European hot spots

Mapping the local conditions for district heating within Heat Roadmap Europe

Sven Werner

Halmstad University, Sweden

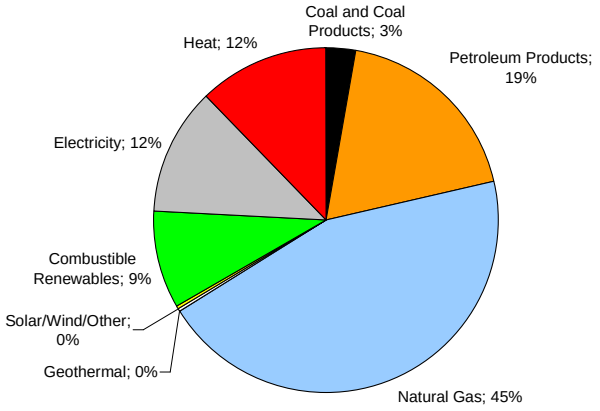
Outline

1. Current heat market context
2. Energy Roadmap 2050
3. Research demand: Heat Roadmap Europe
4. Method used
5. Energy modelling
6. Mapping of local conditions
7. Conclusions

1. Current heat market context

EU27 during 2008, Origin of heat supply for heat demands in residential and service sector buildings

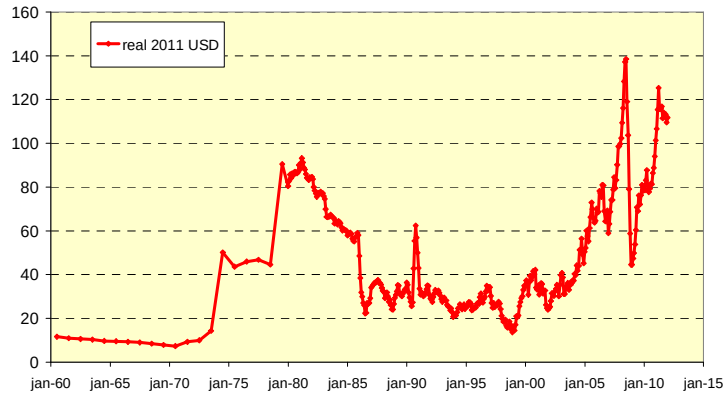
Total heat supply was 11.5 EJ, not including indirect heat supply from all indoor electricity use



1. Current heat market context

USD/barrel

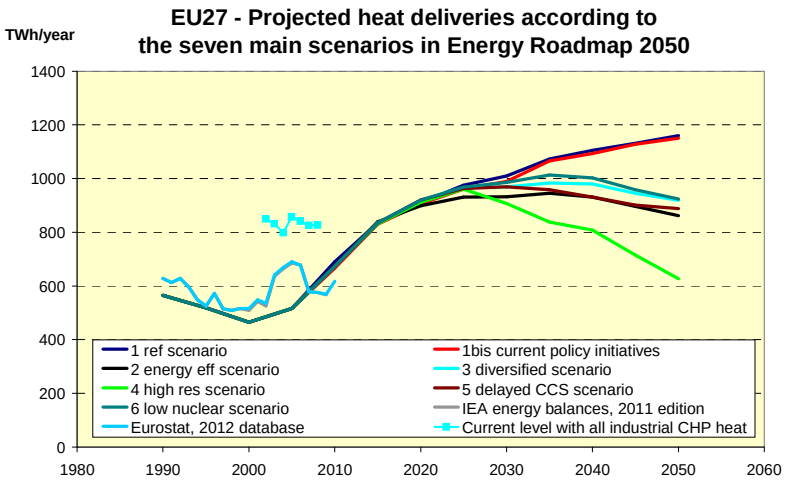
Crude oil, import price to Europe until January 2012



