Some impressions of the Heating and Cooling Conference

In Workshop 1 on Heating and Cooling, a vision for 2050 Prof. **Hans–Martin Henning**, Deputy Director of the Fraunhofer Institute for Solar Energy Systems ISE, presented an inspiring outlook based on the German market but most likely his conclusions are expected to be valid for most of Europe.

JAAP HOGELING
Manager of international projects and standards at ISSO
Chair of CENTC 371 Program Committee on EPBD
Fellow of ASHRAE and REHVA

If we want to reduce the CO_2 emission in 2030 by 55% (compared with 1990) a focus on a heating technology mix on the long-term is needed as the Space-Heating (SH) and Domestic Hot Water (DHW) has to contribute substantially to these CO_2 reductions. Currently 35% of the primary energy in Germany is used in this SH and DHW sector.

As building retrofit by improving the thermal performance of buildings has its limits the decarbonisation of the heating technologies become more and more important.

Solutions for decarbonisation of heat technologies

Solar thermal

- Useful, very low specific CO_2 emissions
- Potential (technical, economic) limited: mainly hot water + low temperature process heat + district heat

Biomass

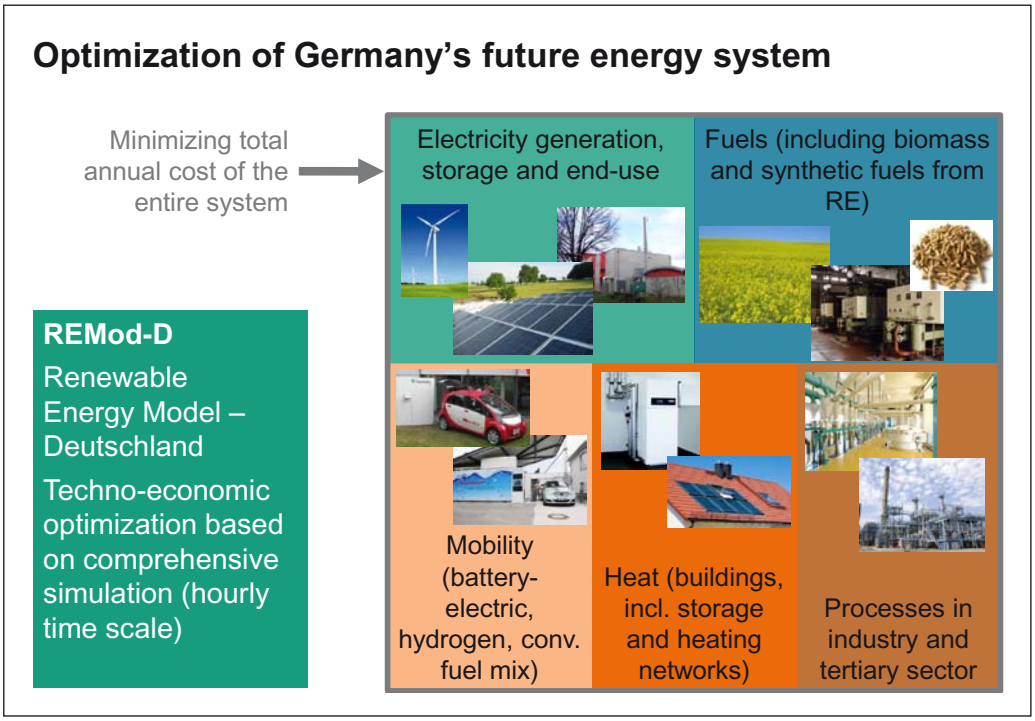
- Strong competition with other uses (non-energy, energy)

