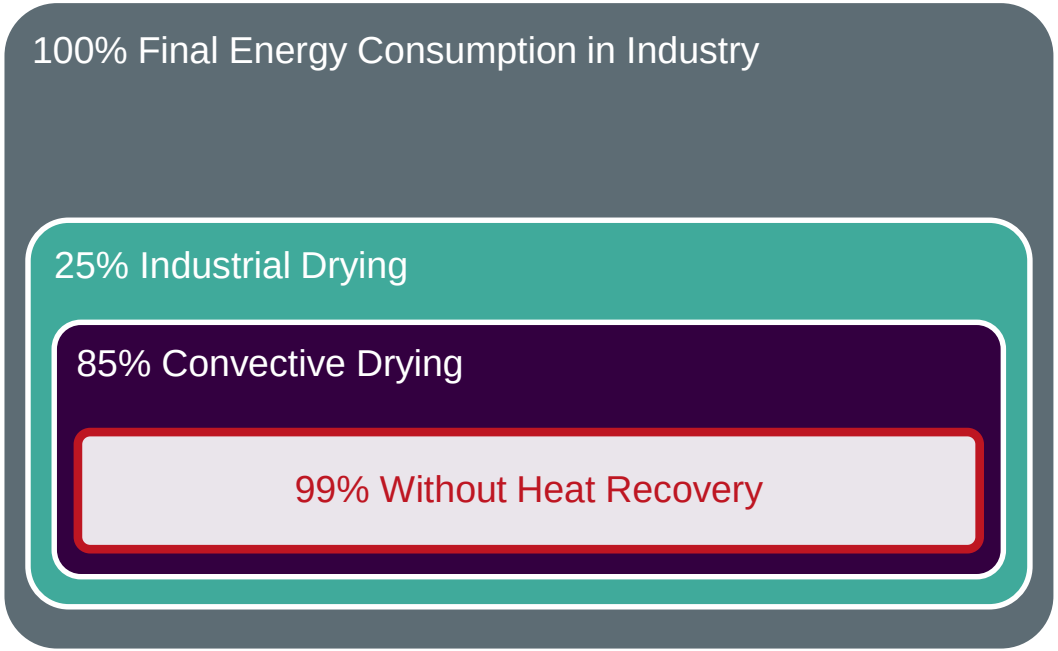
AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY

INDUSTRIAL DRYING PROCESSES WITH HEAT PUMPS

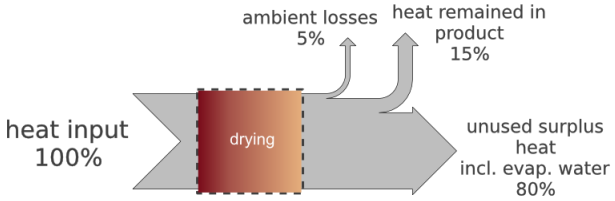
V. Wilk

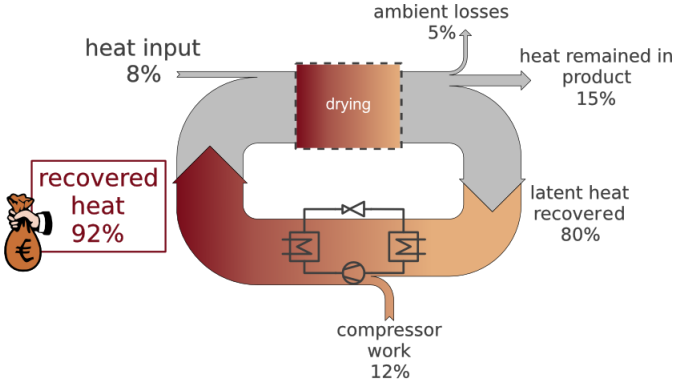
MOTIVATION

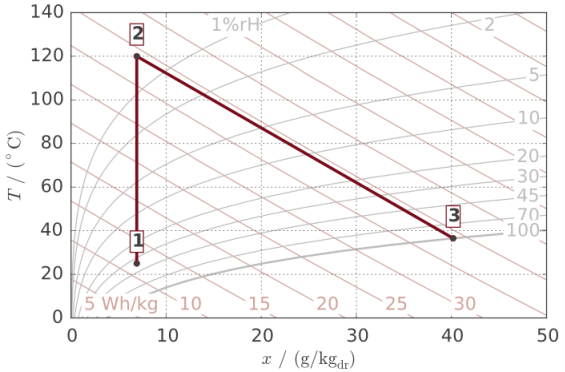


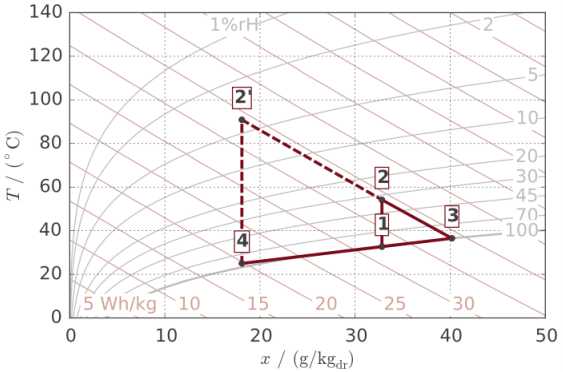
(Source: Mujumdar, Arnu S., Handbook of Industrial Drying, 2014)

