

High temperature creep testing: Operation experience and outlook

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DRYFICIENCY: INDUSTRIAL DEMONSTRATION



High temperature heat pumps up to 160°C



Closed loop heat pump

Open loop heat pump

Brick drying

Starch drying

Bio sludge drying



Wienerberger AG
Uttendorf (AT)

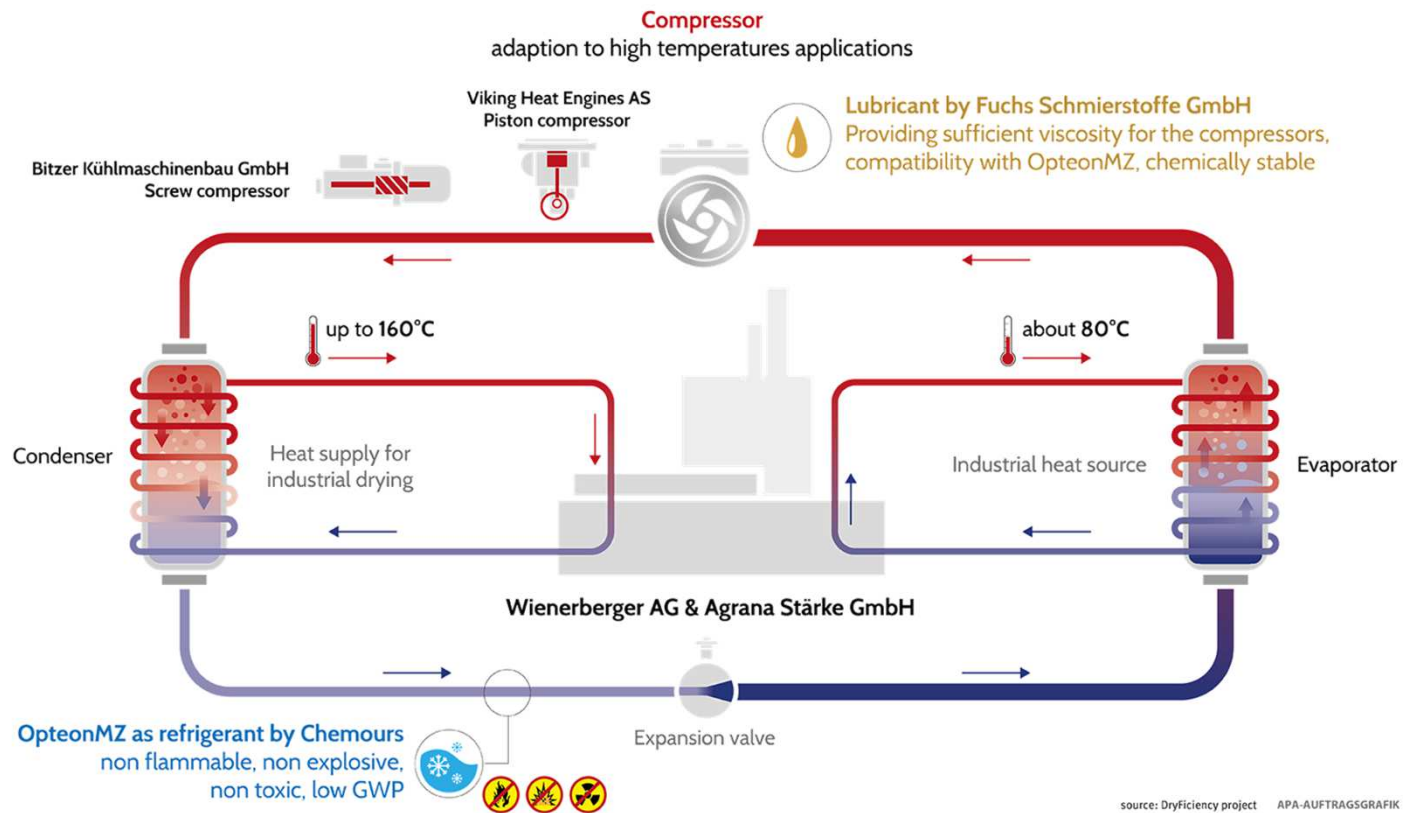


AGRANA Stärke GmbH
Pischelsdorf (AT)



