

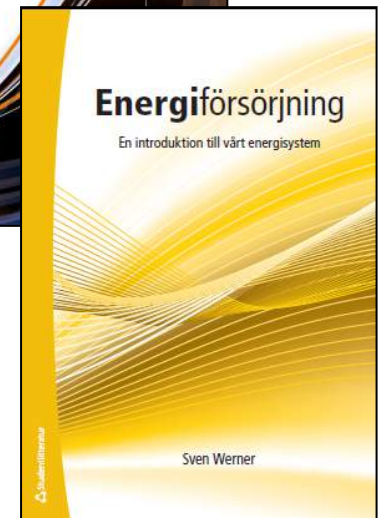
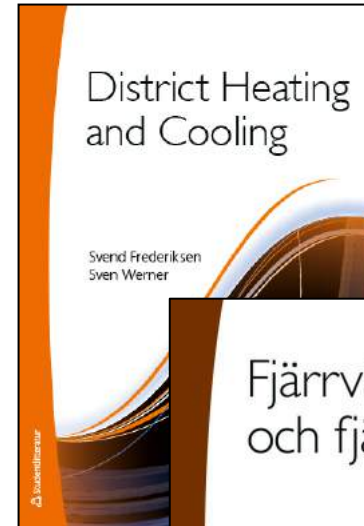
Heat Roadmap Europe

Sven Werner

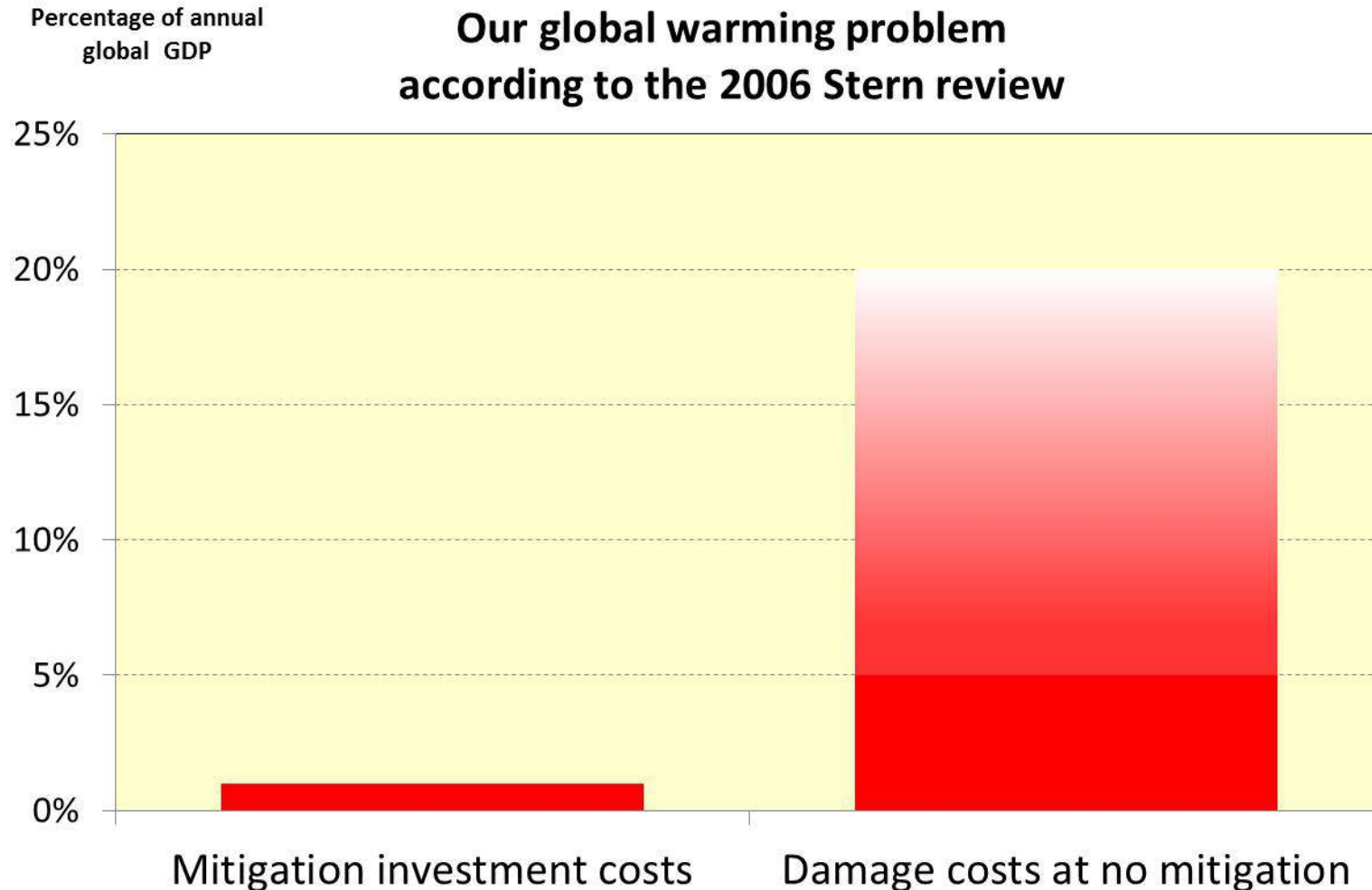
Halmstad University, Sweden

Who is Sven Werner?