MOTIVATION


ambient losses
5%
heat remained in
product
15%
heat input
100%
drying
unused surplus
heat
incl. evap. water
80%

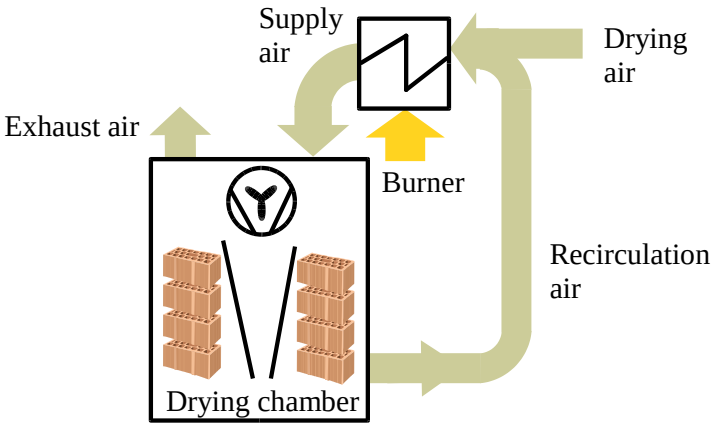

ambient losses
5%
heat input
8%
heat remained in
product
15%
drying
recovered
heat
92%
latent heat
recovered
80%
compressor
work
12%


T / (°C)
x / (g/kg_dr)
1%rH
2
5
10
20
30
45
70
100
5 Wh/kg
10
15
20
25
30
1
2
3

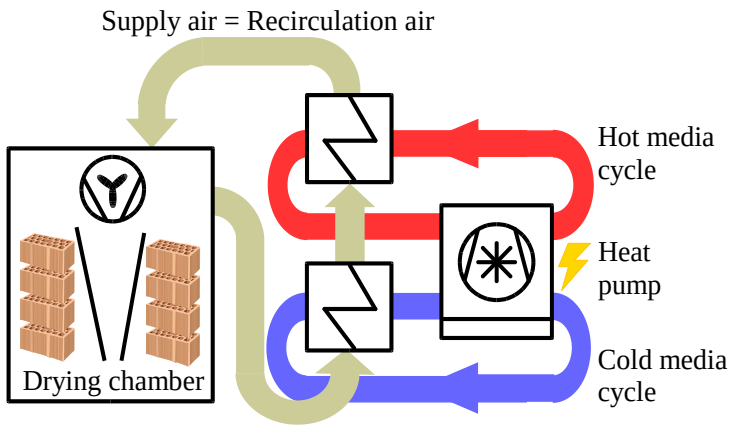

T / (°C)
x / (g/kg_dr)
1%rH
2
5
10
20
30
45
70
100
5 Wh/kg
10
15
20
25
30
1
2
3
4