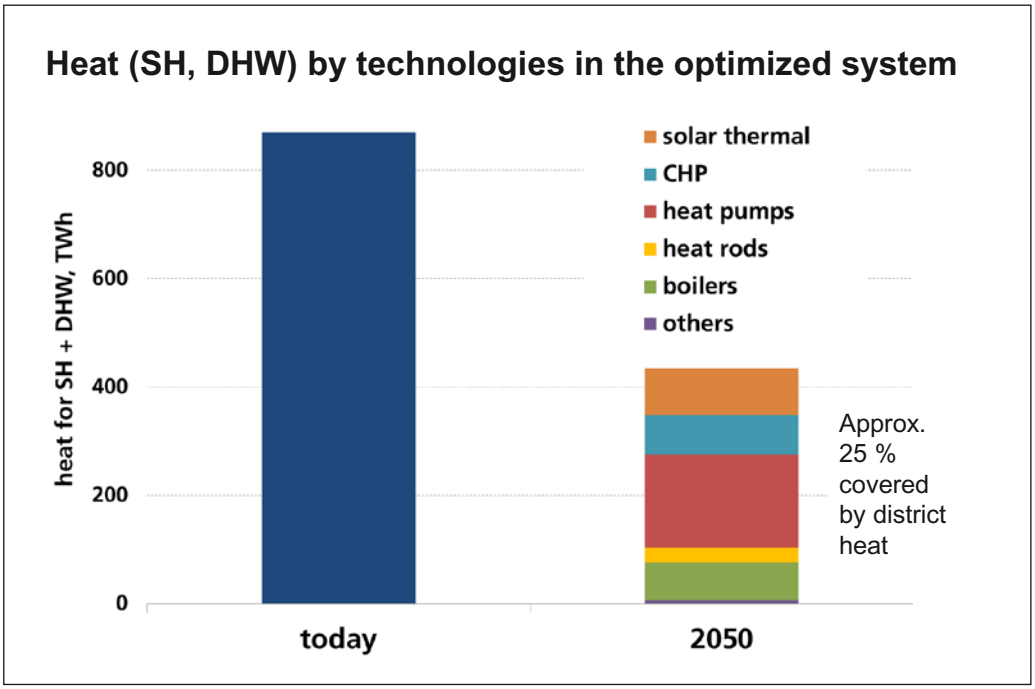
Combined heat & power

- Decreasing attractiveness with reduced CO_2 emissions of grid electricity
- Increasing complexity due to interaction with an increasingly complex electricity system.
- Environmental heat (ground, air, waste heat, others)
- Electric heat pumps , increasingly favourable with reduced CO_2 emissions of grid electricity; interesting potential for flexible use of (renewable) electricity
- Gas heat pumps - boiler follow-up technology for more efficient fuel use
- District heating
- Various heat sources: CHP, solar thermal, large scale heat pumps, renewable electricity
- Increasing attractiveness for energy management on urban or district scale

Conclusions

- Need for a mix of building energy retrofit and decarbonisation of heat technologies
- But: Building energy retrofit has a limited potential due to various restrictions 4 reduction of space heating by 50 to 60% is an ambitious, but doable target
- Cost-efficient solutions for building energy retrofit crucial (e.g. pre-fabrication)
- Electric heat pumps will play a main role for space heating and hot water in combination with decarbonisation of electricity production
- Gas heat pumps important follow-up technology of gas boilers
- CHP important mainly in large scale units (industry, district heating)
- Increasing amount of non-dispatchable electricity from wind and solar leads to increasing needs for flexible loads
- Heat provides a highly promising sector for flexibilization and technologies are mature and available today





Finally a few suggestions have been shared:

- Relate incentives to performance (e.g. solar thermal, heat pumps)
  - Based on rated performance in small scale installations
  - Based on on-site measurements in large scale installations
- Inefficient (related to specific CO_2 emissions) technologies should be excluded by law
- To be considered:
  - Credit programmes for private (long-term) investments in efficiency measures
  - Variable electricity tariff to stimulate demand side management
  - Include fuel trade (heat, mobility) into emission trading system (or carbon tax)

In the presentation of **Brian Vad Mathiesen**, PhD Professor in Energy Planning of Aalborg University Denmark and program director of the 4DH Research Centre on Smart Energy Europe 2050, Integrating EU electricity, heating & cooling sectors the challenges were formulated as:

We want to decrease the use of fossil fuels, but:

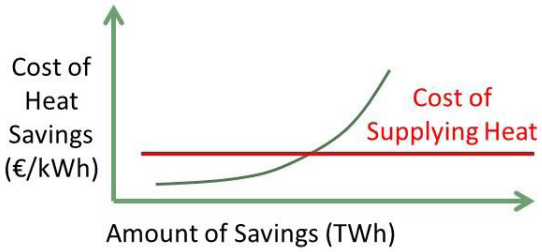
- The current system is extremely flexible...
- We cannot replace with biomass only...
- We need to use intermittent renewable resources!