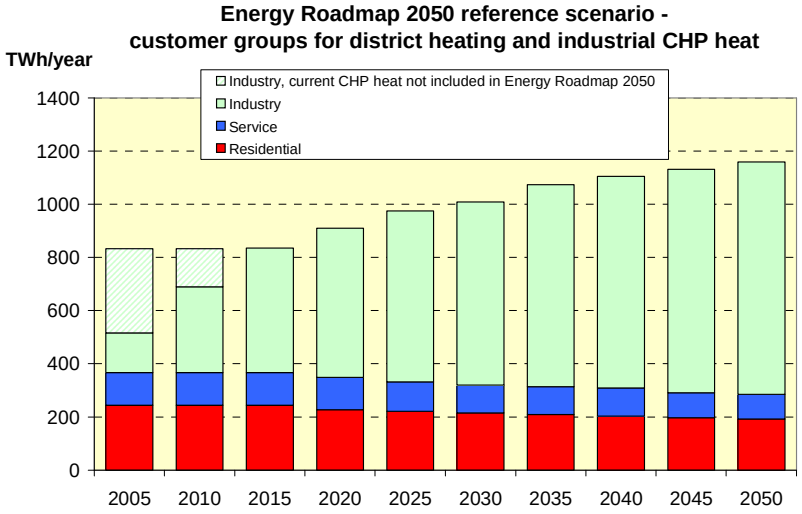
2. Energy Roadmap 2050

- Published by the European Commission on December 15, 2011
- Contains two reference scenarios and five additional policy scenarios until 2050
- Based on energy modelling by the PRIMES model from Greece.
- This model aggregates national information from each member state.

2. Energy Roadmap 2050



2. Energy Roadmap 2050



Data source: Energy Roadmap 2050. Figure 13 on page 81 in part 1 of the impact assessment report

2. Energy Roadmap 2050

- Conclusion: The European Commision do not foresee a bright future for district heating and cooling in urban areas.
- This conclusion must be questioned since Energy Roadmap 2050 is missing information about local conditions vital for district heating and cooling.
- Energy Roadmap 2050 is mainly based on large scale use of electricity and gas provided by large scale organisations.

3. Heat Roadmap Europe

- Initiative from Euroheat & Power in Brussels in order to provide another alternative future projection for the whole heat market
- Considering local conditions as renewables, heat recycling from industries and waste incineration, and existing district heating systems (with almost 200000 km of trench length)

3. Heat Roadmap Europe

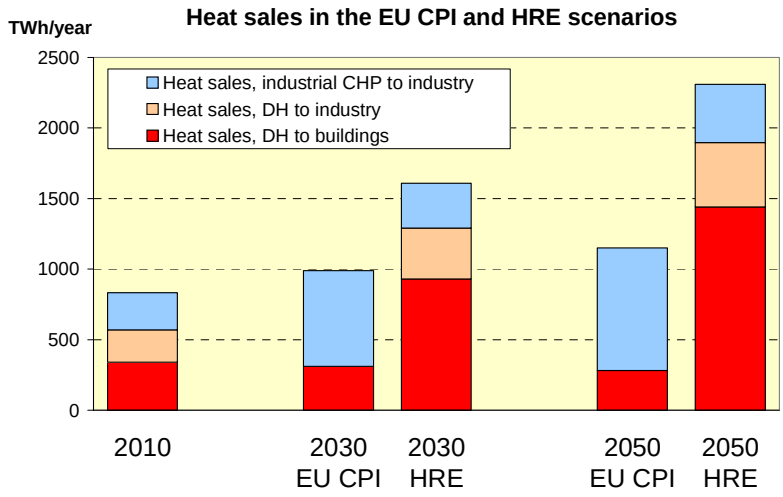
- Pre-study performed in cooperation between the Aalborg and Halmstad Universities between January 2012 and April 2012.
- Full study planned for 2014-2017 including several local case studies for regions having favourable local conditions for extension of district heating systems.

4. Method used

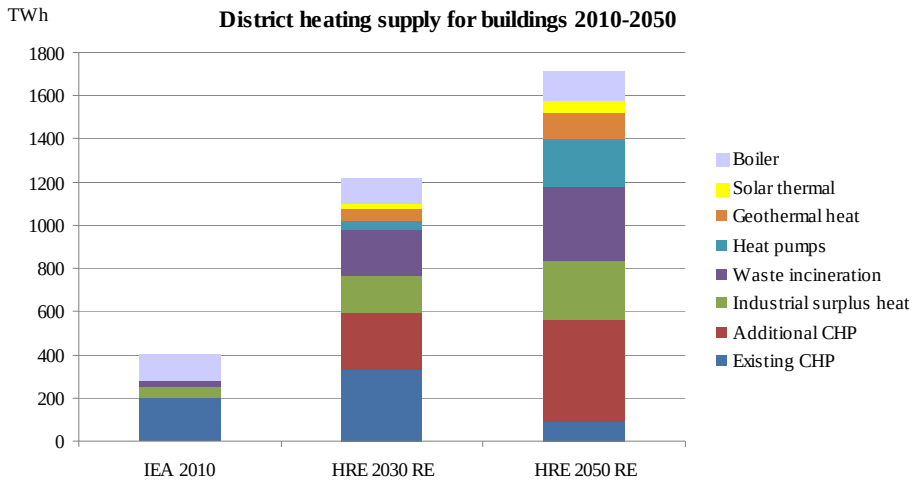
Heat Roadmap Europe is based on two parts:

1. Traditional modelling of the energy system with a comparison between the Current Policy Initiative (CPI) scenario from Energy Roadmap 2050 and our Heat Roadmap Europe (HRE) scenario.
2. Mapping of local conditions important for the competitiveness of district heating.

5.Modelling - Heat sales



5. Modelling – Heat Supply



5. Modelling - Costs

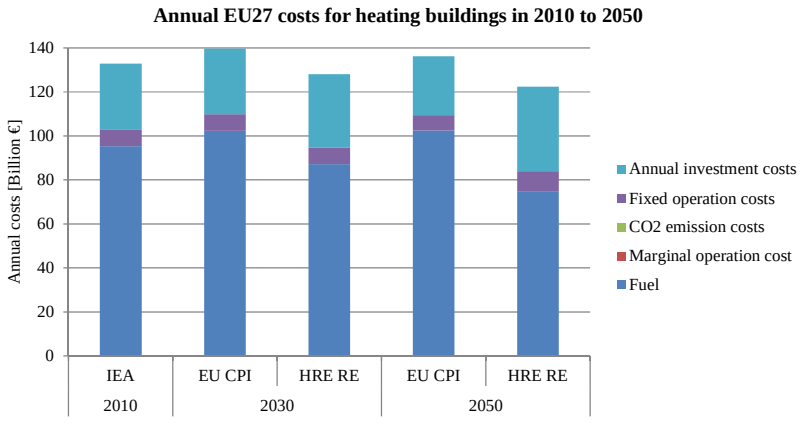
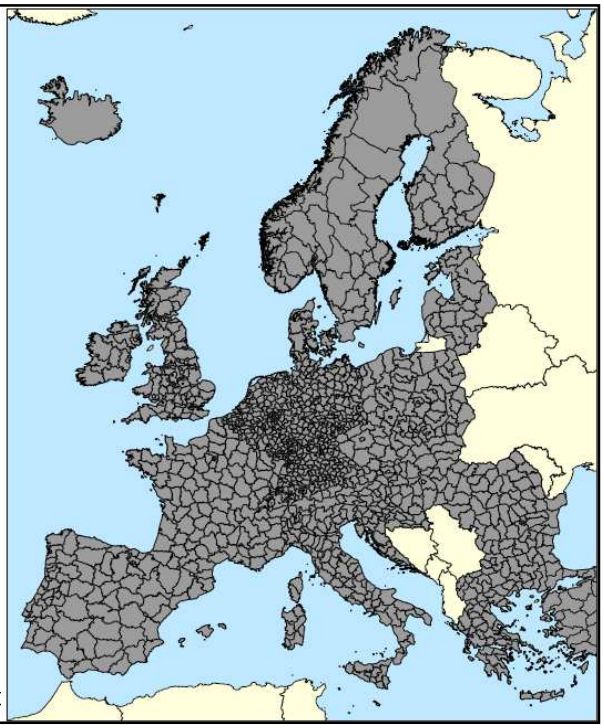


Figure 38: Socio-economic costs for the entire EU27 energy system in 2010, 2030, and 2050 under a business-as-usual scenario and if district heating and CHP were expanded to 30% in 2030 and 50% in 2050, in combination with the expansion of industrial waste heat, waste incineration, geothermal, and solar thermal heat for district heating.

6. Local conditions

The Heat Roadmap Europe project will aggregate local conditions up to the EU27 level by gathering local conditions in administrative regions below national levels.

The picture shows the 1461 NUTS3 regions in Europe, of which 1303 are located within EU27.



