LOW TEMPERATURE WORKSHOP – HEAT PUMPS

German R&D Perspectives on Heat Pumps

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www.ise.fraunhofer.de
Intro

- Climate action plan: 2050 Germany aims to be climate-neutral.
- Industry sector has to reduce emissions by 50% until 2030.
- Nearly 70% of energy used in the industry is provided by fuels.
Climate action plan: 2050 Germany aims to be climate-neutral.

Industry sector has to reduce emissions by 50 % until 2030.

Nearly 70 % of energy used in the industry is provided by fuels.

Substitution of fossil fuels and energy efficiency:
- hydrogen/synthetic fuels
- electricity
- energy efficiency
Similiar goals on the european level

In **buildings**, electrification is expected to play a central role, in particular through the roll-out of heat pumps for space heating and cooling. In the residential sector, the share of electricity in heating demand should grow to 40% by 2030 and to 50-70% by 2050; in the services sector, these shares are expected to be around 65% by 2030 and 80% by 2050. Large-scale heat pumps will play a relevant role in district heating and cooling. The most important
Recent Situation

- 50% of the energy demand in Europe is caused by Heating and Cooling.
  - 27% space heating
  - 16% process heating
  - hot water (4%), space cooling (1%), process cooling (1%)

Source: Heat Roadmap Europe, 2017
Heat Pumps for the Building Sector

Fig. 24  Calculating the annual roll-out required to achieve the target ranges set out above

Baseline situation: sales of heat generators in 2018

Total heat generators sold

732,000

Heat pumps sold

84,000

Average annual expansion required between 2018 and 2030

to reduce GHG emissions by 80%–95% against 1990 levels by 2050

Average annual expansion required between 2018 and 2050

to reduce GHG emissions by 95% against 1990 levels by 2050

New heat pumps installed to reach target in EL95 scenario in dena study

631,000

New heat pumps installed to reach target in EL80 or EL95 scenario in dena study

521,000

New heat pumps installed to reach target in TM80 or TM95 scenario in dena study

213,000

New heat pumps installed to reach target in TM95 scenario in dena study

274,000


Source: PWC/ BWP 2020
Heat Pumps for the Building Sector

Challenging approach needs
➢ closing the discussions around refrigerants.
➢ more industrialized production of heat pumps.

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Source: PWC/ BWP 2020
Heat Pumps for the Building Sector – recent R&D at ISE

LC150 - Low Charge Heat Pump Module using 150g of R-290

Steering Committee, definition of requirements, receipt of results and access to IPs

1,2 Mio. € (approx. 1-4 % of total project volume, pro rata market share)

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3,6 Mio. € (75 % funding rate)

LC150 PLATFORM DEVELOPMENT OF A CHARGE-REDUCED HEAT PUMP MODULE WITH PROPANE

4,8 Mio. € project budget, 2.5 years, 1.10.2020 – 31.03.2023

- Component testing (heat exchangers, compressors, valves etc.) in single component tests and in broad cross evaluation
- Charge reduction and localization of refrigerant
- Operating strategies
- Standardization
- Network and platform for manufacturers
Heat Pumps for Industrial Applications

Source: Arpagaus 2018
Heat Pumps for Industrial Applications

Substitution of fossil fuels used for process heating by heat pumps needs

- approved and simple high temperature heat pumps/refrigerants/components
- shorter payback times

Source: Arpagaus 2018
Heat Pumps for Industrial Applications – recent R&D at ISE
research network of “SubSie” projects

- Evaporation of water as refrigerant is limited to > 0°C due to risk of freezing
- Research network of 5 projects with 12 partners develops different concepts for thermally driven heat pumps / chillers:
  - heat pumps: → utilization of ambient air as low T heat source
  - chillers: → significant extension of the scope of application
- Focus on different evaporator concepts
  - tolerate temperatures below 0°C (→ freezing / lower freezing point / …)
  - supply sufficient evaporation power

grant no. 03EN2012A

Wasser als Kältemittel – Nutzbar für die Zukunft!

[2] https://chemdemos.uoregon.edu/sites/chemdemos1.uoregon.edu/files/PhaseDiagramWater.jpg
Summary – remarks on „How to get more heat pumps into the market?“

- Lets work together; there is not much time!

- Keep it as efficient as needed and as reliable as possible! … real systems have to be reliable and should keep their efficiency in operation. Efficiency related control strategies and failure detection will help.

- Make it sustainable! … use natural refrigerants, no complex materials, easy maintainable.
Vielen Dank für Ihre Aufmerksamkeit!

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