LOW TEMPERATURE WORKSHOP – HEAT PUMPS

German R&D Perspectives on Heat Pumps

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www.ise.fraunhofer.de

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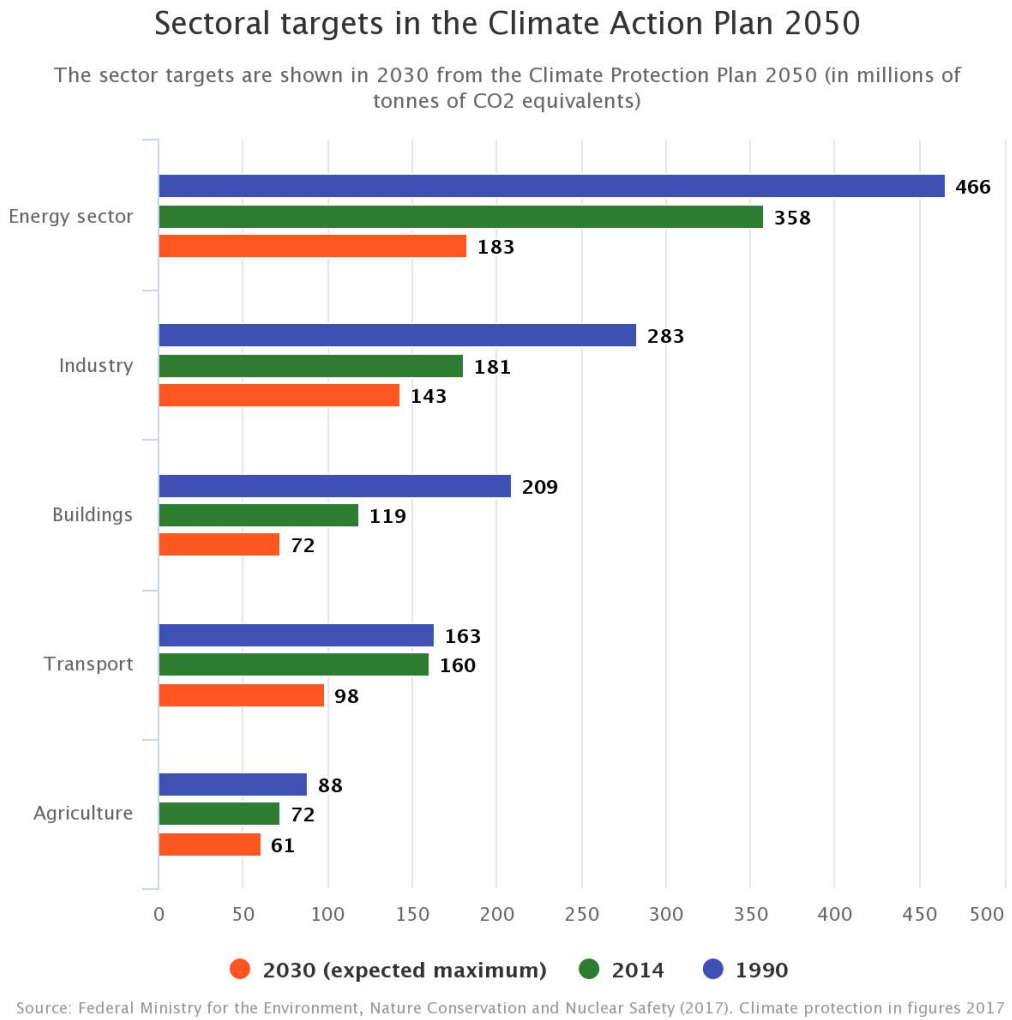
Intro

- 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.



