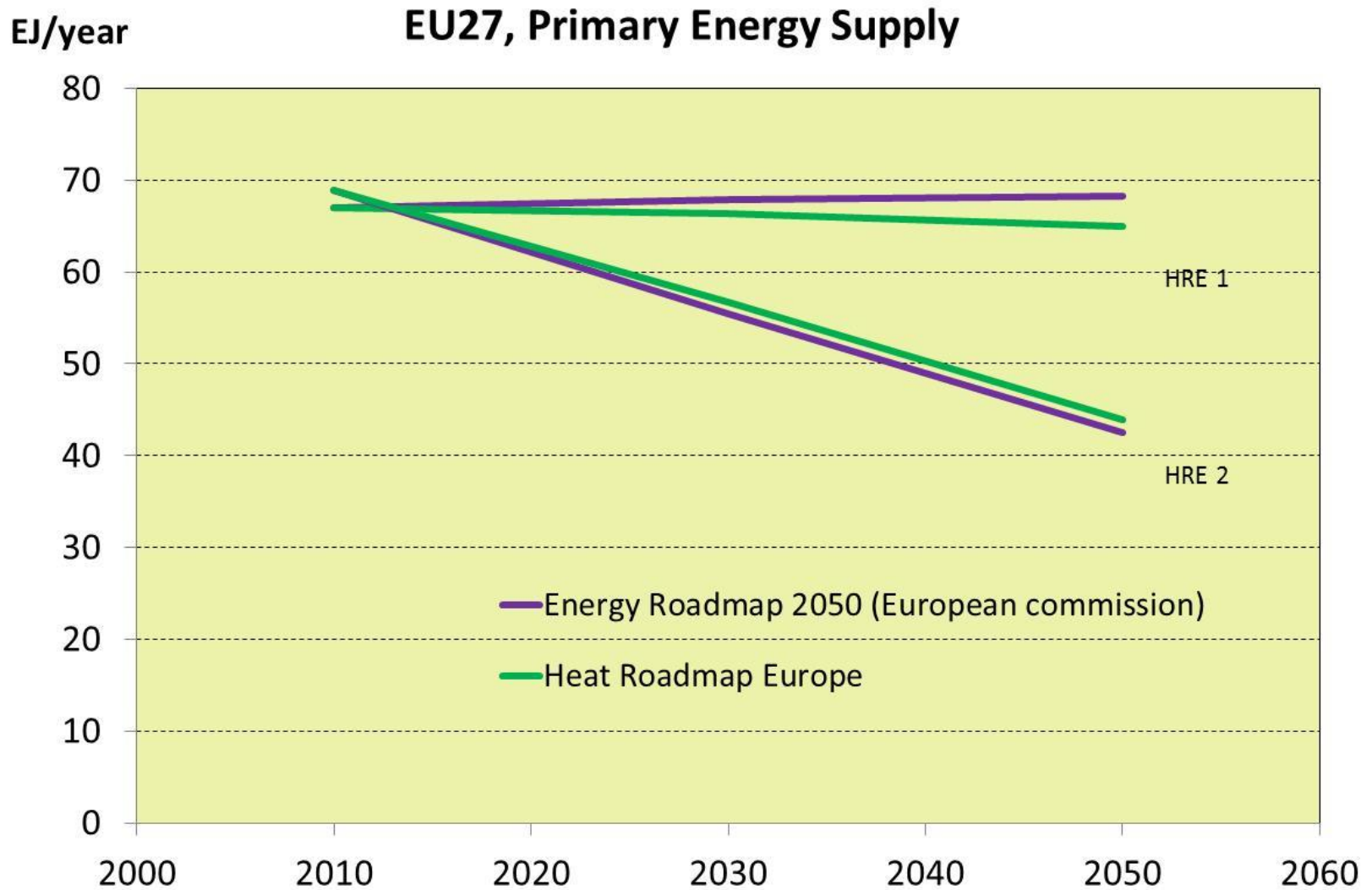
2. The Heat Roadmap Europe Initiative

- The **heating and cooling sector has largely been overlooked** in all scenarios exploring the energy future towards 2050.
- **Heat Roadmap Europe** focuses on the future European heat and cooling market and its importance in terms of cost-savings, job creation, investments, and **a smarter energy system.**