6. Local conditions

- Current district heating systems
- Heat demands
- Current themal power generation
- Current waste incineration
- Current energy intensive industries
- Location of geothermal possibilities
- Available biomass
- Available solar heat
- Heat distribution costs
- Location of possible ”hot spots”

6. Current district heating systems

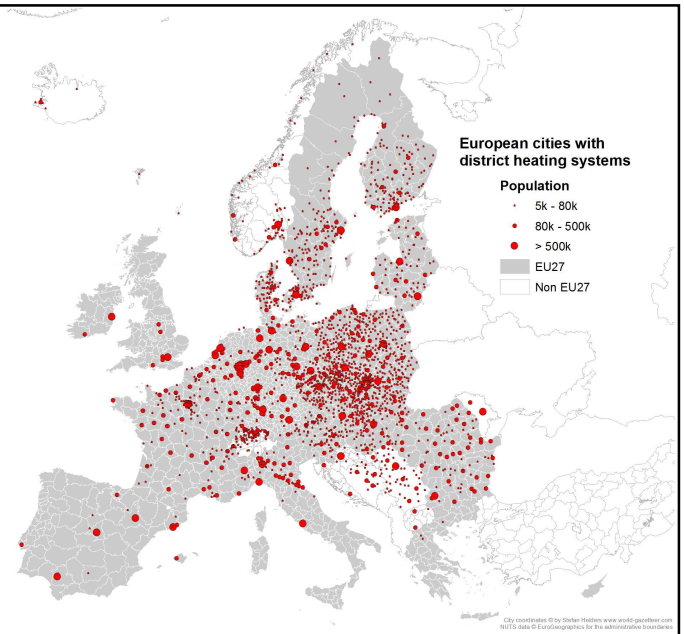


Figure 17. District heating systems in EU27 by city size and for cities having more than 5000 inhabitants. The map shows 2428 cities with 2779 systems. Source: Halmstad University DHC Database.

6. Heat demands located in urban areas

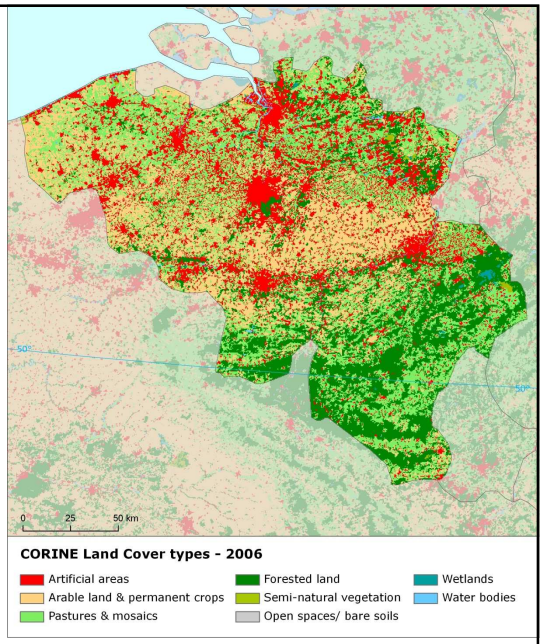


Figure 18. The land cover types for Belgium as an example from the CORINE database.

6. Thermal power generation

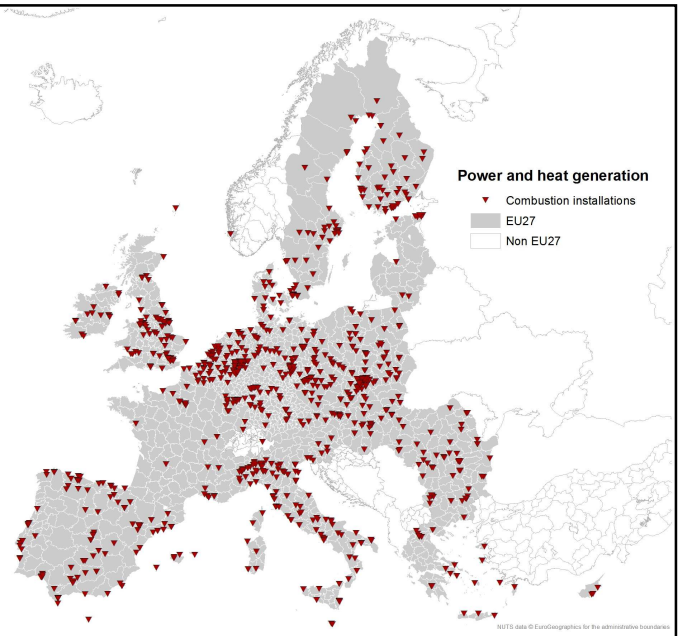


Figure 40. Major combustion installations above 50 MW for power and heat generation in Europe. Source: The E-PRTR database at EEA in Copenhagen.