Intro

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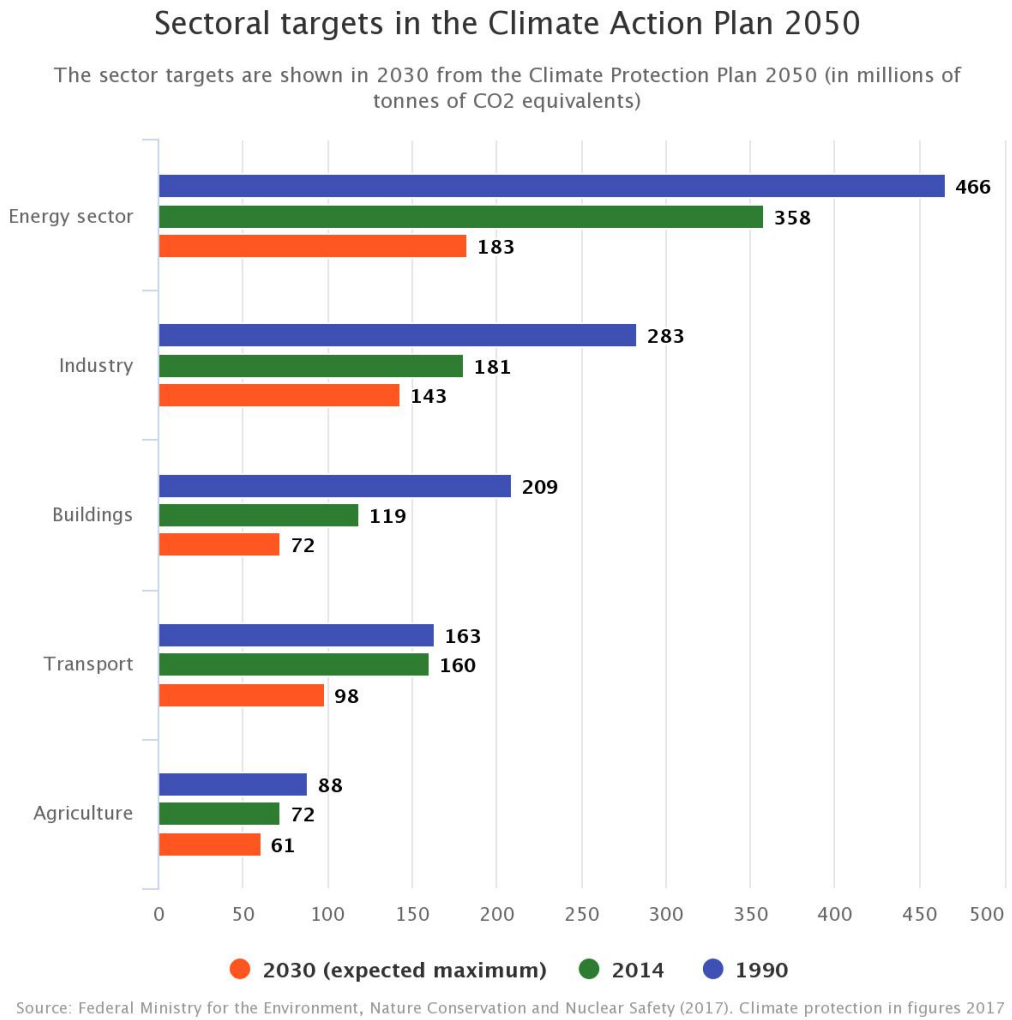
substitution of fossil fuels and energy efficiency

- hydrogen/ synthetic fuels
- electricity
- energy efficiency



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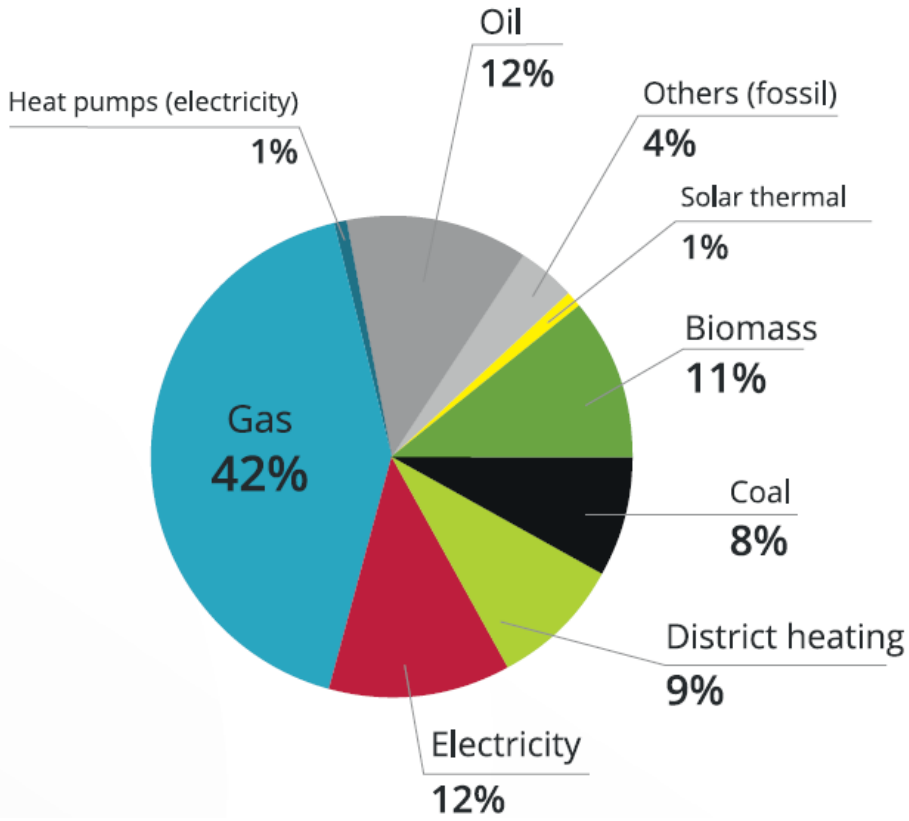
Intro