EXAMPLE: BRICK DRYING

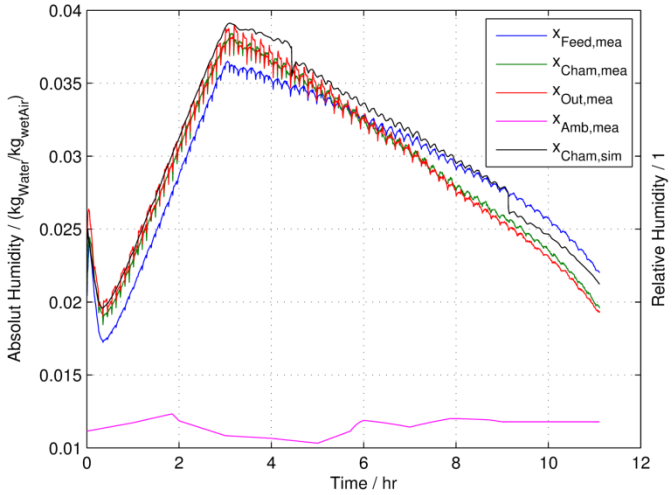
- Conventional open-loop drying process

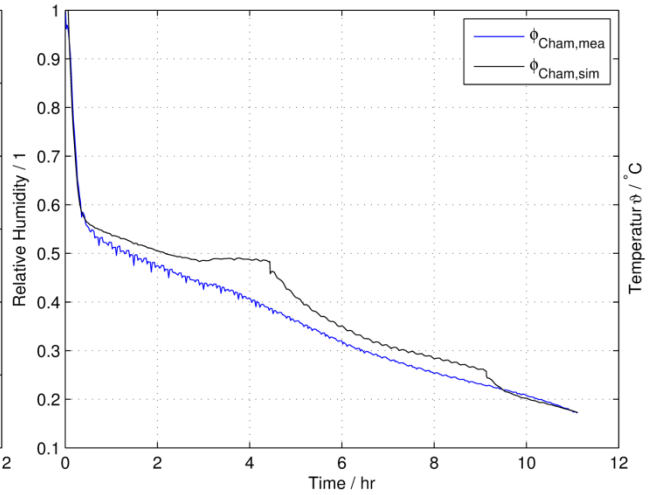


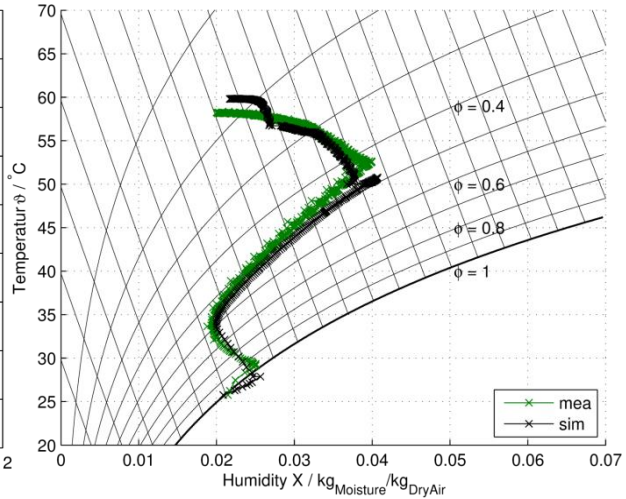
- Closed-loop heat pump drying