6. Waste incineration

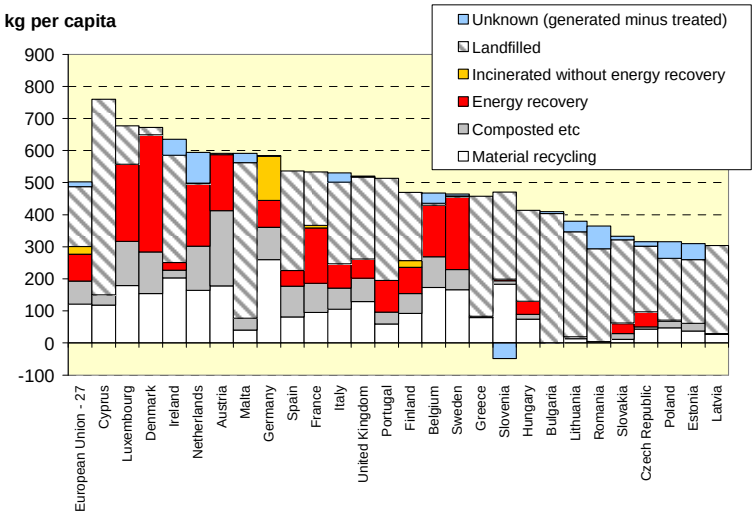


Figure 19. Distribution of municipal solid waste treatment in EU27 Member States during 2010 according to the waste hierarchy order categories. Source: [46].

6. Current waste incineration

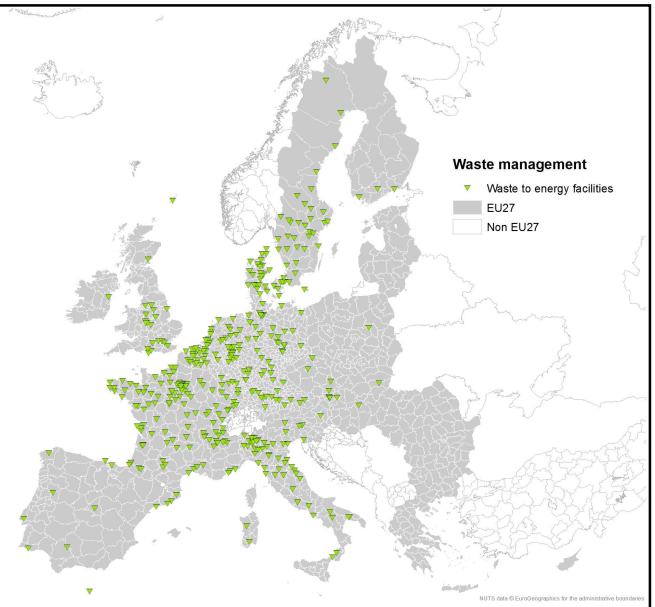


Figure 41. Locations of 414 waste incineration plants in Europe. Sources: CEWEP, E-PRTR, ISWA, and some national sources for Sweden, Denmark, and France.

EHP & RHC Conference,
Copenhagen April 26-27, 2012

6. Current energy intensive industries

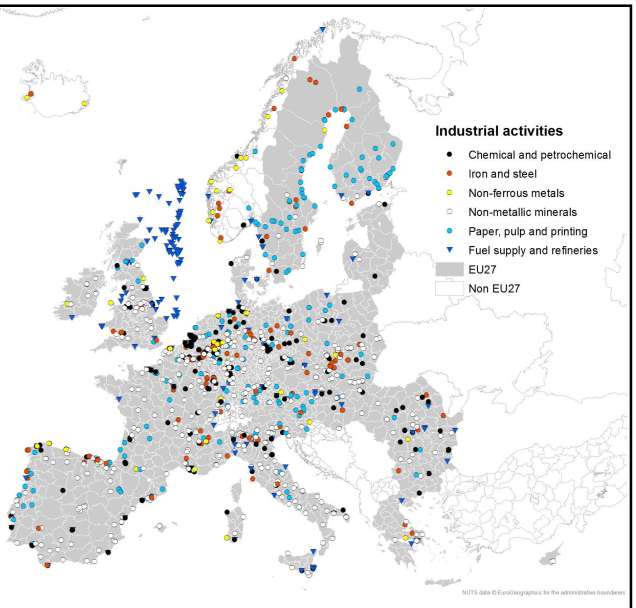


Figure 42. Locations of major energy intensive industries with considerable volumes of excess heat. Source: The E-PRTR database at EEA in Copenhagen.

