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Heat Roadmap Europe 2050

A low-carbon heating and cooling strategy

# Tools and methods for strategic analyses in heating and cooling: What is the state of the art and how to improve our tools?

Copenhagen, September 11, 2017

# Workshop summary

**Objective of workshop**

In Europe, there is a clear long-term objective to decarbonise the energy system, but it is currently unclear how this will be achieved in the heating and cooling sector. A huge variety of tools and methods is currently applied to support the transition and develop efficient strategies and policies. The Heat Roadmap Europe project and the Strategic Research Centre for 4th Generation District Heating Technologies (www.4dh.eu) both aims to provide new capacity and skills for lead-users in the heating and cooling sector by developing the data, tools, methodologies, and results necessary to manage the transition of the sector.

This workshop intends to bring together experts on heating and cooling system analyses from various ongoing (EU and beyond) H2020 research and innovations projects to exchange about experiences, lessons learned and ways forward with regard to heating and cooling focused energy system analyses. The workshop aims at both: getting a better understanding of today's state of the art as well as identifying promising ways forward to improve existing tools and methods.

**Agenda**

13:00 Arrival with coffee and tea

13:30 Introduction to the worshop (Tobias Fleiter)

13.40 The Heat Roadmap Europe project (Brian Vad Mathiesen)

13:50 Discussion of tools and method

13:50 Plenum: Tools and methods applied in H/C projects and teaser for group discussion

1. Hot Maps: **What are the user needs?**
   (Jørgen Lindgaard Olesen)
2. PLANHEAT: **Mapping waste heat at urban level**
   (Stefano Barberis)
3. PLANHEAT: **How can we map heating and cooling?**
   (Erwin Cornelis)
4. progRESsHEAT: **Integrated modelling of heat savings and heat supply**
   (Stefan Petrovic)
5. Heat Roadmap Europe: **H&C in energy systems modeling**
   (Brian vad Matthiesen)

14:20 Break out groups: Discussion on 5 individual topics

15:00 Plenum: Summary of conclusions and suggestions for ways forward to improve tools and methods

15:30 End of workshop and networking coffee

**Summary**

A workshop organised in the framework of the 4DH conference and the Heat Roadmap Europe 4 project took place in Copenhagen (Denmark) to foster the exchange and discussion of tools and methods used for H/C assessments.

After initial presentations, the 40 participants broke into groups to discuss 5 main topics, ranging from user needs via mapping and waste heat to integrated modelling and energy systems' analyses. In all topics, ways forward to improve existing tools and develop more useful methods were discussed and proposed.

From a user-needs perspective it seems important that tools are specific to the users and purposes. A similar conclusion was taken by the energy systems group which does not believe that the one tool that fits all users will appear soon. On the other hand, separated tools for demand and supply modelling were not considered to be so practical in the long-run, even though it is still common practice today. Instead an integrated modelling of both elements was recommended. For energy systems' analyses to be really valuable, a clear research question is very important.

Across all topics, data quality and availability was highly discussed. Data is often scattered or not available (e.g. excess heat potentials are generally estimated from alternative datasets, like emissions ) or its quality is questionable (e.g. technology costs). Still, good data remains a prerequisite for sound analyses and robust results. Ways forward relate to open data sets, extended official statistics and also common activities instead of parallel data collection.

Results from the five individual break-out sessions are summarised below.

## 1. User needs

- Define the users
- Data is key
- No more general tools
- Dialogue vs decision
- One tool per user group

## 2. How to map urban waste heat?

1) **TWO DIFFERENT KIND OF WASTE HEAT AND AVAILABILITY OF DATA:**
   First of all it's important to highlight that two different kind of waste heat could be available: industrial one (High temperature, available directly through heat exchanger, substation, but often available far from the city centre) and from spot sources all around the cities (large refrigeration systems of supermarkets/leisure/commercial centre, ventilation shaft of undergrounds/car parking etc.). Both sources have difficulties to be mapped for two main reasons:
   a. Inexistence of standard methods for their localization and estimation

b. Low availability of data

2) **INDUSTRIAL WASTE HEAT**: Passing through Emission trading system and the difficulty to estimate already recovered waste heat
Only scattered literature is available that estimates this kind of source that depends on the type of industry, the different type of process present at industry level (temperature of te waste heat) and the degree of the recovery already internally performed. All these data are not so easy to be gathered (no available official databases) but will permit for example to evaluate industrial waste heat starting from industrial installation emission coming from EU ETS database.
Another crucial point to be considered is to map the distance between end user and industrial waste heat source.
Several project are currently ongoing in EU and monitoring data could become a good reference for future studies: these data have to be open access.