2. The Heat Roadmap Europe Initiative

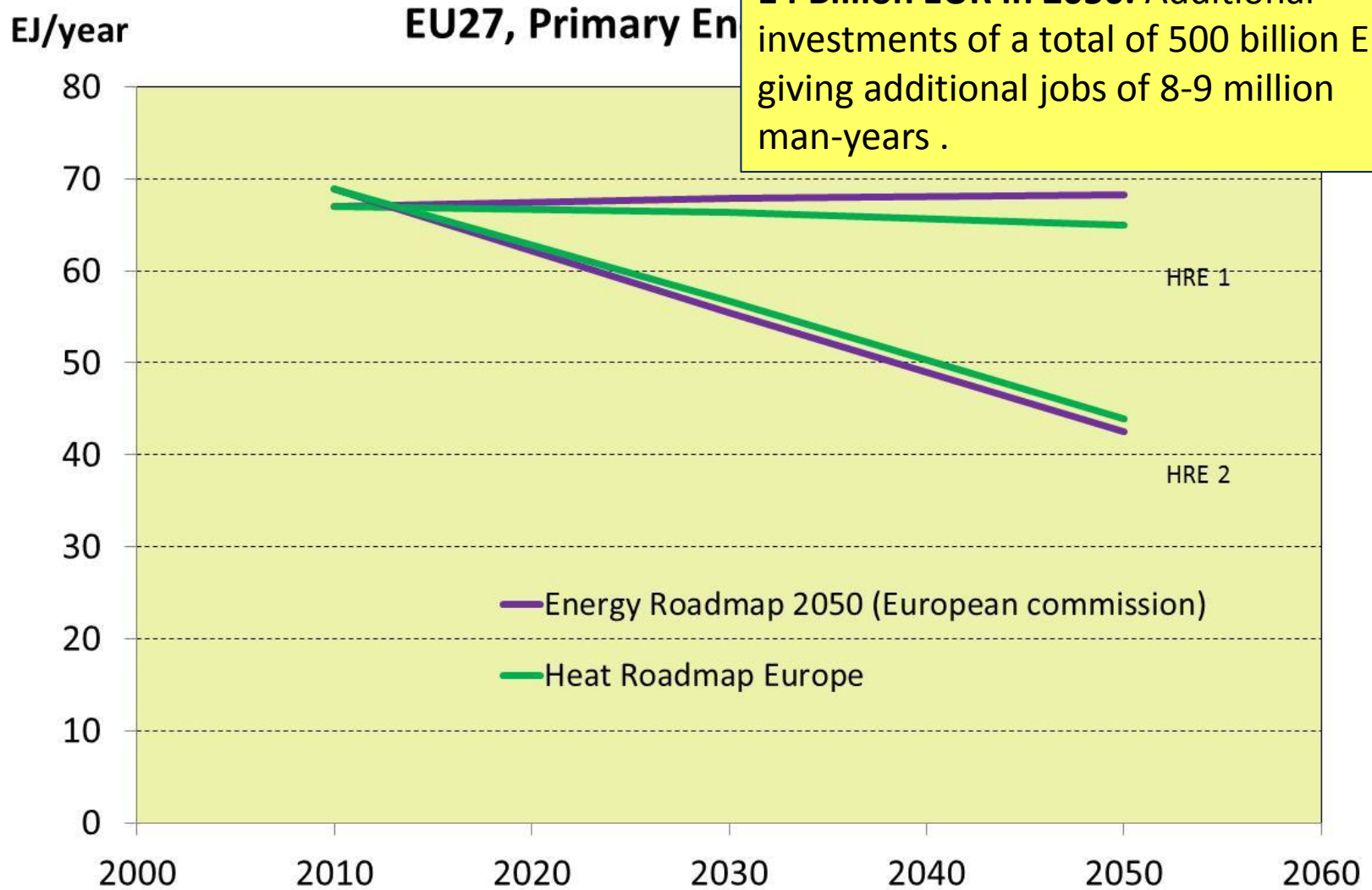
- All results are benchmarked against the EC communication called **Energy Roadmap 2050** (Dec 2011), which did not see a bright future for district heating with a market share of **10%** in 2050.
- **Heat Roadmap Europe** presumes a market share of **50%** for district heating in 2050 for heating the EU27 buildings.
- The current market share is **13%**.