- Professor in energy technology at Halmstad University since 2007.
- Initiates, coordinates and participates in research projects concerning the future of district heating in Europe.
- Author of textbooks about district heating 1993 and 2014 (Swedish versions) and 2013 (English version). Also an introductory textbook in Swedish about energy supply this year (Energiförsörjning).
- Will retire during 2017!



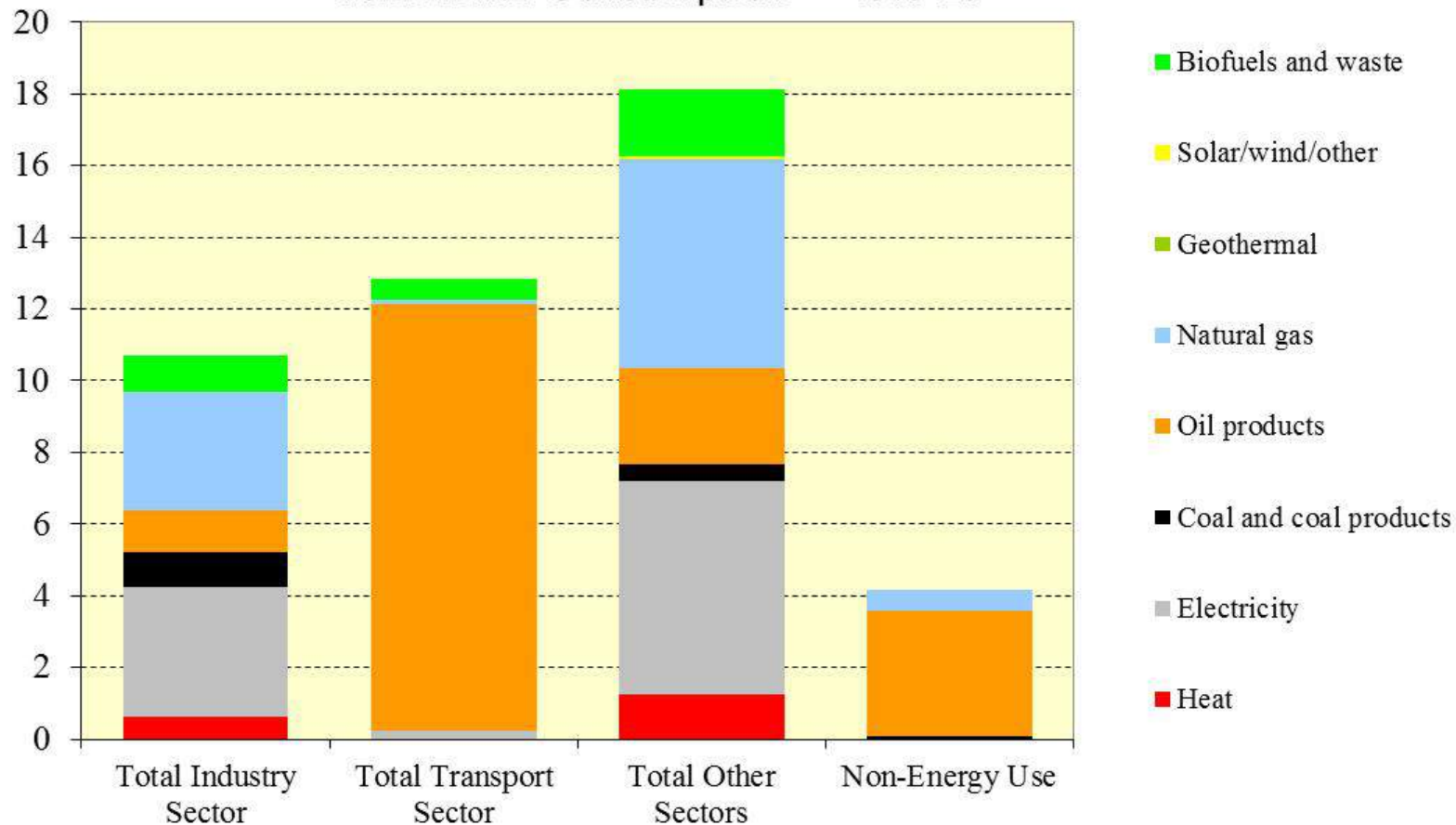
The challenge of our time



European Union-28 during 2014

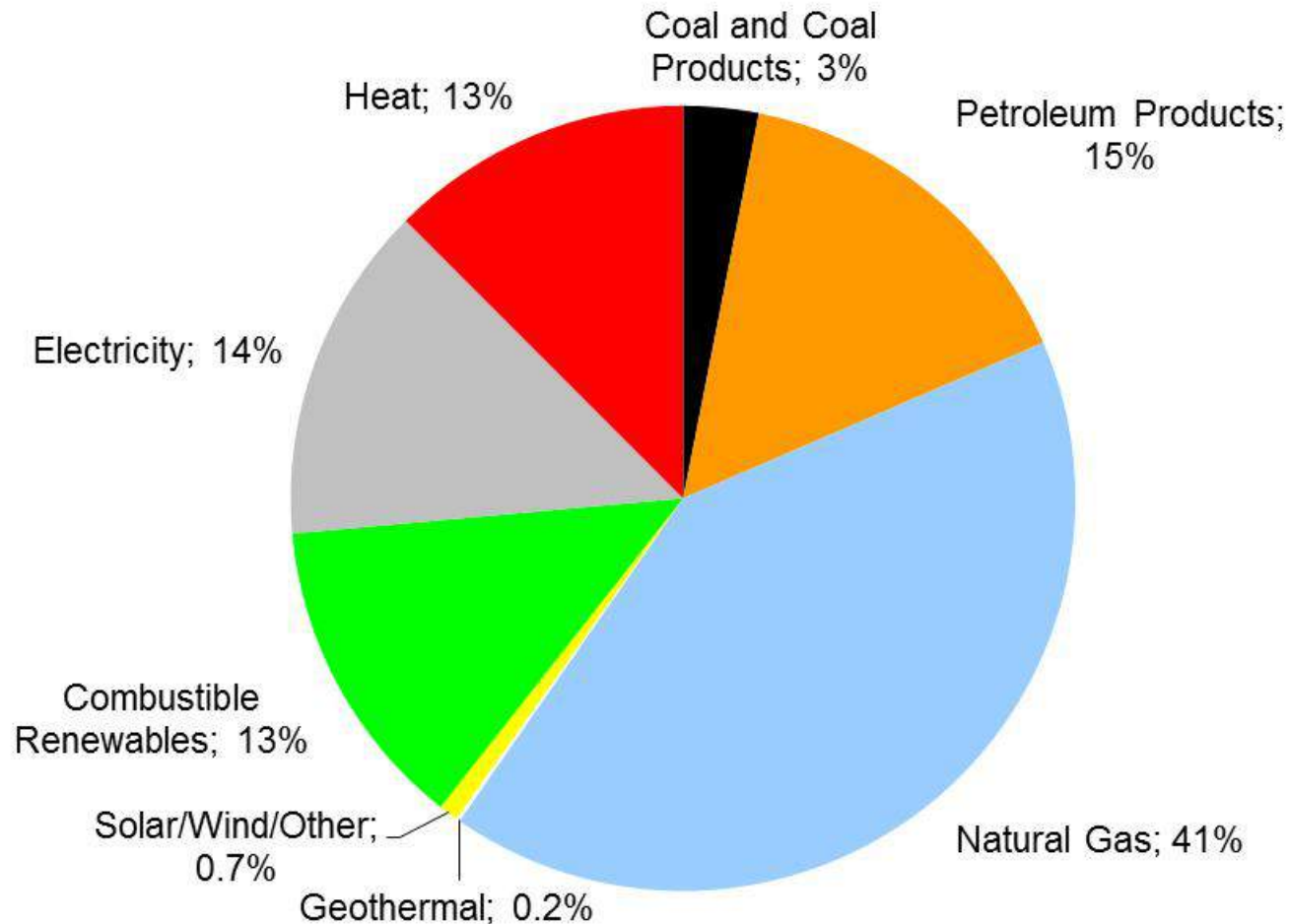
EJ

Total Final Consumption = 45.8 EJ



EU28 during 2014, Proportions of heat supply for heat demands in residential and service sector buildings

Total heat supply was 10.0 EJ for 507 million inhabitants, not including indirect heat supply from all indoor electricity use



Basic heat flows in current district heating systems

Secondary Energy Supply:

Heat recycled from combined heat and power, waste incineration, fuel refineries, and industrial excess heat

Primary Energy Supply:

Renewables such as geothermal heat, biomass, and solar heat

Primary Energy Supply:

Fossil fuels for peak and back-up demands

The fundamental idea of district heating

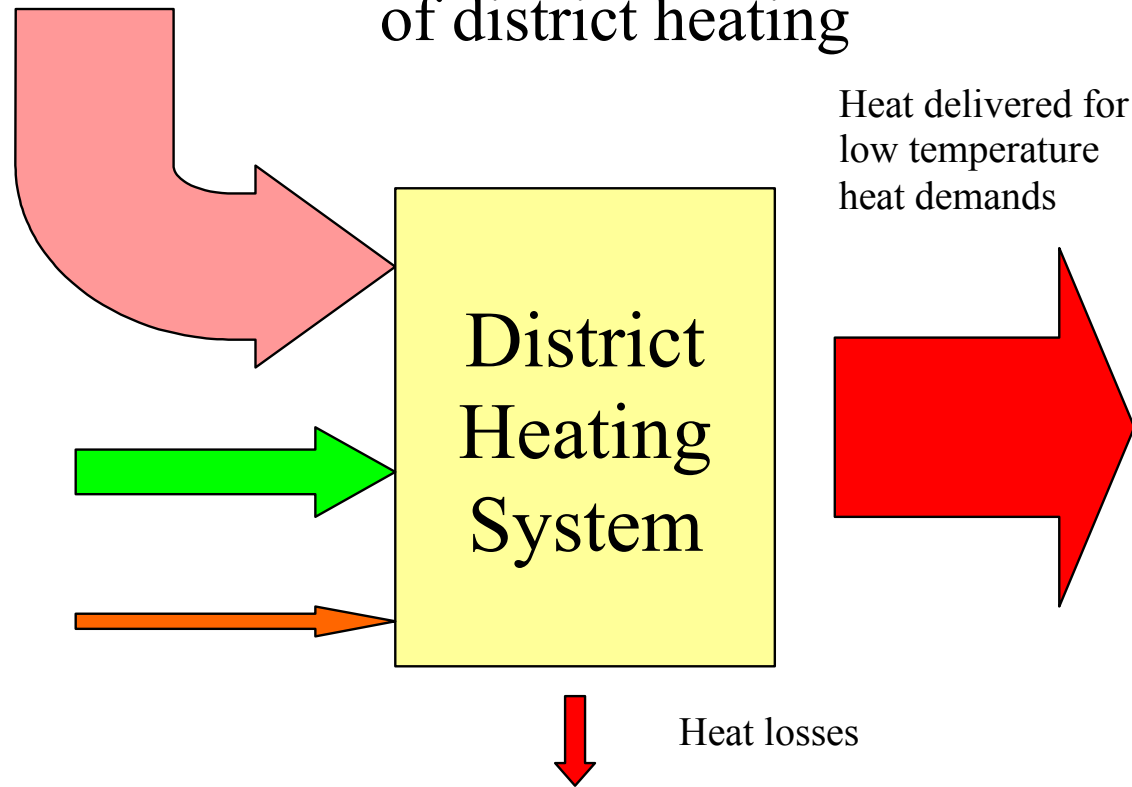


Figure 2-1. The basic energy flows in a district heating system designed according to the fundamental idea.

Heat Roadmap Europe projects

- 1st Heat Roadmap Europe pre-study 2012 about the future conditions for district heating in a business-as-usual scenario. Benefit of lower costs with 14 billion EUR in 2050.
- 2nd Heat Roadmap Europe pre-study 2013 about the future conditions for district heating and heat pumps in a strong energy efficiency scenario. Benefit of lower costs with 100 billion EUR in 2050.
- Stratego – HRE3, European project between 2014 and 2016 with several partners. Detailed studies of five European countries.
- Heat Roadmap Europe 4, European project between 2016 and 2018 with several partners. Detailed studies of further ten European countries.
- Outputs and corresponding maps are available at www.heatroadmap.eu

Main results from Heat Roadmap Europe

- 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.

Heat Roadmap Europe methodology

We sliced EU into about 1300 pieces (NUTS3 regions), and estimated what was possible in each region.