We can increase e.g. wind power, but:

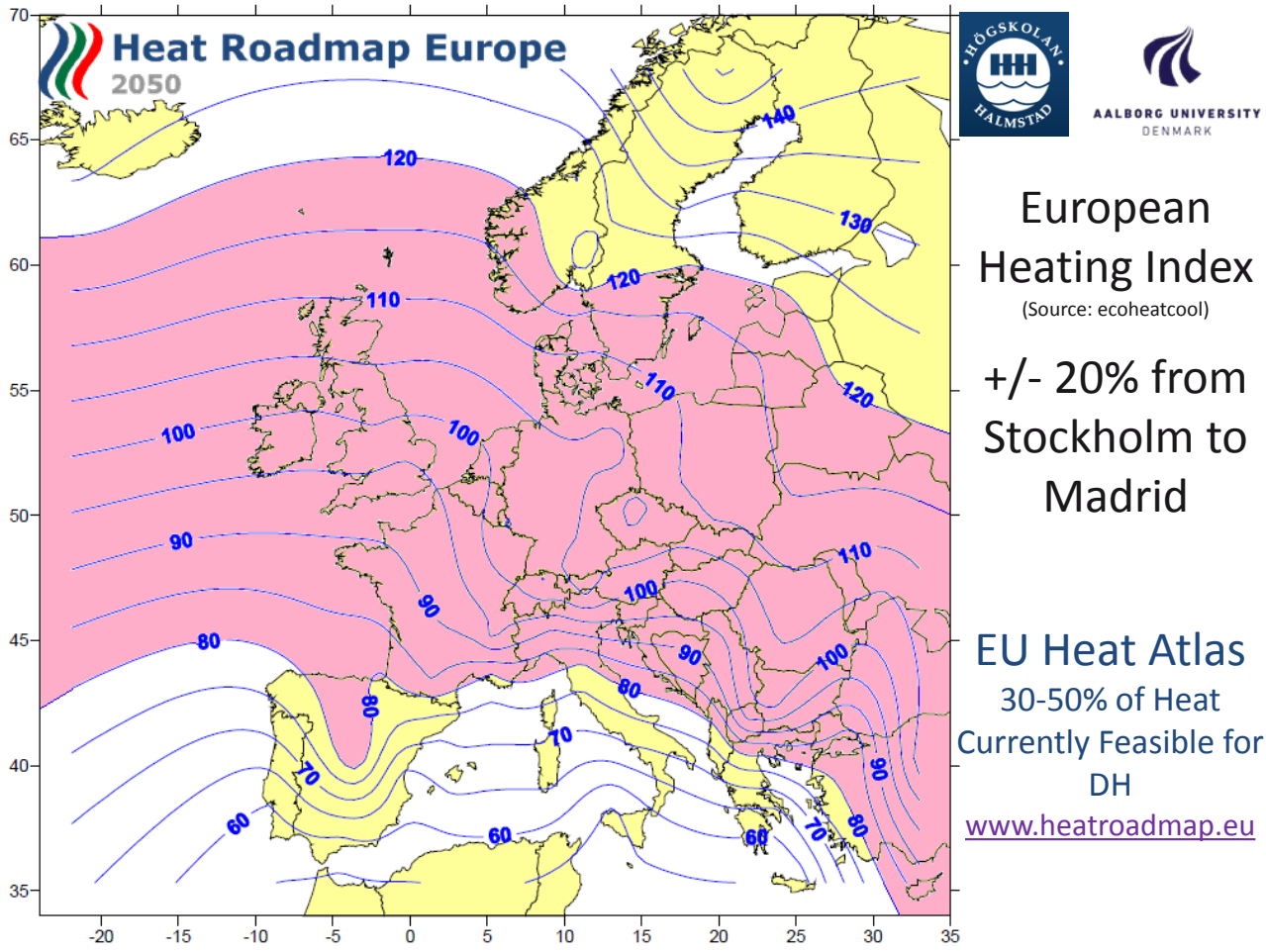
- There is a limit with the current energy system design
- There is a need for a new system design

The solutions on the table are:

- Interconnectors and trading
- Flexible electricity demands and smart grids
- Integrated efficient Smart Energy Systems



Another challenging statement was that we should implement heat savings until the price of sustainable supply is less than the marginal price of additional savings as this is illustrated in the figure left.