- 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[27]. 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%)



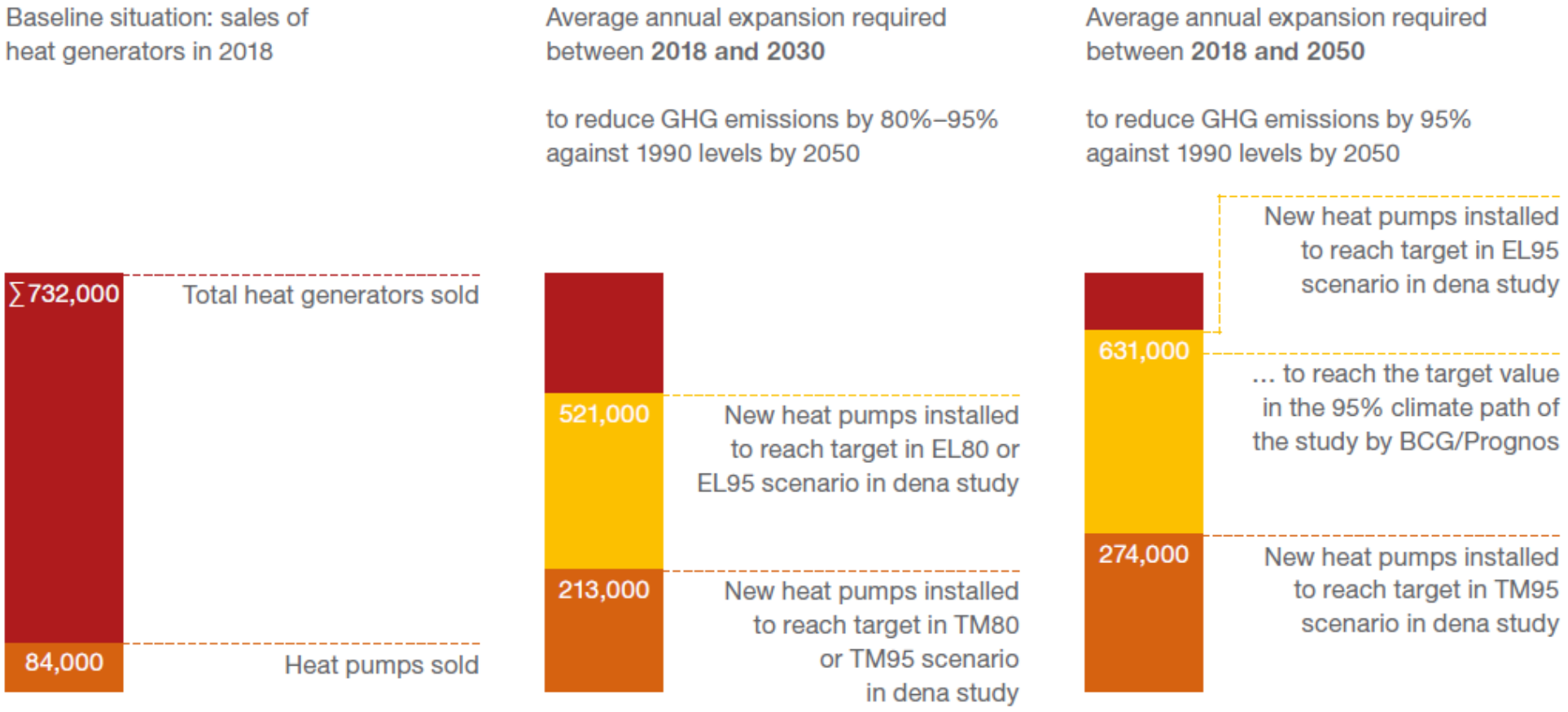
Most of the thermal energy is produced from **fossil fuels (66%)** and **only 13%** comes from **renewable energies**. Electricity and district heat together supply 21% of heat, which may or may not be renewable, depending on local circumstances.