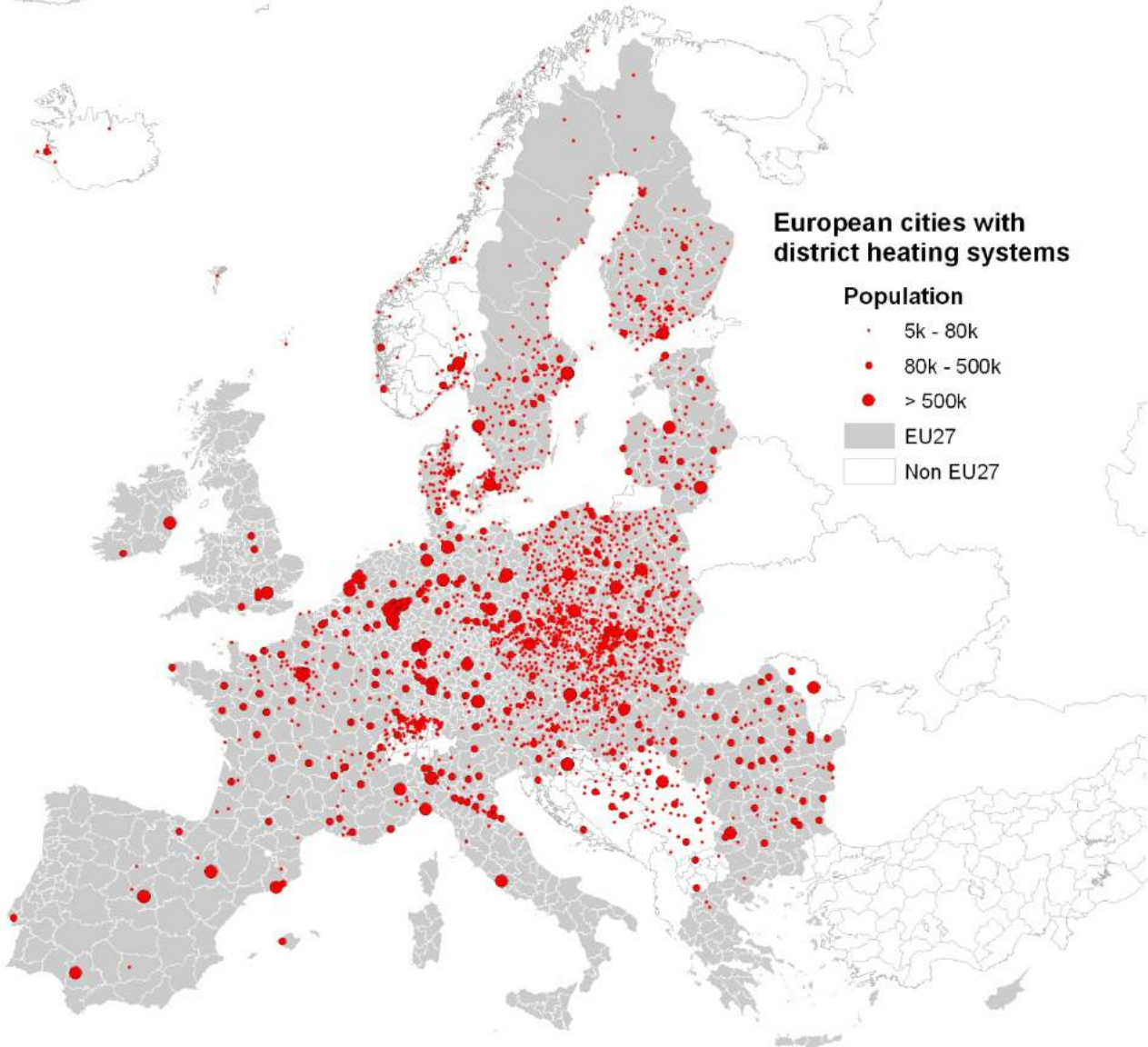
Other energy modellers just cut EU into 27 pieces (the national energy balances)

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)



District Heating

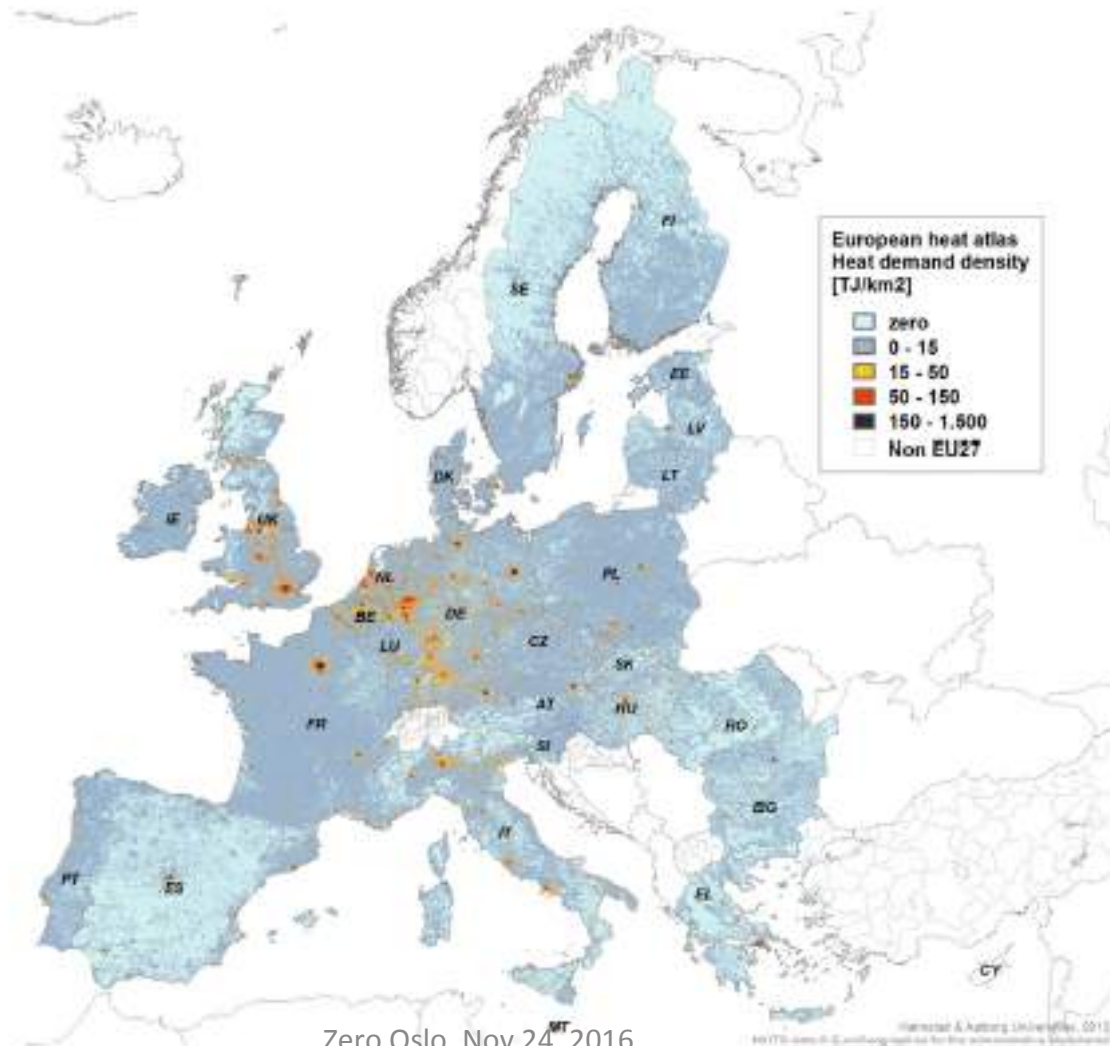
Figure 12-2. Map showing district heating systems in Europe in 2011. Systems have identified in 2779 cities and towns having more than 5000 inhabitants. Further 1395 district heating systems have been found in smaller towns and villages, mostly in Denmark, Sweden, Switzerland, Austria, the Czech Republic, 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).