EHP & RHC Conference,
Copenhagen April 26-27, 2012

6. Geothermal district heating systems

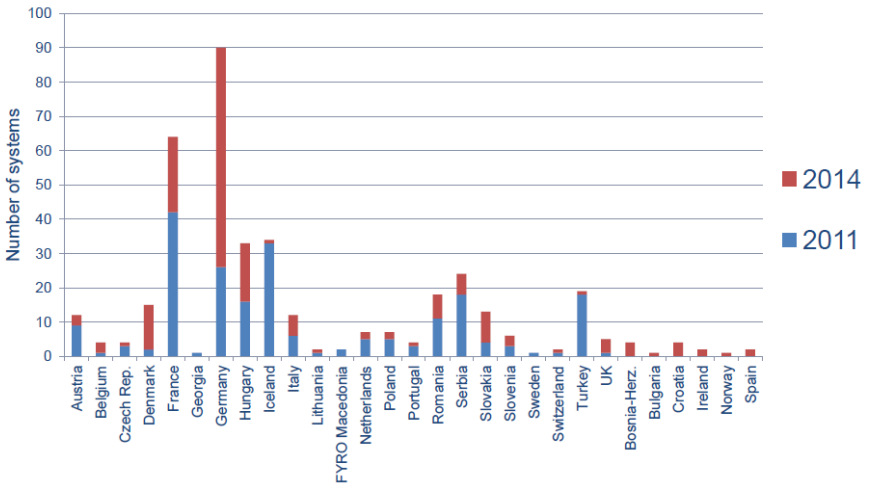


Figure 20. Number of geothermal district heating systems in Europe by country: Firstly as existing systems in 2011 and secondly as planned additions for 2014. Source: [47].

6. Location of geothermal possibilities

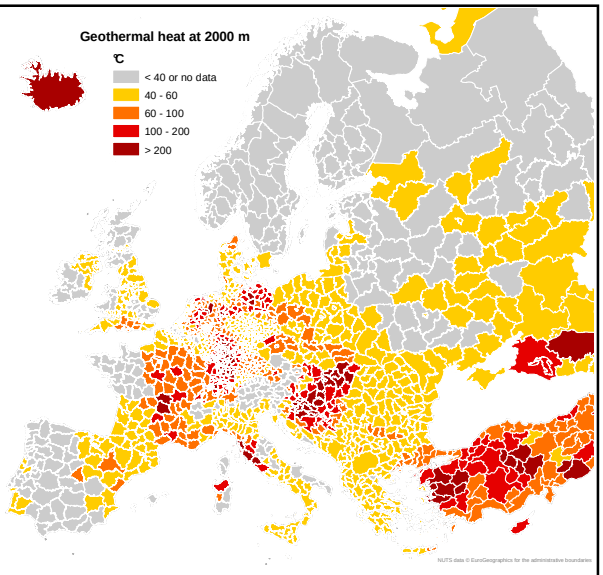


Figure 43. Identified geothermal heat resources by temperature at 2000 m depth by NUTS3 area. Source: European Commission, Atlas of Geothermal Resources in Europe. Publication EUR 17811, Luxembourg 2002.