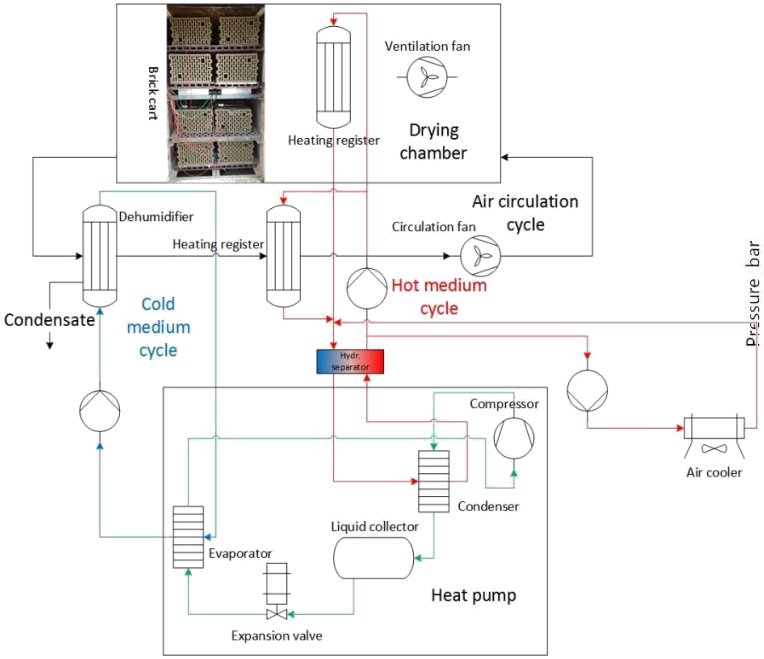
BRICK DRYING: SIMULATION MODEL

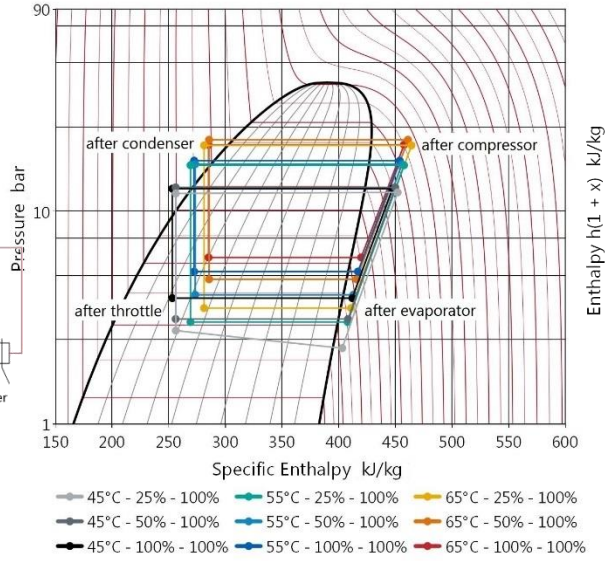


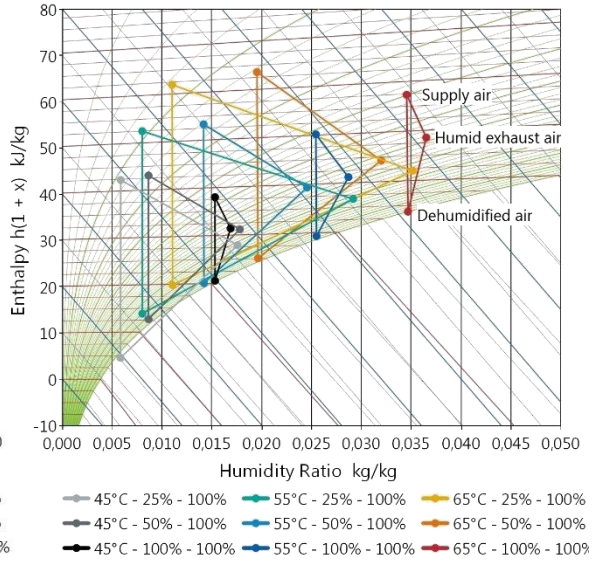




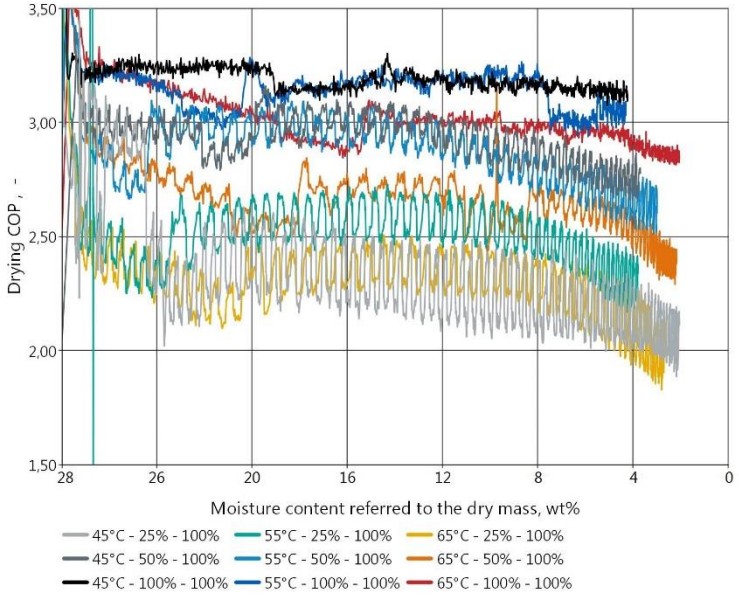
BRICK DRYING: EXPERIMENTS WITH HP DRYER