The European heat density map

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D. Connolly et al. / Energy Policy 65 (2014) 475–489



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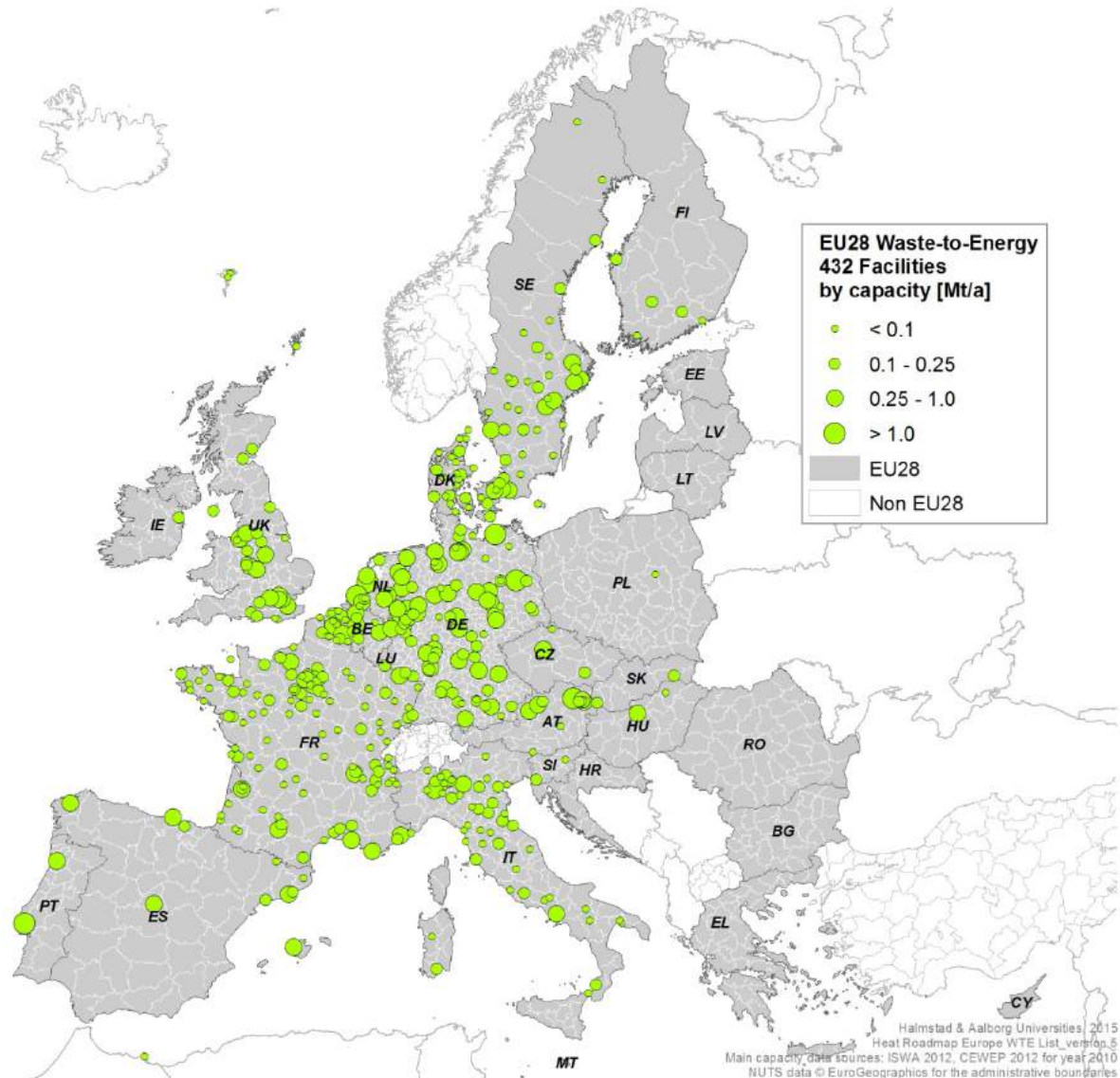
Zero Oslo, Nov 24, 2016

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Fig. 6. European Heat Atlas: by heat demand density classes based on the GEOSTAT 2006 1 km² population grid.