Figure 4:
H&C final energy by energy carrier in 2015 (EU28)

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



Sources: BCG/Prognos (2018), BDH (2019a), BDH (2019e), BWP (2020), dena (2018).

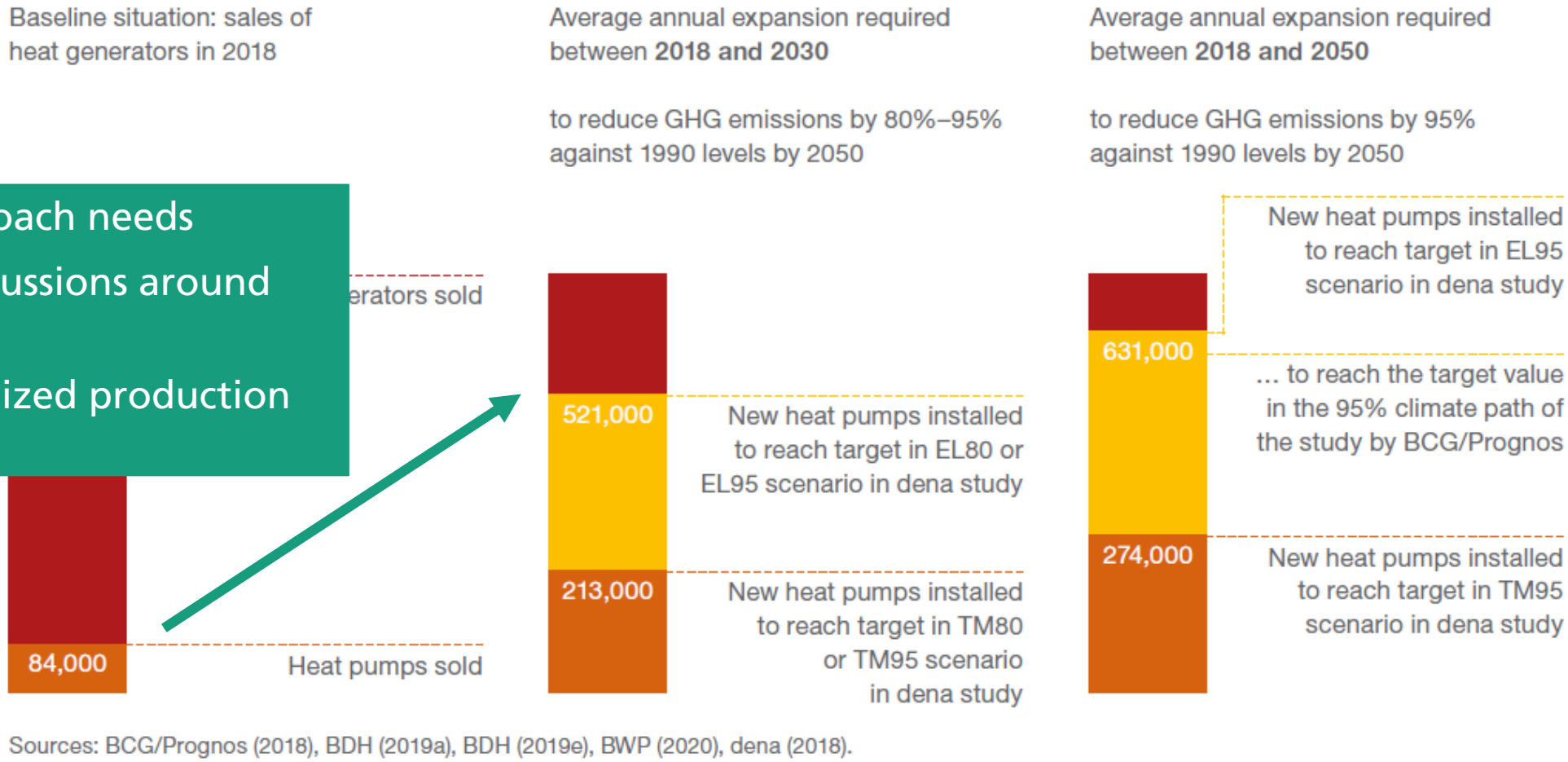
Source: PWC/ BWP 2020

Heat Pumps for the Building Sector

Challenging approach needs

- closing the discussions around refrigerants.
- more industrialized production of heat pumps.