Heat Roadmap Europe - Results



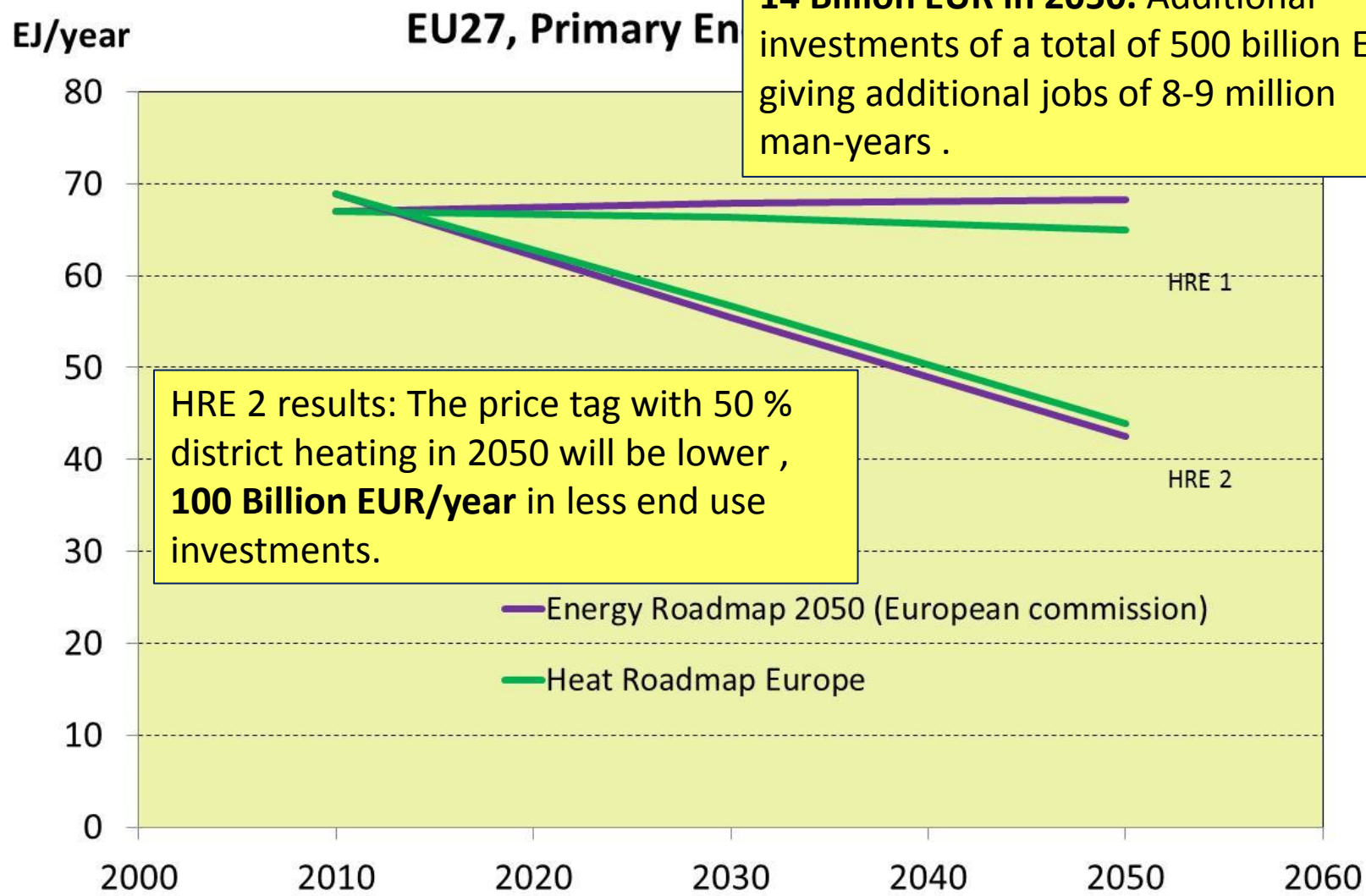
Heat Roadmap Europe

HRE 1 results: Reduced fuel costs of 30 Billion EUR with 50% district heating in 2050. Total heating costs are reduced by **14 Billion EUR in 2050**. Additional investments of a total of 500 billion EUR giving additional jobs of 8-9 million man-years .



Heat Roadmap E

HRE 1 results: Reduced fuel costs of 30 Billion EUR with 50% district heating in 2050. Total heating costs are reduced by **14 Billion EUR in 2050**. Additional investments of a total of 500 billion EUR giving additional jobs of 8-9 million man-years .



HRE 2 results: The price tag with 50 % district heating in 2050 will be lower , **100 Billion EUR/year** in less end use investments.

2. The Heat Roadmap Europe Initiative

- A. Forecast:** District heating will be suitable in dense urban areas, while local heat pumps and biomass boilers will be suitable in other areas.
- B. News:** First ever estimation of the district heating benefits in the future European energy system.
- C. Less costly:** We can avoid the most expensive end use energy efficiency measures in buildings by using district heating as an energy efficiency tool.
- D. Paradox:** District heating will have a higher competitiveness in a future more energy efficient Europe.

2. The Heat Roadmap Europe Initiative

We slice EU into about 1300 pieces (NUTS3 regions), and estimate what is possible in each region.