Examples of heat sources: Waste incineration

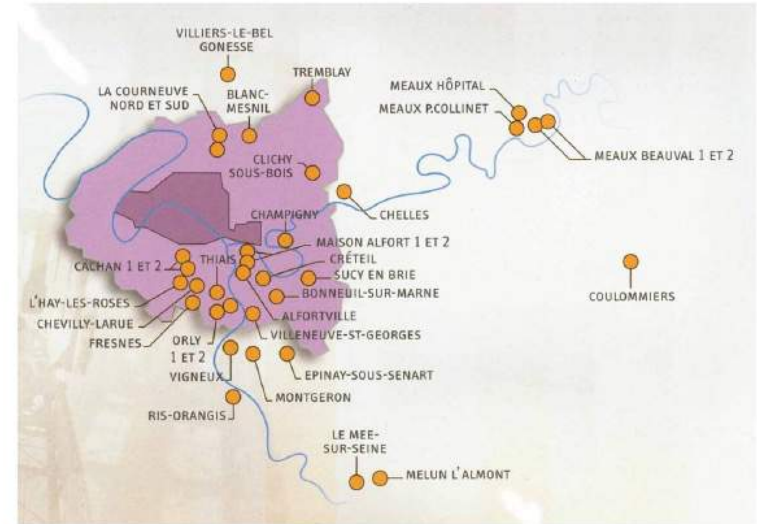
All waste incineration plants within EU with respect to size and location as example of available large central heat sources.



Geothermal district heating systems in Europe

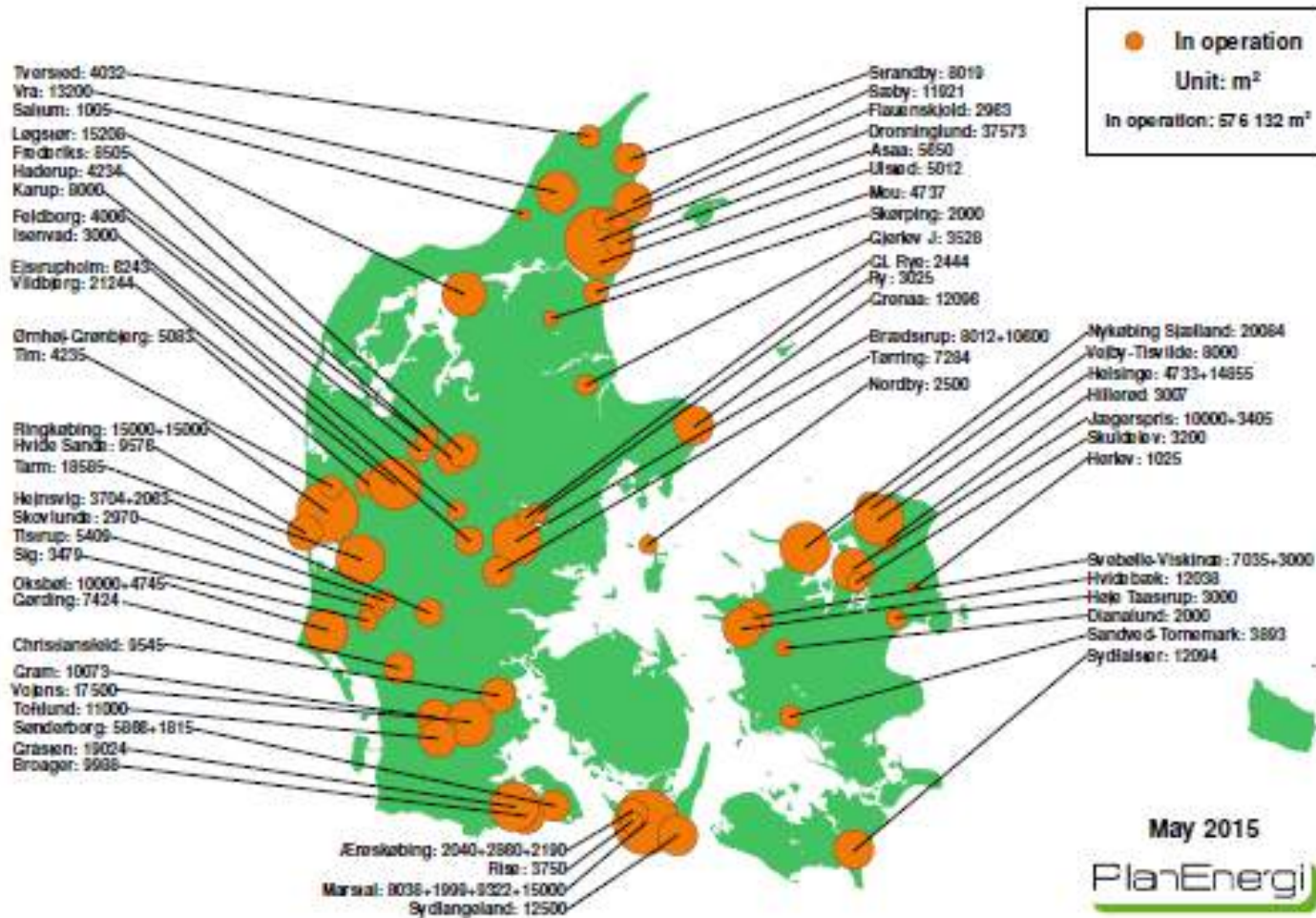


Location of Paris Basin geothermal district heating doublets 2006 status (source ADEME)