6. Biomass availibility

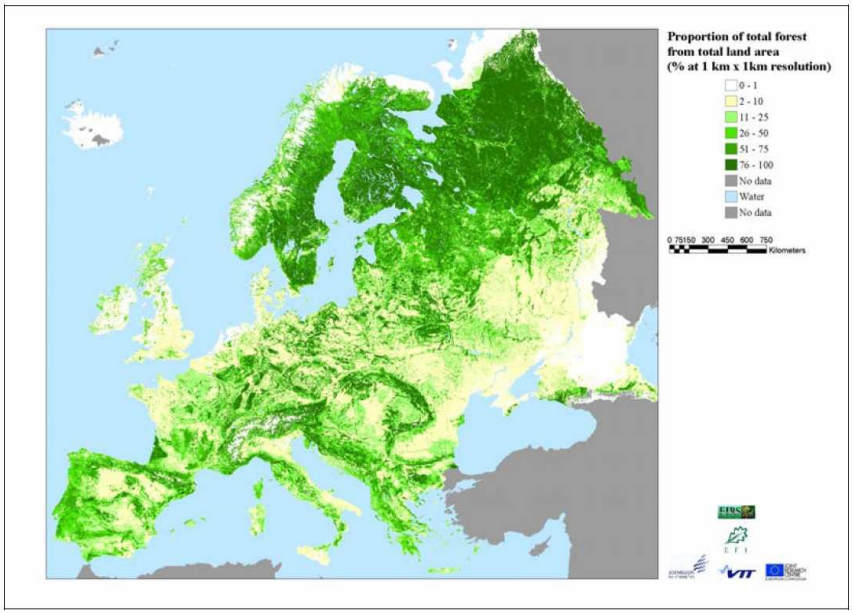
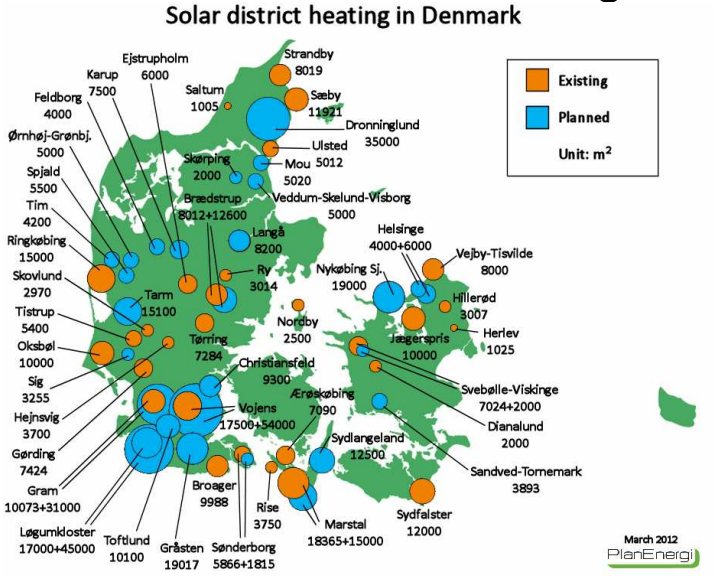


Figure 44. Proportion of forest area in various parts of Europe. Source: European Forest Institute.