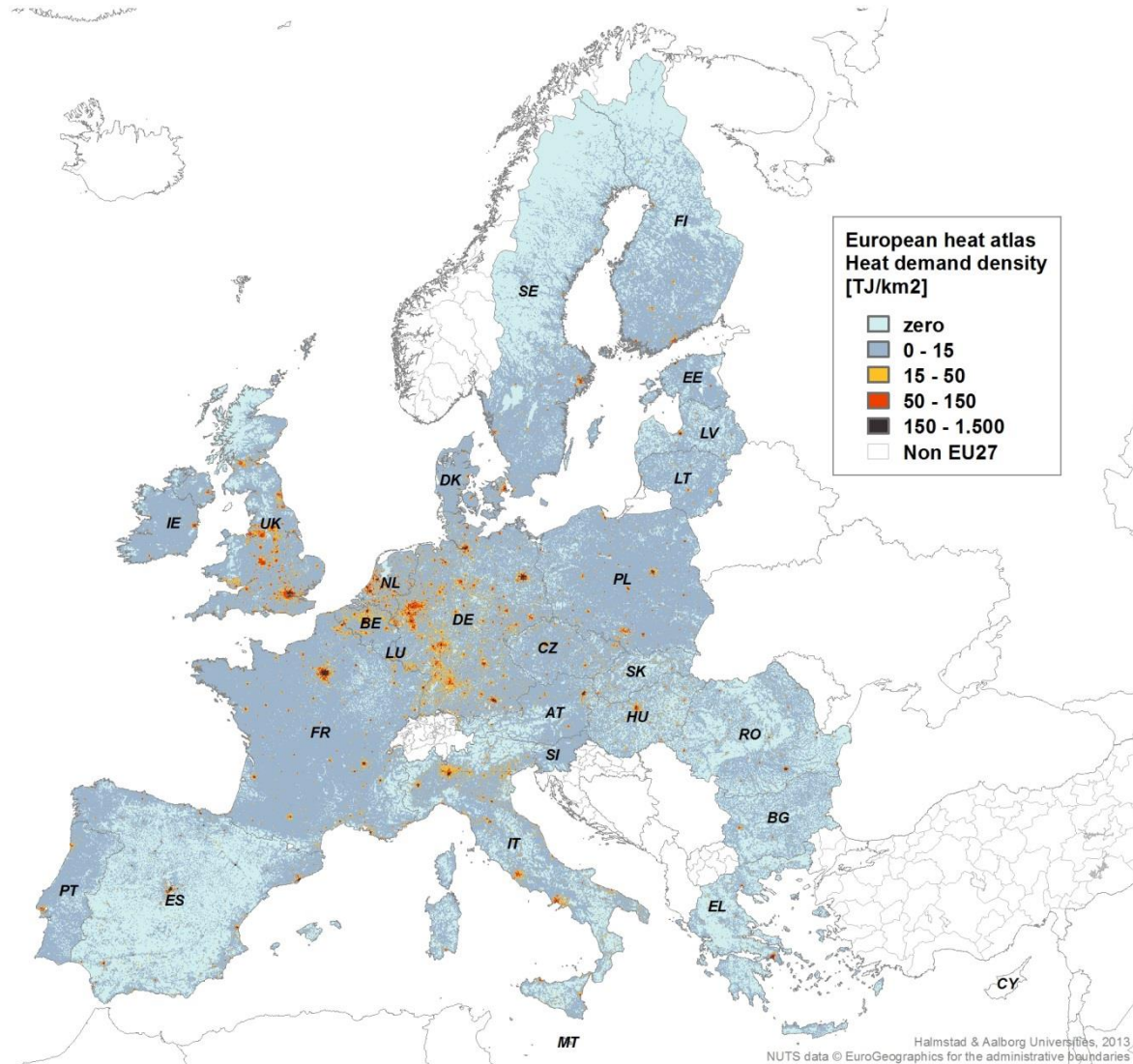
Other energy modellers just cut EU into 27 pieces (the national energy balances)

Figure 11: The NUTS3 regions of Europe, of which 1289 are located within the EU27 European territory and 14 are located overseas. (from the second pre-study)