3) **URBAN WASTE HEAT**
For what it concern mapping urban waste heat potential, it is crucial to highlight that its exploitation is mainly related to the use of heat pumps. So temperature level has to be properly mapped
As for industrial waste heat, no literature and databases are currently existing, but for all the idenified potential sources some solution for their estimation can be done starting from installed refrigeration capacity or standards about ventilation volumes or sewage network heat extraction.
In this sense some experiences in Sweden about exploitation of waste heat of refrigeration systems of supermarket have been performed and monitoring data could be very interesting for future evaluation of the potential.

## 3. How well an we map heating and cooling?

1) **Data is key**
The availability of local data should improve in order to map heating and cooling well. The involvement of data owners, such as district heating grid operators and natural gas grid operators, in the data harvesting exercise can help to overcome barriers in collecting and harvesting data. One of the barriers is the privacy concerns on energy data, making data owners reluctant in providing data.
Data from national and European statistics and reports can be useful input. The drawback is that these data are not usually designed to support mapping heating and cooling; post-processing is quite often necessary in order to prepare the data. Support from national and European authorities in organizing these data for the sake of mapping heating and cooling would be welcome.

Quite a lot of data is collected in various heating and cooling related EU projects; having a common database would improve the availability and distribution of these data.
There are significant data gaps on which energy carriers used and technologies installed; for example data on heating oil consumption and the age of boilers are hard to find.

2) **Tools, tools and tools**
Quite some mapping tools for heating and cooling are still in a phase of development and are not yet ready for the market. There is yet no standard tool or tools; there are rather expert tools still in a need for a continued development.
Some tools operate from a webserver while others are desktop-GIS tools; both approaches seem to work.

3) One of the challenges is how to **map future heating and cooling demand**.
Local authorities seem to have more interest in using mapping tools for input on heating and cooling actions on a short and medium term perspective; they have a lesser need for input on long term strategies on heating and cooling
To validate or not to validate, that's the question.
It is not clear how heating and cooling maps can be validated. Already existing local heat maps, if available, might serve as a benchmark. Also the PETA can be a useful tool for validation. The best is to compare estimated heating and cooling demand with measured demand for a building or building block.

4) **Mapping heating and cooling for what purpose**
Some heating and cooling maps are designed to present information for individual buildings, such as for instance the solar hot water potential, in order to stimulate the building owner or resident to consider investments in sustainable heating and cooling options.
Other maps are designed to provide input to public officers of local authorities, so that they can use it as an input for a local heating and cooling strategy.
It is essential to understand, when designing these tools, what kind of use the public officers have in mind.

**Integrated modeling of savings and supply**

- We should integrate modelling of savings and supply! Even more important on the local than on the national level
- Important for both, short and long term
- Building data: national are aggregated; local are not available; no common format
- Cost data on heat supply and heat savings: Large variation in costs within and between countries

**Energy Systems Analyses of H&C**

- **Challenges**
  - Different tools for different purposes – it is important to have a clear idea of what problem is being solved in order to choose the right tool.

- Geographical and temporal differences matter – in regards to the level of renewable energy and the area etc. at hand in the problems being analysed these differences are important to consider.
- Accuracy of data – It is important to asses which data are important to have on which accuracy level, as this depends on which problem is being analysed, and what the tools are able to asses. Also this is connected to the time perspective; short-term og long-term modelling/scenarios.
- System boundaries and internal model assumptions are important to understand for the user, in order to be able to accurately use the results that come out.
- Tools can be hard to integrate, and this may not be feasible. Different tools have different assumptions and limitations built into them as well as different advantages and disadvantages e.g. some are plant level and some are regional to national level. It may be useful to operate a set of tools separately.

- **Suggested solutions**
  - Clarity of purpose /research question
  - Connections between different tools
  - Collaboration between researchers
  - Openness of data and tools
  - Further research