6. Solar district heating



6. Solar heat availibility

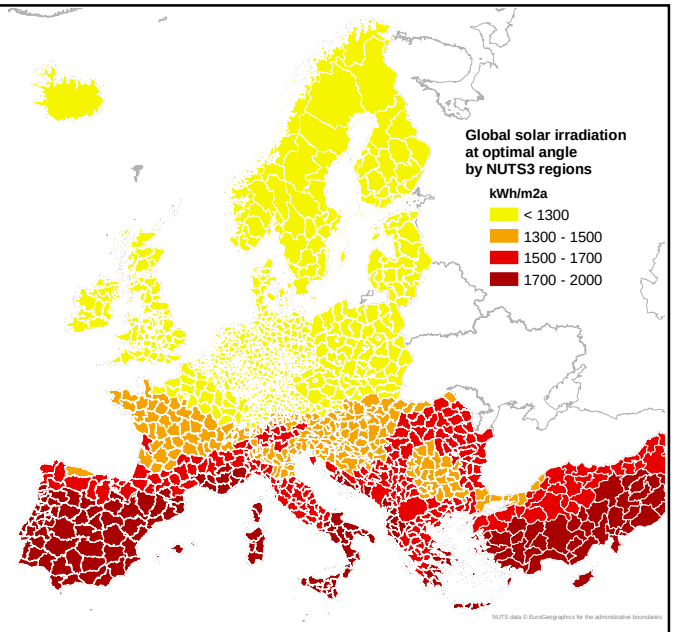


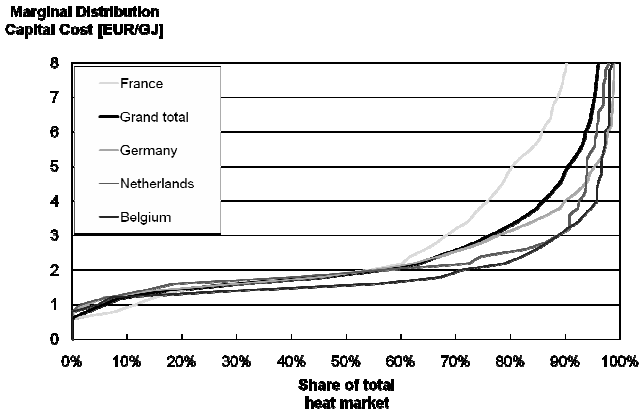
Figure 45. Annual solar irradiation on a south-oriented tilted surface at optimal angle by NUTS3 area.

6. Heat distribution costs

Heat distribution costs:

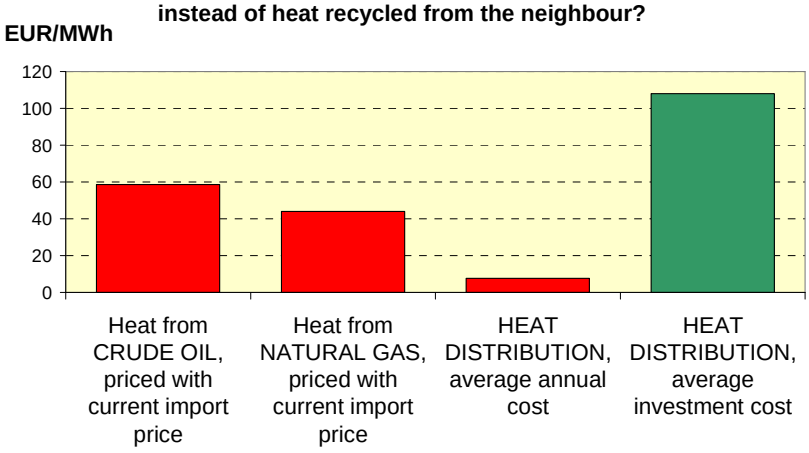
During 2011, our research group published an analysis of the heat distribution costs in 83 European cities within 1703 city parts. These cities are located in Belgium, France, Germany, and Netherlands.

Source:
Persson & Werner, Applied Energy 2011



6. A decisive question!

Why do Europeans prefer imported energy instead of heat recycled from the neighbour?



6. Hot spot areas

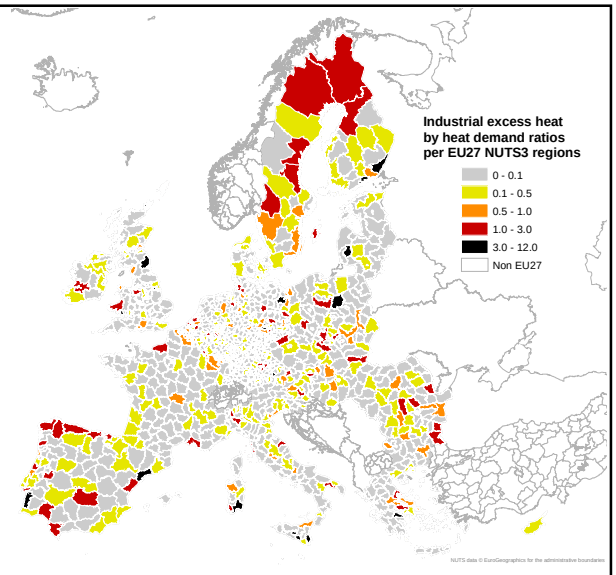


Figure 24. NUTS3 regions with respect to industrial excess heat by heat demand ratios.

7. Conclusions

1. Lower energy system cost in the European energy system with more district heating.
2. Substituted fossil fuels will give lower carbon dioxide emissions and lower energy import.
3. More district heating will generate more local investments and corresponding job creation.
4. More district heating will provide more reliable balancing power in both directions to the future European electricity system with considerable variable power supply sources.

7. Conclusions

5. Important to redistribute our local conditions gathered to all local and regional energy planning.
6. Our method with integration of energy modelling and mapping of local conditions with high resolution can provide new input.
7. Traditional energy modelling do not consider local conditions since low resolution in their input.
8. Energy Roadmap 2050 is not transparent with respect to future heat balances.