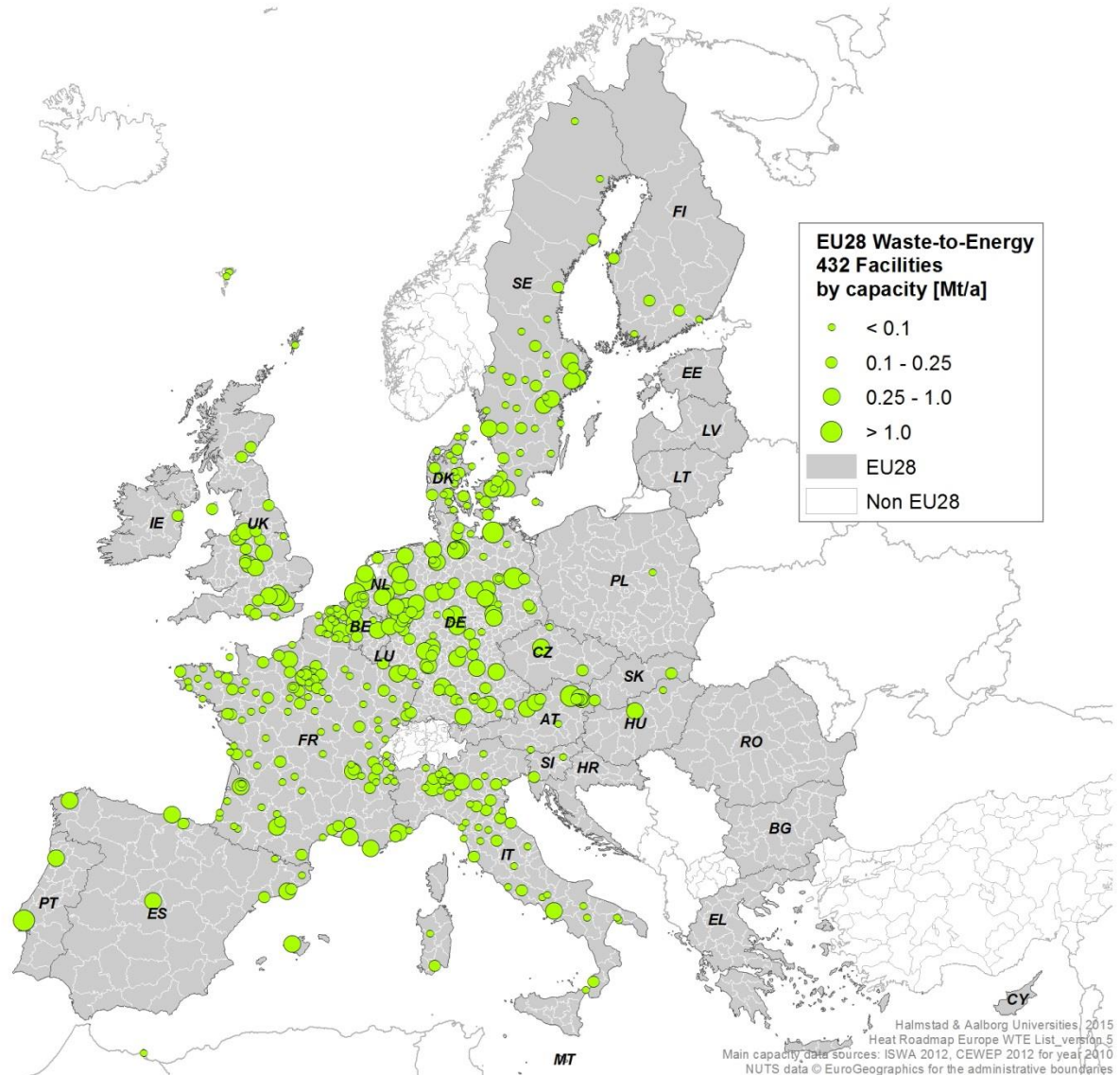
2. The Heat Roadmap Europe Initiative

The high resolution heat density map from the second pre-study



2. The Heat Roadmap Europe Initiative

All waste incineration plants within EU with respect to size and location.



2. The Heat Roadmap Europe Initiative

Straw resources within EU with respect to location.