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



Sources: BCG/Prognos (2018), BDH (2019a), BDH (2019e), BWP (2020), dena (2018).

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

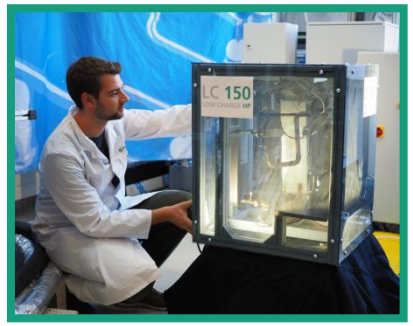
alpha innotec – the better way to heat | BDR THERMEA | Vaillant | BOSCH | VIESMANN | KERMI

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)

Federal Ministry for Economic Affairs and Energy

3,6 Mio. €
(75 % funding rate)

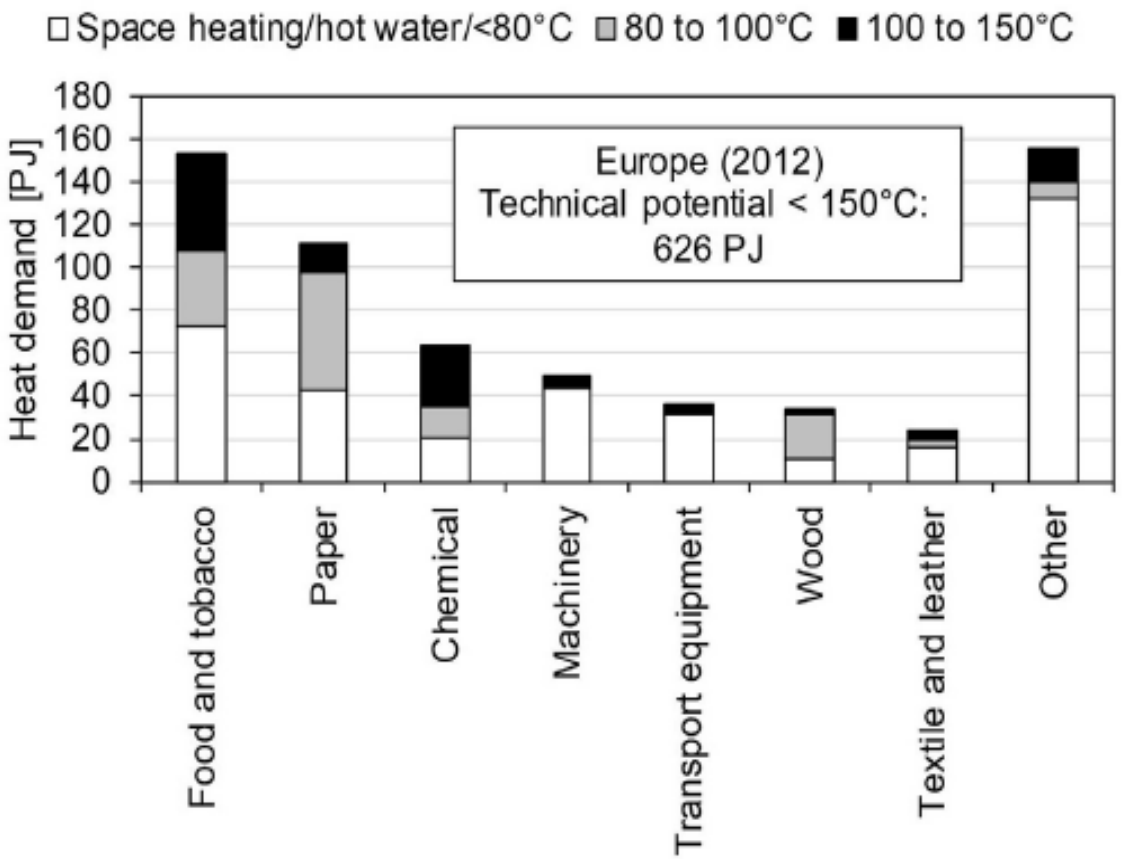


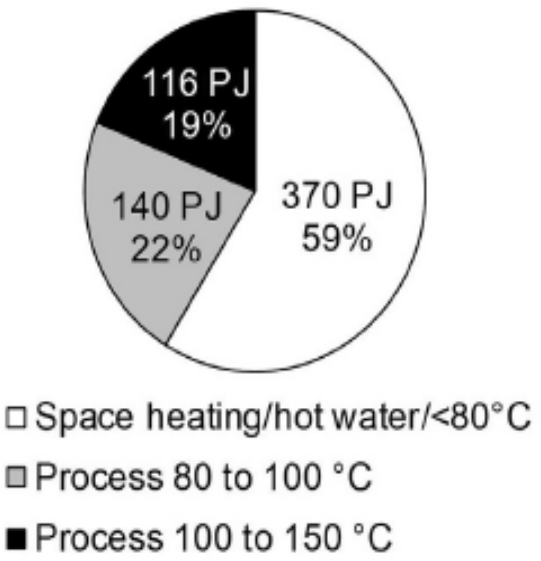