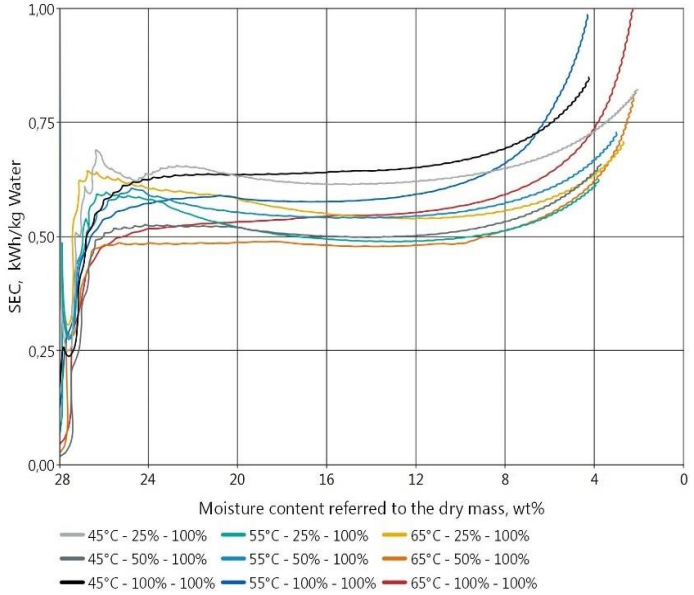




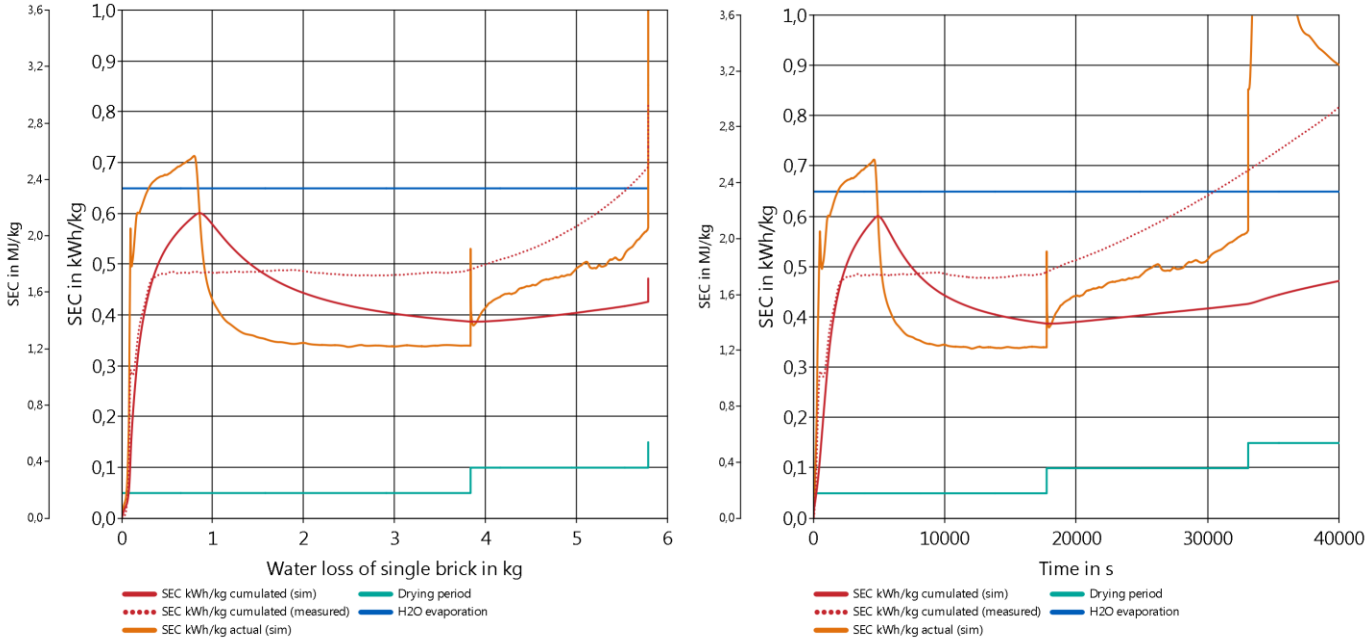


BRICK DRYING: EFFICIENCY





BRICK DRYING: IMPROVEMENTS



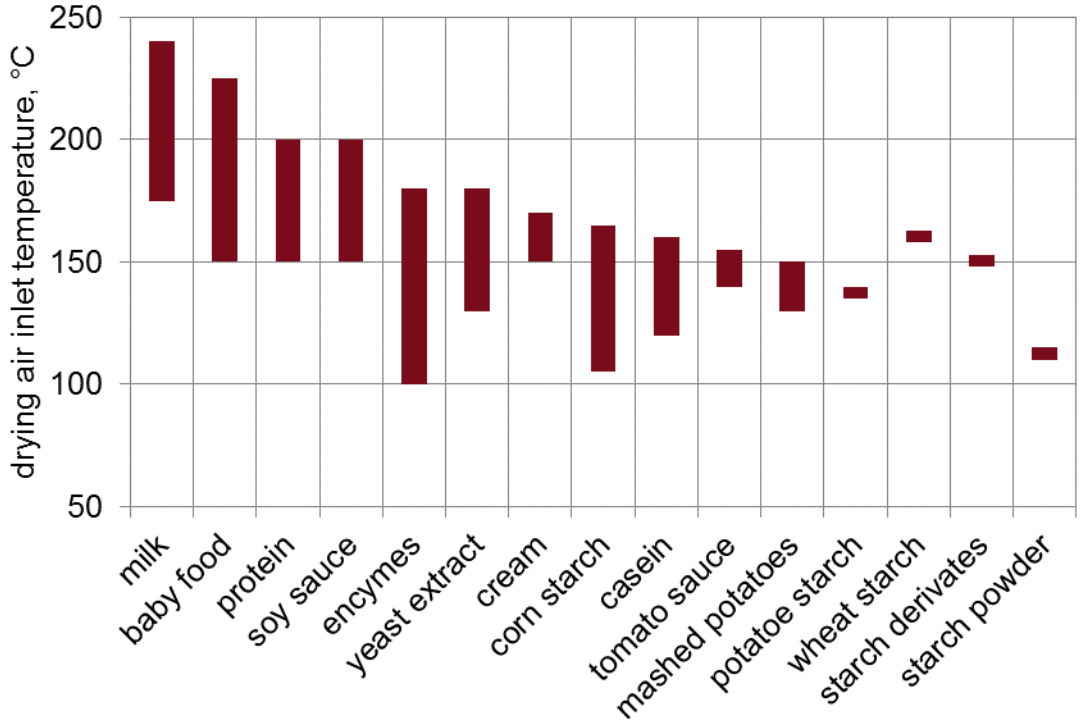
Improvements:

- no leckage
- HX

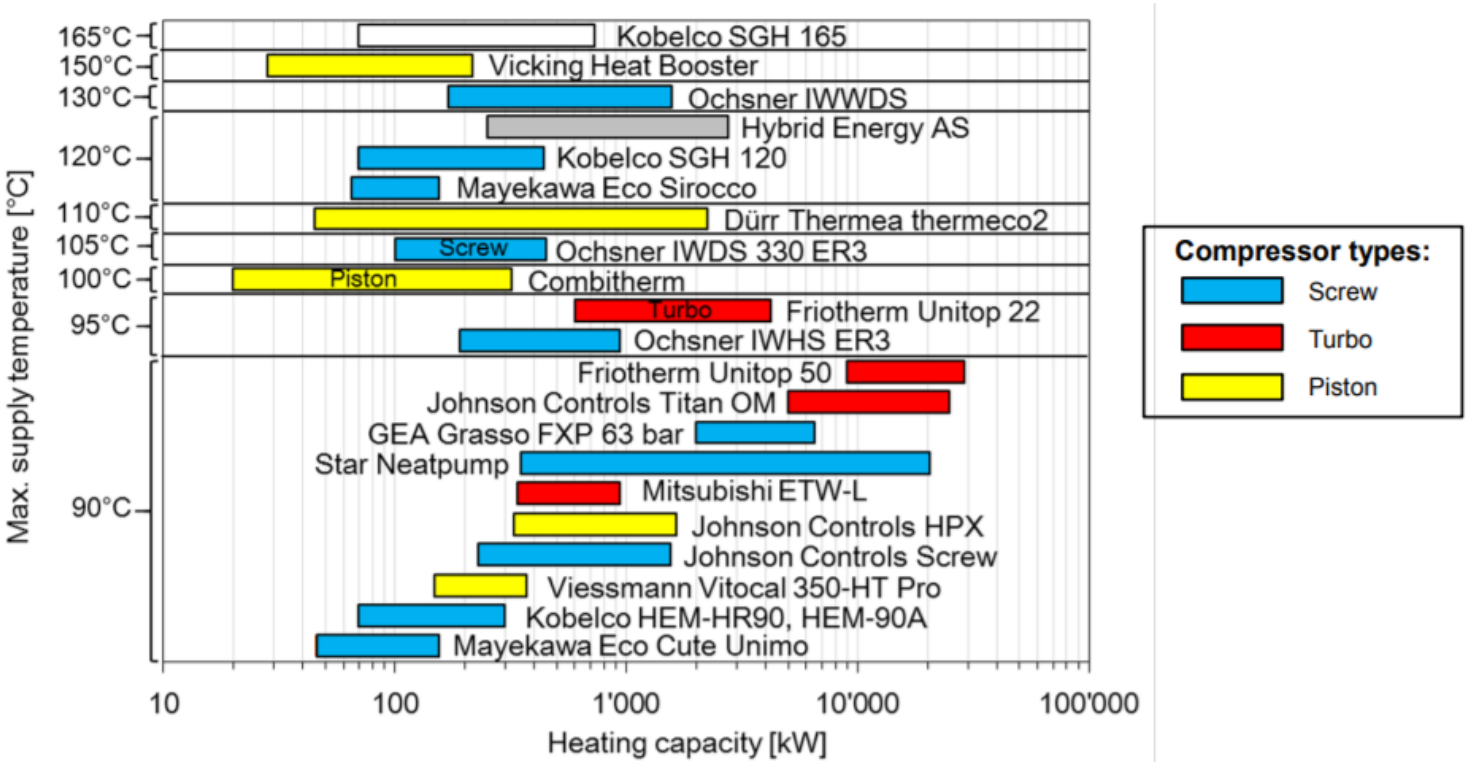
→ -25% SEC

powered by klima+ energie fonds

OTHER DRYING PROCESSES



AVAILABLE HEAT PUMPS



C. Arpagaus, Review on high temperature heat pumps, market overview and research status, European Heat Pump Summit Nuremberg, 2017.