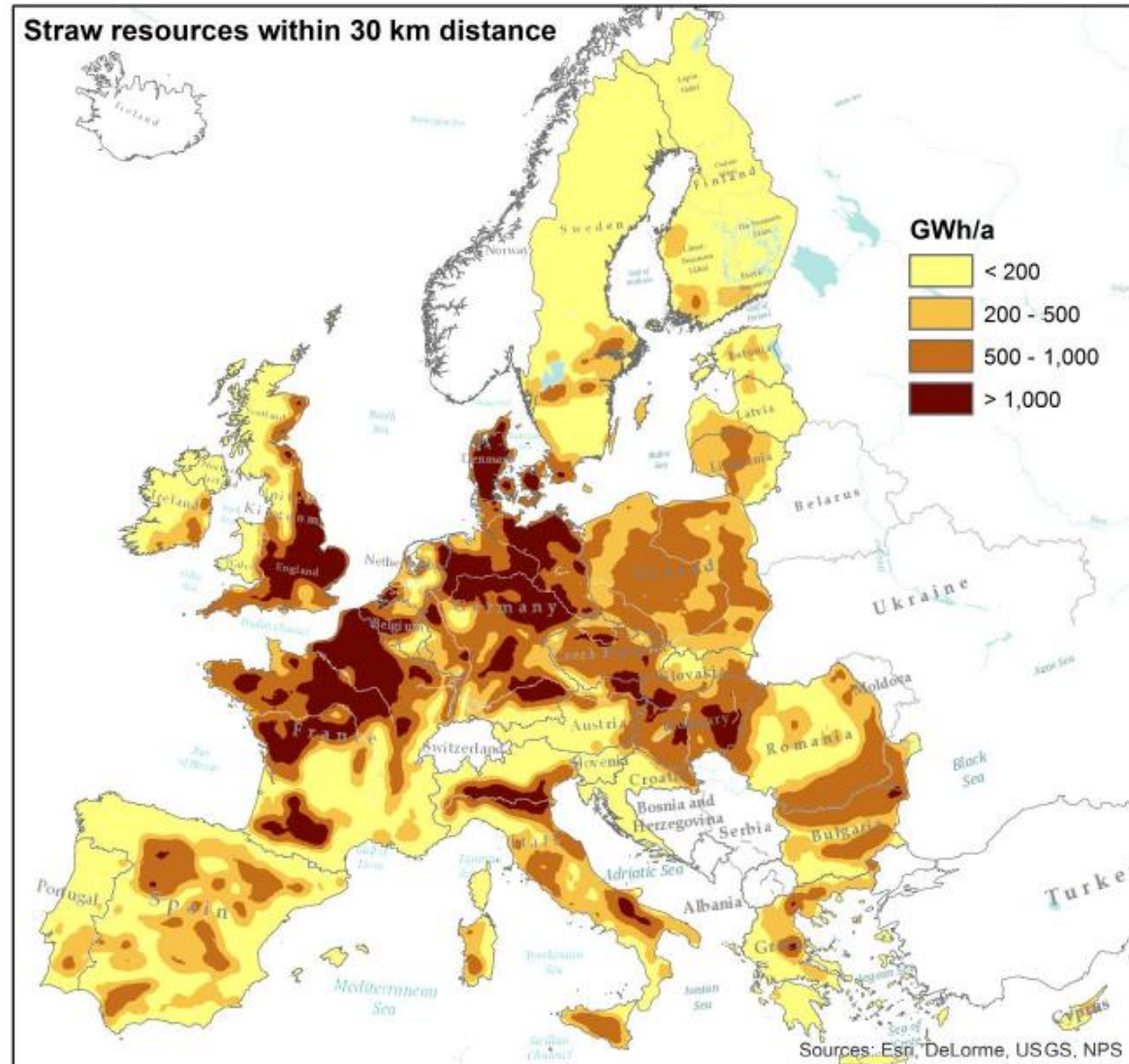


Figure 1: Straw resources from biomass within a distance of 30km of each location. This map shows densities of straw wastes from cereal production from all possible arable lands.

2. The Heat Roadmap Europe Initiative

Forest biomass within EU with respect to location.

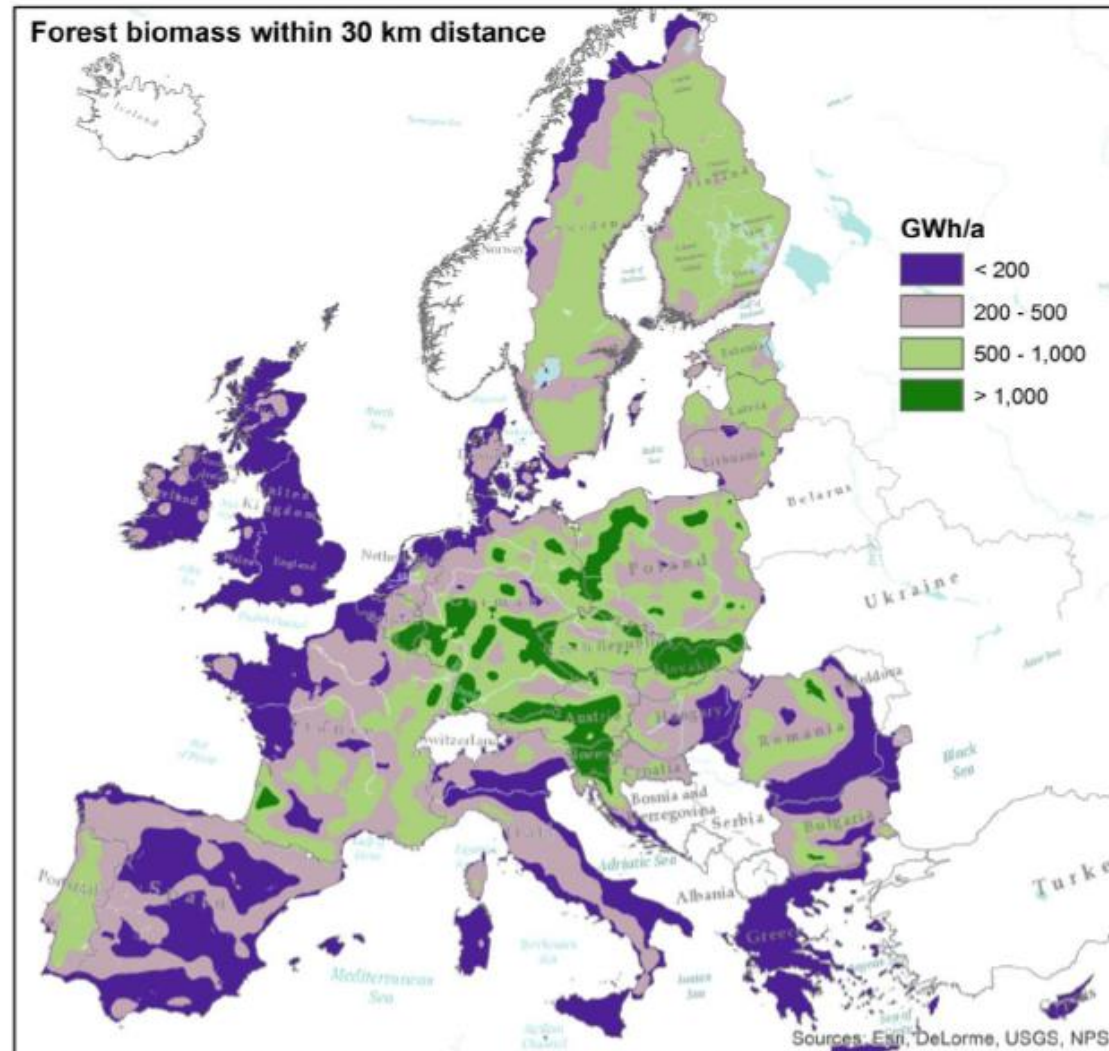


Figure 2: Potential biomass resources from forestry including thinning as fraction of annual increment and logging residues as share of annual felling. The map shows densities by accounting for forest biomass available within a radius of 30km around each location.