LC150 PLATFORM DEVELOPMENT OF A CHARGE-REDUCED HEAT PUMP MODULE WITH PROPANE

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



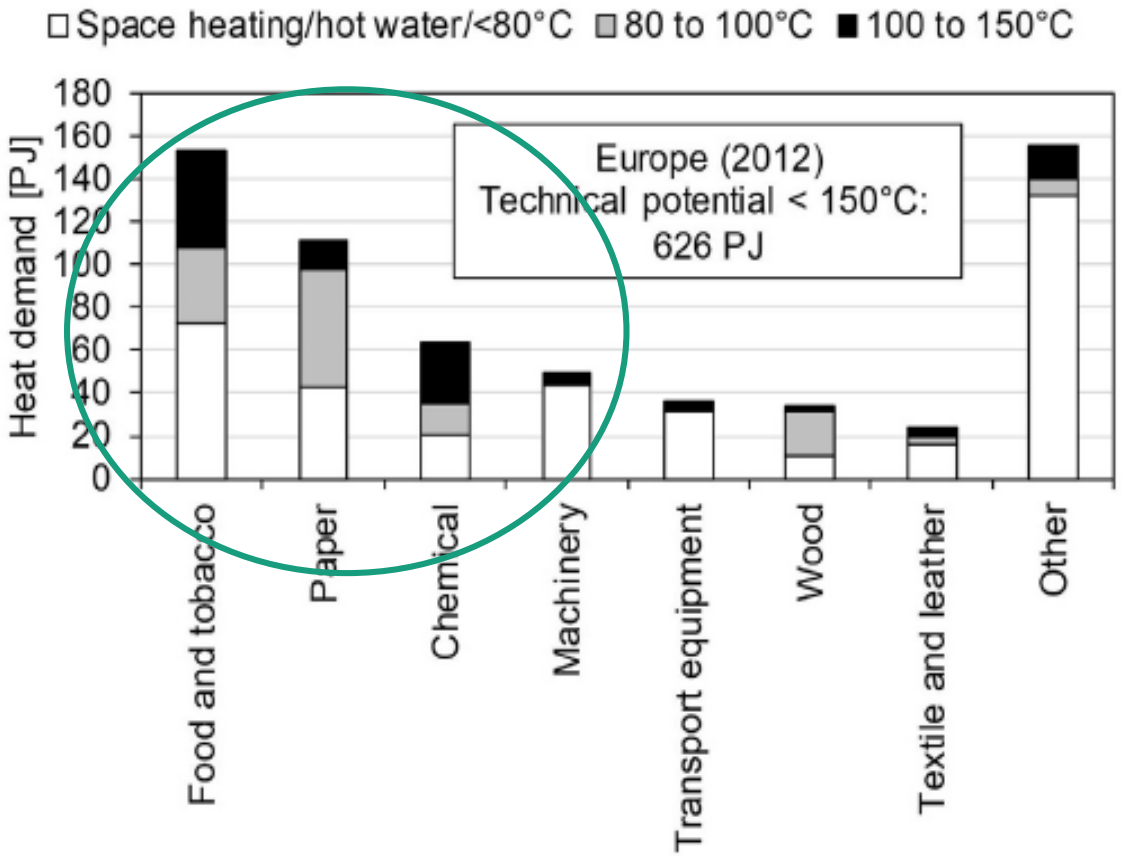


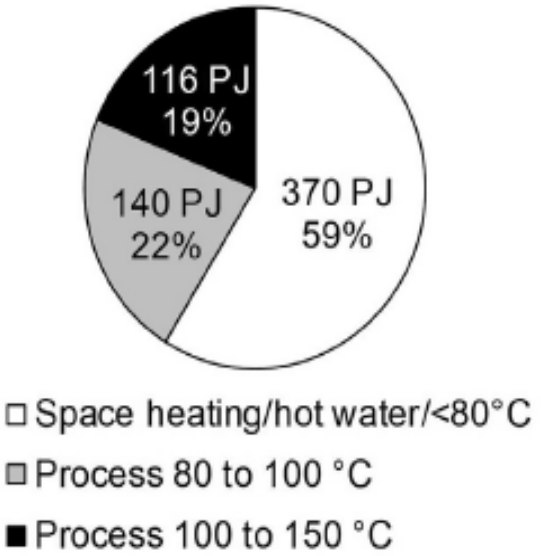
Source: Arpagaus 2018

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



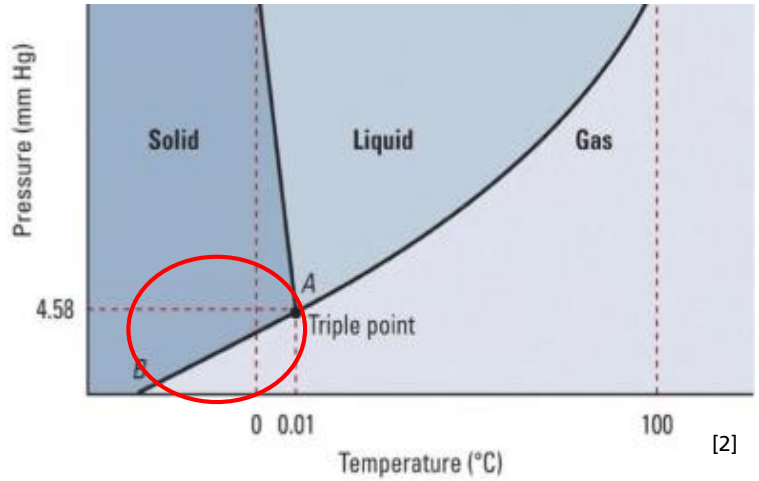


Source: Arpagaus 2018

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



[2]

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Wasser als Kältemittel – Nutzbar für die Zukunft!