This figure illustrates that the heating demand is quite uniform over Europe and this information illustrates the challenges for smart Energy infrastructure throughout Europe

Renewable Energy Strategies for:

- Savings in Energy Demand
- Efficiency improvements in energy production
- Renewable energy sources (RES)

An interesting reference is made to EnergyPLAN:

EnergyPLAN simulates the operation of national energy systems on an hourly basis, including the electricity, heating, cooling, industry, and transport sectors. It is developed and maintained by the Sustainable Energy Planning Research Group at Aalborg University, Denmark. The model is used by many researchers, consultancies, and policymakers worldwide. This is possible due to the key focus on sharing the model during its development. For example, the model has a user-friendly interface, it is disseminated as a freeware, there is a variety of training available including our forum, and existing models are already available for many countries. The EnergyPLAN model has been used in hundreds of scientific publications and reports, which are presented in the case studies section.

The conclusions are do it **Smart**, for the EU a combination of:

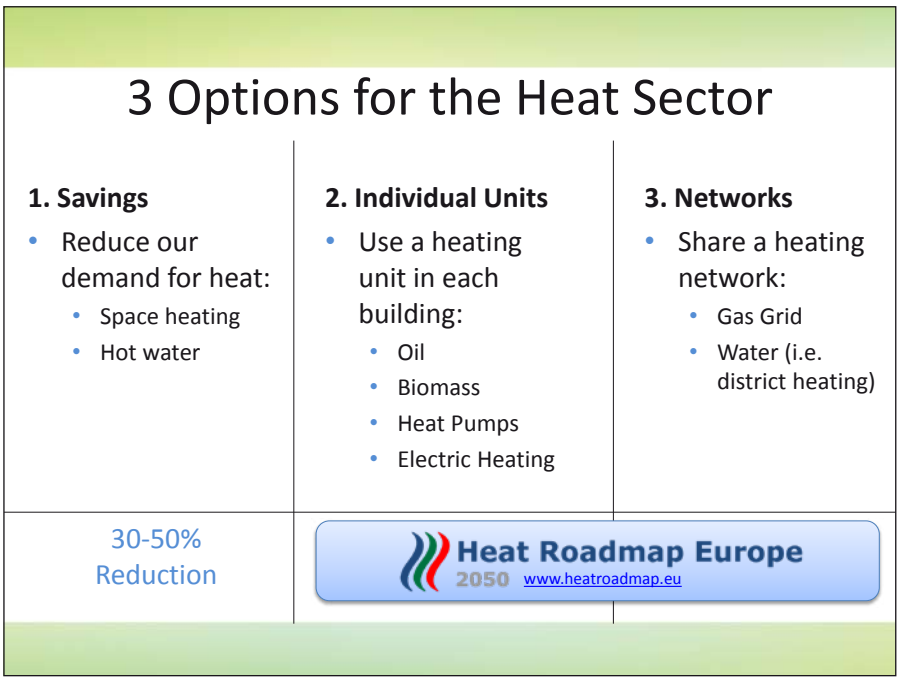
- 50% District Heating (Cities)
- 50% Heat Pumps (Rural Areas)
- 30-50% Heat savings (Everywhere)

This can enable the EU to reach its CO_2 target in 2050 for €100 billion/year less than energy savings on their own.

EU 2030 targets and Energy Union policies should consider the following

Regarding Heating/cooling of the buildings:

- Policy should enable to identify synergies with neighbours (old and new houses)
- Separate production and savings in energy requirements in regulation
- Have high energy saving ambitions but balance with sustainable supply



Re-think the system design:

- New infrastructure investments support should include thermal grid across Europe
- Need for integrated markets and unbundling (e.g. NordPOOL and integrated heat markets)
- Need for new energy system design to exploit costs-effective synergies
- More cross-sector approach in the Energy Union

In Workshop 4 on Heating and cooling for buildings : a presentation on Heat Supply & Demand in a Low Carbon Energy System by **David Connolly**, PhD Associate Professor in Energy Planning of Aalborg University Denmark

Various options for the Heat Sector have been discussed and presented in the following picture:

Conclusions regarding the Heating sector

Savings:

- There is an economic balance between reducing heat and supplying heat
- 30-50% heat savings is a good proxy for the economic limit of heat savings

Individual:

Heat pumps are the most suitable individual heating solution in a 100% renewable context.

Networks/Urban:

District heating is the most suitable urban heating in a 100% renewable energy context. ■