2. The Heat Roadmap Europe Initiative

All geothermal fields within EU with respect to location.

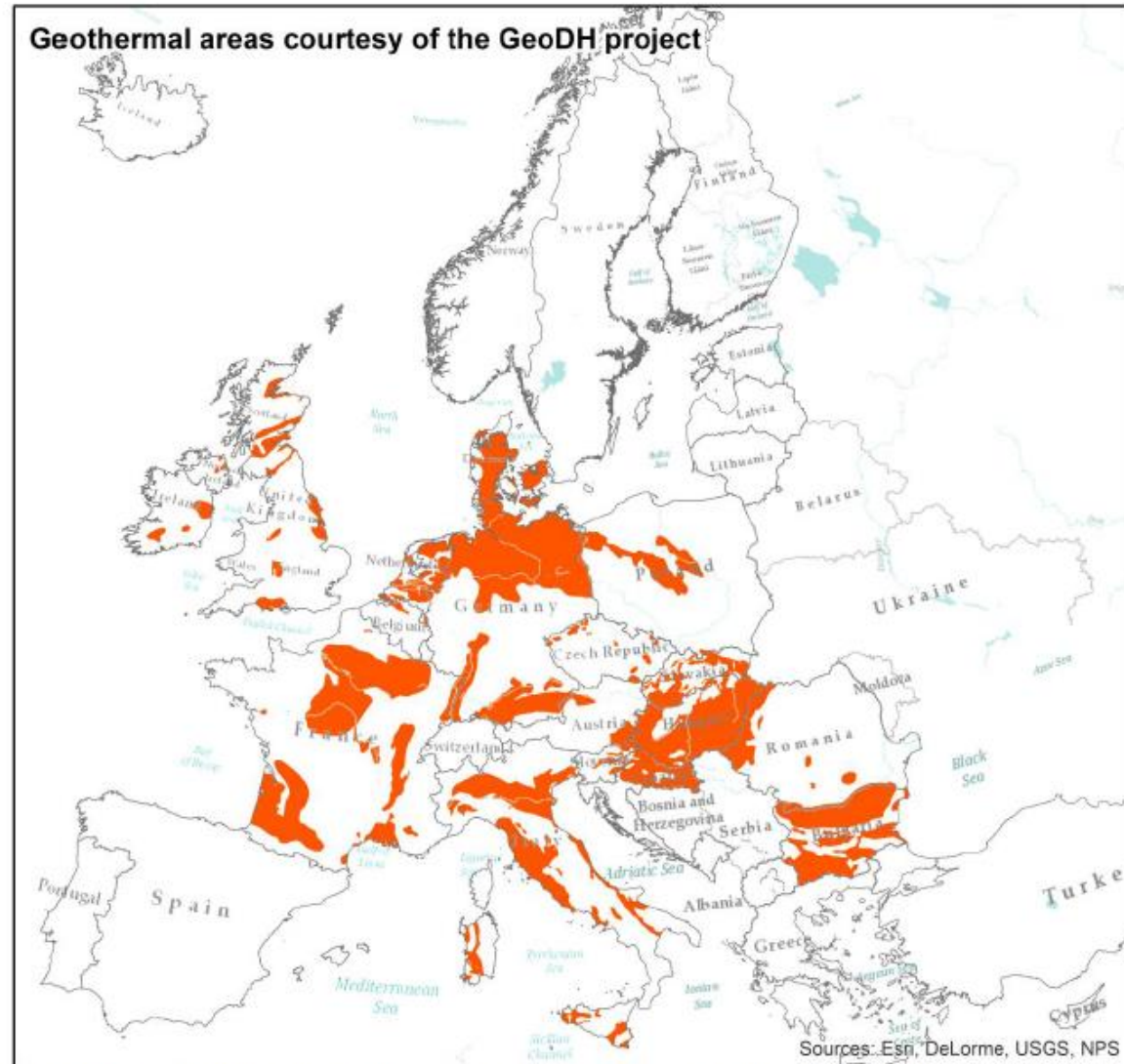


Figure 3: Map of suitable geothermal areas, which are characterised by hot sedimentary aquifers or other potential reservoirs.

3. The IEE Stratego project (2014-2016)

Main purposes:

1. Provide HRE modelling for five countries: UK, Italy, Romania, Czech Republic, and Croatia (performed).
2. Support local authorities in taking action through 44 project proposals in 23 regions located in eight countries (UK, Italy, Romania, Czech Republic, Croatia, Belgium, Austria, and Germany) as input to NHCPs (in progress).
3. Best practise and knowledge transfer concerning NHCPs (in progress).

