

### **Heat Roadmap Europe – a research impact case**

What has become known today as the Heat Roadmap Europe project was in fact a series of four independent research projects that, building one upon the other during the years 2011 to 2019, came into being due to the simultaneous realisation of three distinct and important conditions for successful research.

The first of these conditions was the recognition and identification of a possibility for improvement of the methodology used in previous energy system modelling research in Europe, which up until the first decade of the 21st century mainly focused on national and international energy distribution infrastructures (such as electricity and gas grids). If properly to assess and estimate the possibilities for increased energy efficiency, for fuel substitutions, for decarbonisation, and for the integration of more renewable energy resources in the European energy system, also thermal energy distribution infrastructures, e.g. district heating and cooling systems, should be part of the study focus. This insight, which had matured during several years of European level research in the conceptual thinking of Professor Emeritus Sven Werner, together with the fact that thermal energy infrastructures – as opposed to power and gas networks – are strictly local, led to the proposition of including local, as well as regional and national, perspectives in future energy system modelling.

The second condition, that of enriching and inspiring collaboration with other actors sharing the same interests and objectives, became a reality when researchers from the Energy Group at Halmstad University made the acquaintance and joined forces with Professor Henrik Lund and his team at the Department of Planning at Aalborg University in Denmark. By a series of early seminars and meetings during the years 2011 and 2012, where the principle insight of including local conditions in energy system modelling led to the development of a new methodology that combined high temporal resolution modelling with high spatial resolution mapping, a new, and alternative, conceptual approach whereby to assess European energy futures was formulated and subsequently put to the test in two initial pre-studies (2012 and 2013).

The third condition, being at the right place at the right time, was to some degree a strike of luck since at the time of the pre-studies, the awareness and concern within the European community regarding the connotation between energy system characteristics and the anthropogenic influence on the world's use of resources and its climate balance, reached unprecedented levels of actuality and attention. As the Heat Roadmap Europe consortia began the third project (the IEE Stratego project, 2014 to 2016), the European Commission published its first ever strategy on heating and cooling for the EU, in which several findings and messages from the Heat Roadmap Europe works were referenced.

In 2016, the fourth leg of the project series, the Horizon 2020 project Heat Roadmap Europe 2050, started with a kick-off meeting in Copenhagen, which counted among its 14 European partners high-ranking institutes and actors such as the Europa Universität Flensburg (DE), Fraunhofer ISI (DE), Utrecht University (NL), TEP Energy (CH), Euroheat and Power (BE) among others. In this final leg, lasting up until February 2019, the new methodology could eventually be applied uniformly to all the EU member states of that time, for which a number of new metrics, findings, and conclusions could be established.

The Heat Roadmap Europe project series has had a considerable impact on the contemporary view and understanding of the European energy system and the pathways open to it to reduce its current primary energy demands. Apart from a multitude of reports and academic papers,

the project has developed and used dissemination opportunities available by interactive web map applications (such as the Pan-European Thermal Atlas), which has facilitated access to project results and findings to local, regional, and national decision makers, planners, researchers, and the general public all over Europe.

The core Heat Roadmap Europe consortia partners (Halmstad University, Aalborg University, and Europa Universität Flensburg) are currently continuing the development and application of the new methodology within the new Horizon 2020 project sEEnergies (2019 to 2022). The idea to combine energy system modelling with mapping of local conditions, however, has won general acceptance within the field by now, and several other projects, as well as municipalities, cities, and utilities across Europe, are developing their own models and mapping tools to identify synergies and opportunities for improved energy system efficiencies. In fact, European Union member states, as stipulated in the EU Energy Efficiency Directive (into which some of the findings of the Heat Roadmap Europe project found its way already in 2012), are required to perform spatial mapping of local heat synergy opportunities to be reported to the Commission every fifth year.

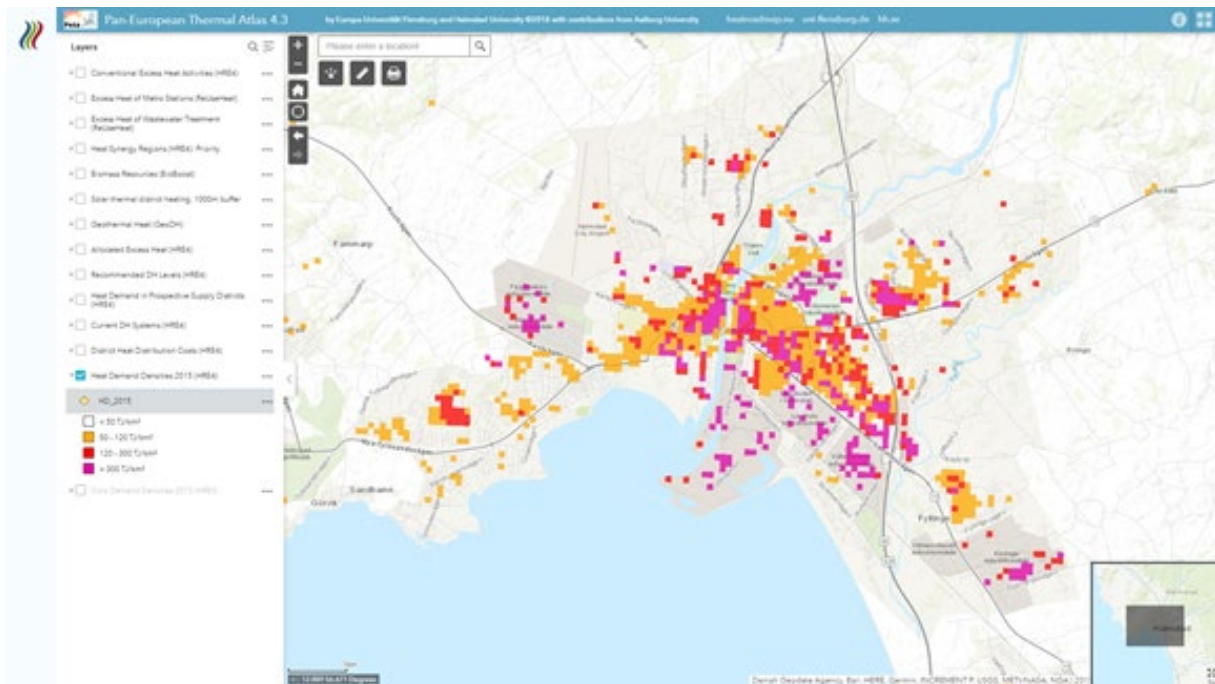


Figure 1. Example map from the Heat Roadmap Europe web map application, the Pan-European Thermal Atlas, depicting residential and service sector heat demand densities by hectare grid cells for the city area of Halmstad (SE).

The results from the Heat Roadmap Europe project have been documented in several reports and journal publications. Three key papers are:

- Connolly D, Lund H, Mathiesen BV, Werner S, Möller B, Persson U, et al. **Heat Roadmap Europe: Combining district heating with heat savings to decarbonise the EU energy system.** *Energy Policy.* 2014;65(0):475-89.
- Persson U, Möller B, Werner S. **Heat Roadmap Europe: Identifying strategic heat synergy regions.** *Energy Policy.* 2014;74(0):663-81.
- Persson U, Wiechers E, Möller B, Werner S. **Heat Roadmap Europe: Heat distribution costs.** *Energy.* 2019;176:604-22.