H2020: DRYFICIENCY

Austrian Institute of Technology, Project Coordinator

Bitzer Kühlmaschinenbau GmbH, Germany

EPCON Evaporation Technology AS, Norway

European Heat Pump Association, Belgium

ROTREX AS, Denmark

SINTEF ENERGI AS, Norway

AGRANA STÄRKE GmbH, Austria

Chemours Deutschland GmbH, Germany

Fuchs Europe Schmierstoffe GmbH, Germany

Mars GmbH, Germany

RTDS Association, Austria

Wienerberger AG, Austria

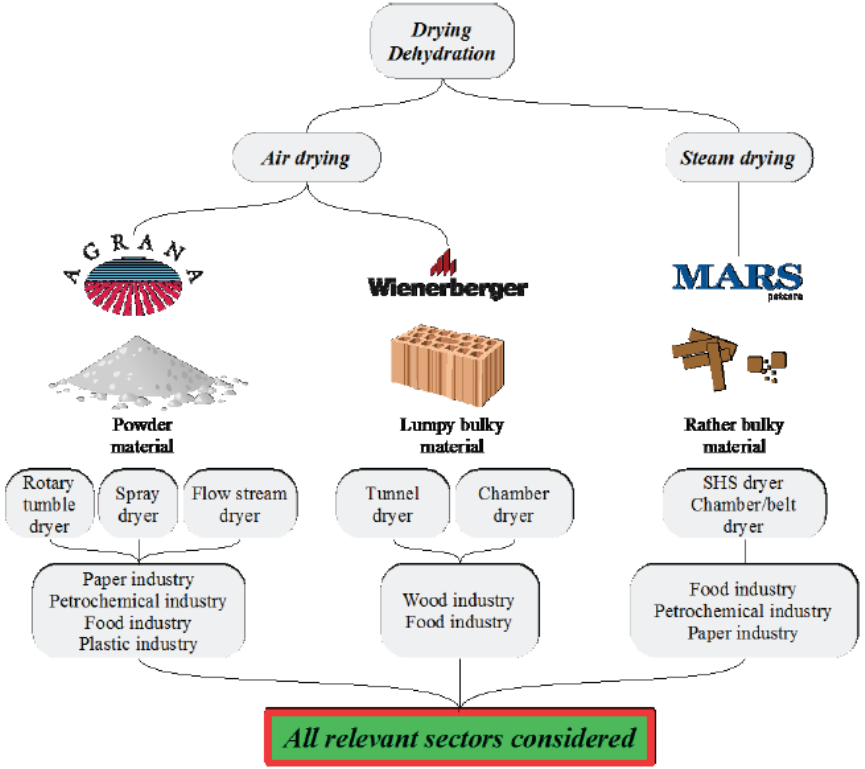
Grant Agreement No 723576 – Energy Efficiency

DRYFICIENCY

Efficient drying with heat pumps on industrial scale

Highlights

- heat pumps for industrial waste heat recovery with supply temperatures up to 180 °C
- demonstration in three industrial drying processes
  - brick
  - pet care/feed
  - food industry