One quarter of the EU population lives in urban areas where geothermal heat is available.

Solar district heating in Denmark



Vojens, Denmark



Construction of
the large
thermal storage
during 2014



Possible supply proportions

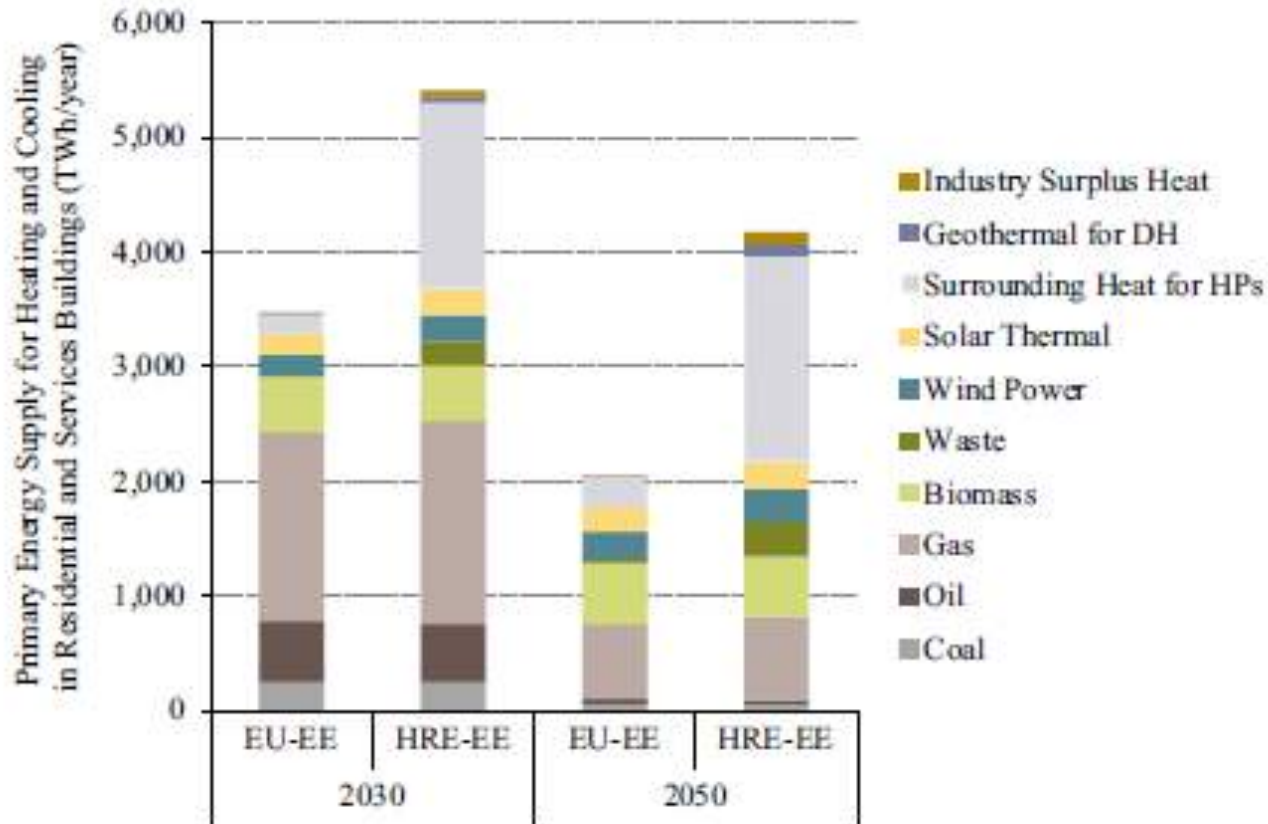


Fig. 10. Primary energy supply for heating and cooling in residential and services buildings in the EU-EE and HRE-EE scenarios for the years 2030 and 2050.

Conclusions

- Yes, a combination of energy efficiency end use measures, urban district heating systems, and local heat pumps can substitute the current use of natural gas and fuel oil for heat supply to European buildings.
- However, we need strong steering mechanisms for activating mitigation of climate change in order to avoid the high damage costs of global warming.

The End

Thank you for your attention!

More info about Heat Roadmap Europe at:

<http://heatroadmap.eu/>

Scientific summary articles:

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

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

<http://www.sciencedirect.com/science/article/pii/S0360544216308064>