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ZAE BAYERN
Technische Universität Berlin
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TRANE ROGGENKAMP Kälte. Technik. Kompet
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invensor making life cooler
FAHRENHEIT
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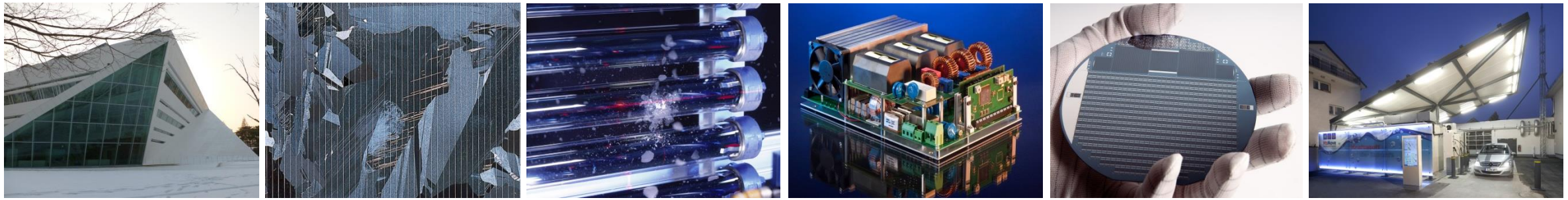
ILK Dresden Institut für Luft- und Kältetechnik gemeinnützige Gesellschaft mbH
WEGRA ANLAGENBAU GMBH

[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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