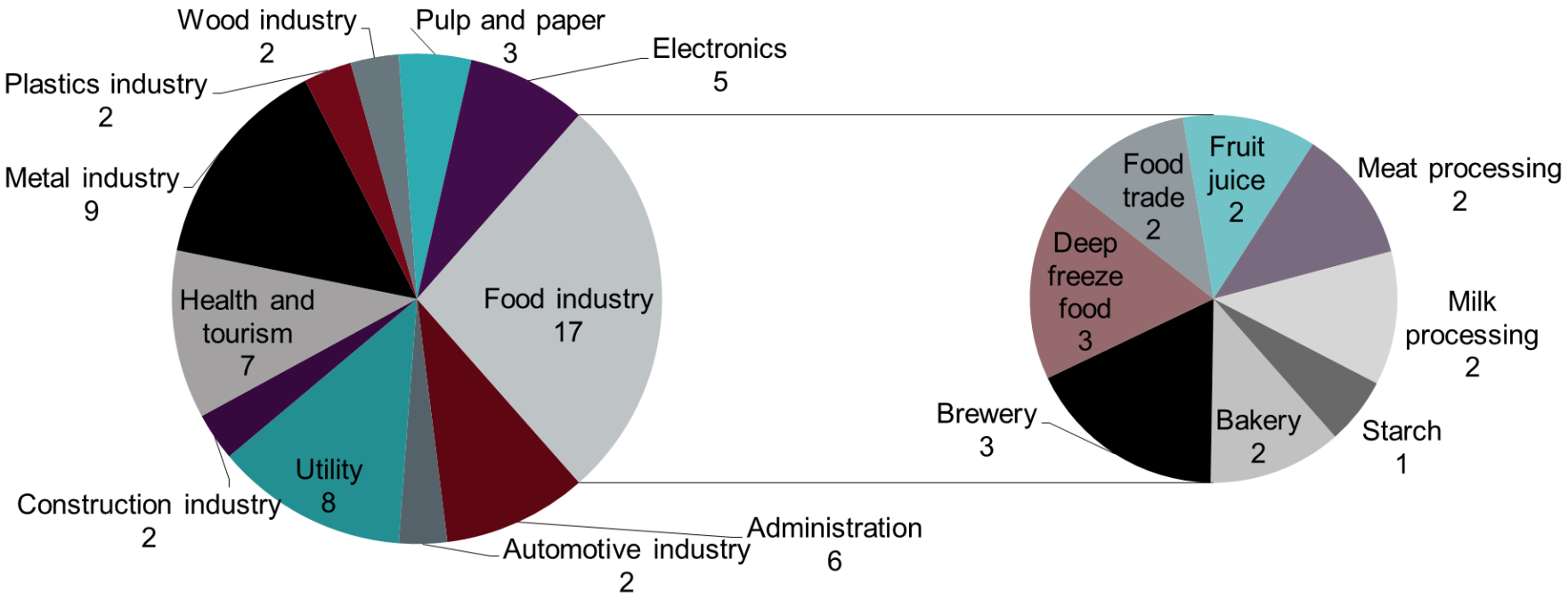


ANNEX48 – INDUSTRIAL HEAT PUMPS

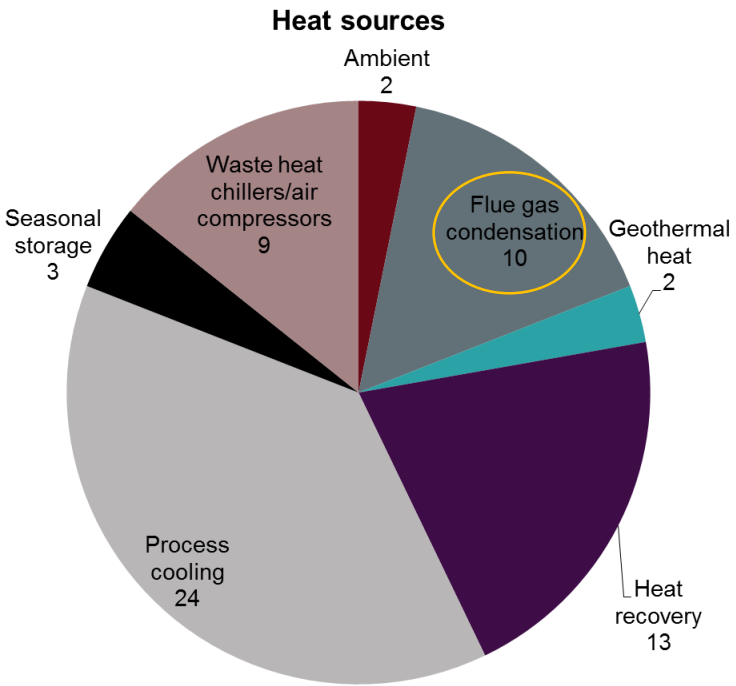
- Adressing barriers for heat pumps
- Diffusion of knowledge of successful heat pump applications in industry
- Participating countries: Japan, France, UK, Denmark, Switzerland, Austria
  Operating Agent: IZW Germany

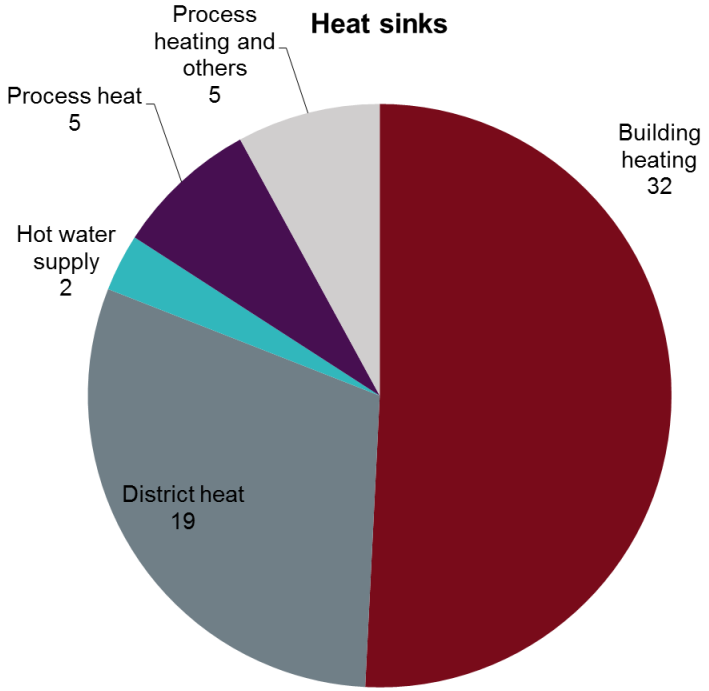
CASE STUDIES – ANNEX 48

63 examples of heat pumps in Austrian industries collected so far



CASE STUDIES: HEAT SOURCES AND SINKS





CONCLUSIONS

- Heat pumps allow for more efficient drying processes
- Positive effects for the environment
- Simulations and experiments are necessary to optimize an interlinked system
- Next steps: demonstration plants
- prove the concept
- to learn more about the operation and optimize it

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THANK YOU!

V. Wilk, 14.11.2017