3. The IEE Stratego project (2014-2016)

Heat Roadmap Scenario in 2050 Compared to a Business-As-Usual Energy System for the Year 2050

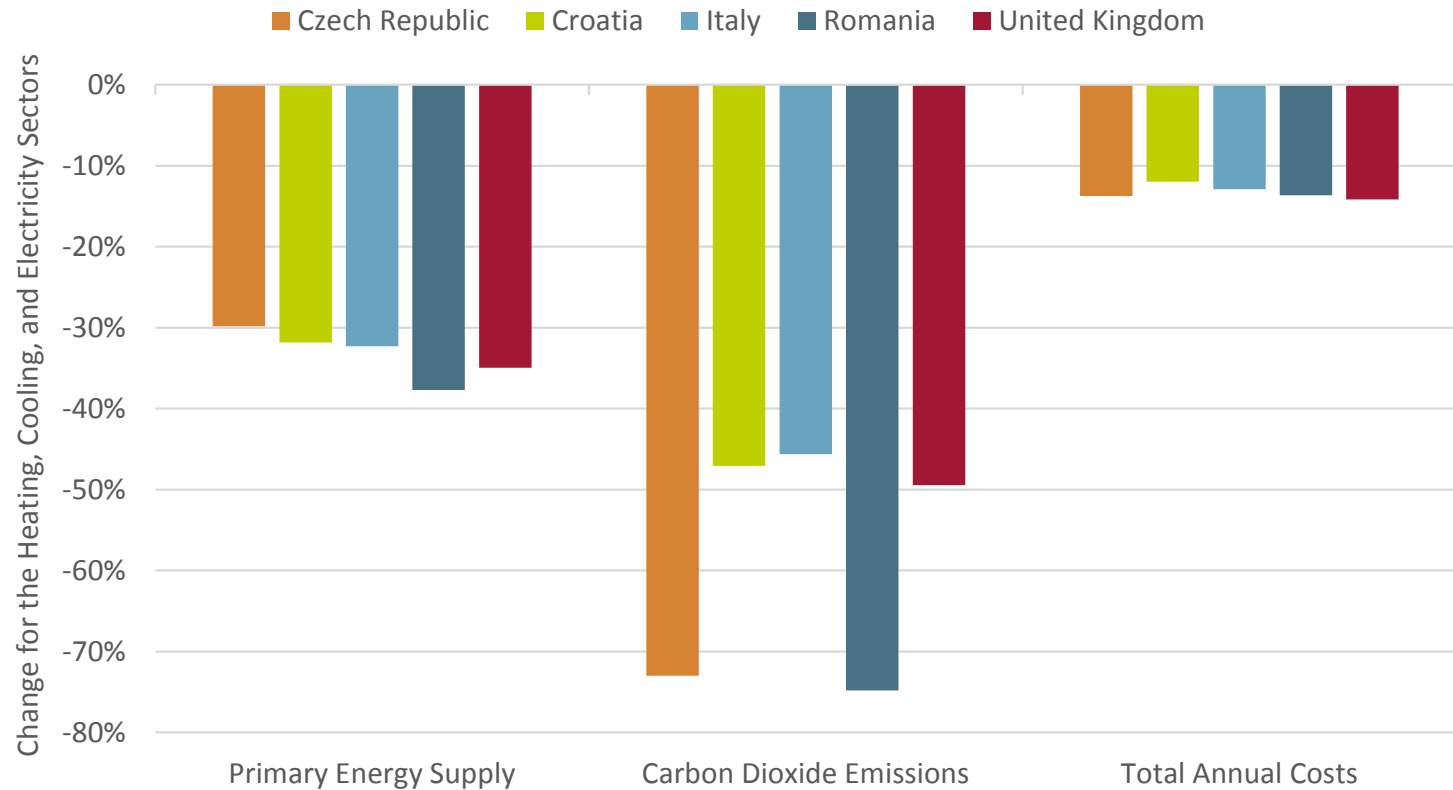


Figure 3: Heat Roadmap impacts on Energy, Environment and Economy compared to the BAU 2050 scenario for the Heating, Cooling and Electricity sectors (excludes the industry and transport sectors).

5. Conclusions

1. Currently, low market share of district heating in Europe (12 percent with EU28)
2. More district heating systems can provide lower costs, less energy import, and lower carbon dioxide emissions.
3. Combination with heat demand reductions of about 40 percent will support the long term European climate and energy policies for 2050 and beyond.

Acknowledgement

- This presentation is based on research performed within the **Danish 4DH research centre** with basic funding from the Danish Innovation Fund and the **Stratego** project with basic funding from the European Commission.
- My participation in these two research projects is co-financed by Fjärrsyn, the Swedish research programme for district heating and cooling, provided by the Swedish Energy Agency and the Swedish District Heating Association.

The End

Thank you for your attention!

More info about Heat Roadmap Europe at: <http://heatroadmap.eu/>

Two scientific articles about Heat Roadmap Europe :

Heat Roadmap Europe: Combining district heating with heat savings to decarbonise the EU energy system

<http://www.sciencedirect.com/science/article/pii/S0301421513010574>

Heat Roadmap Europe: Identifying strategic heat synergy regions

<http://www.sciencedirect.com/science/article/pii/S0301421514004194>