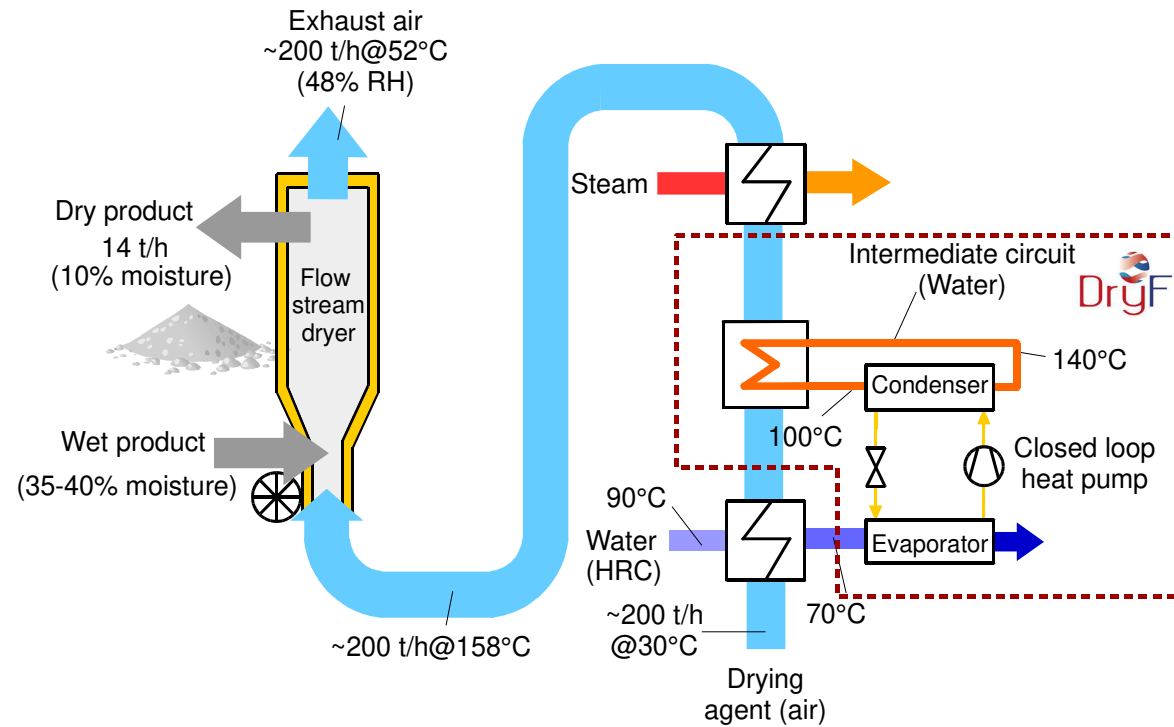
Scanship A/S
Drammen (NO)

CLOSED LOOP HEAT PUMP

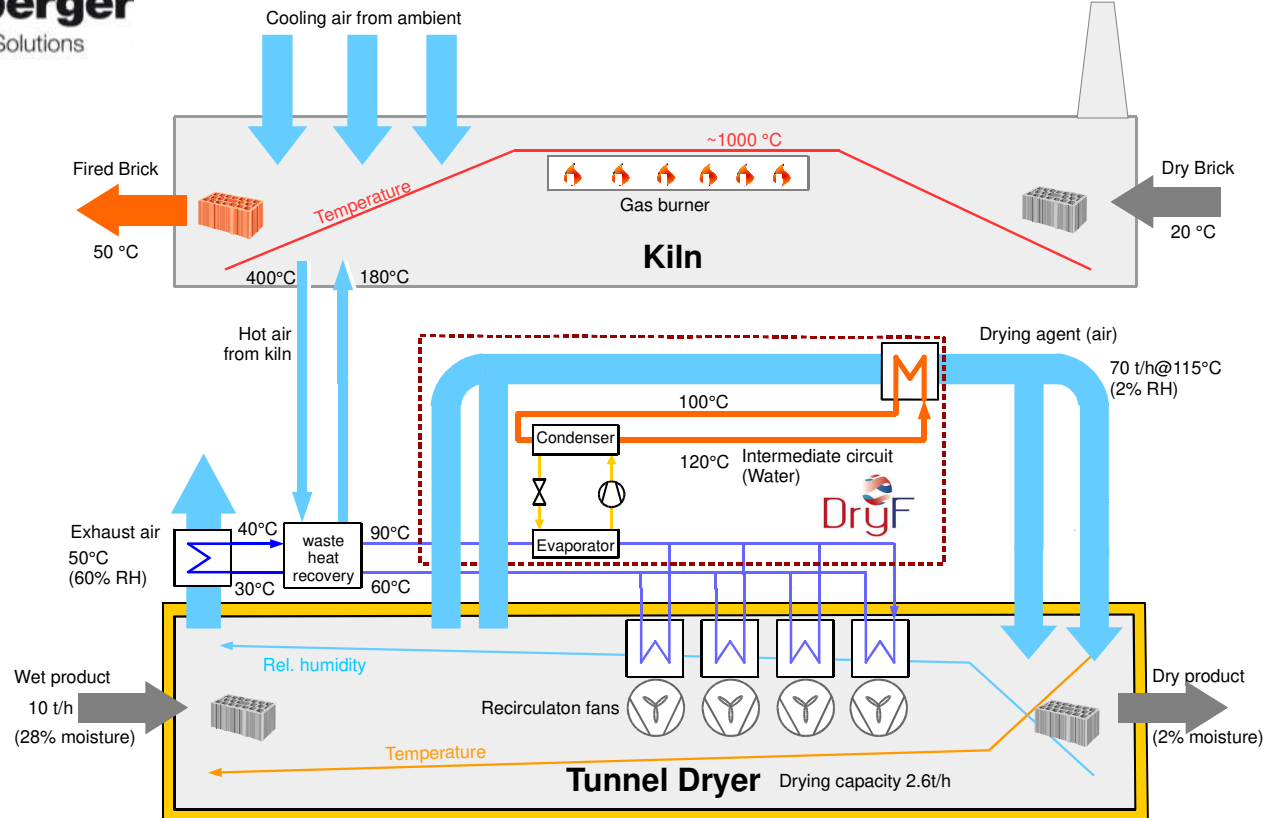


source: DryFiciency project APA-AUFTRAGSGRAFIK

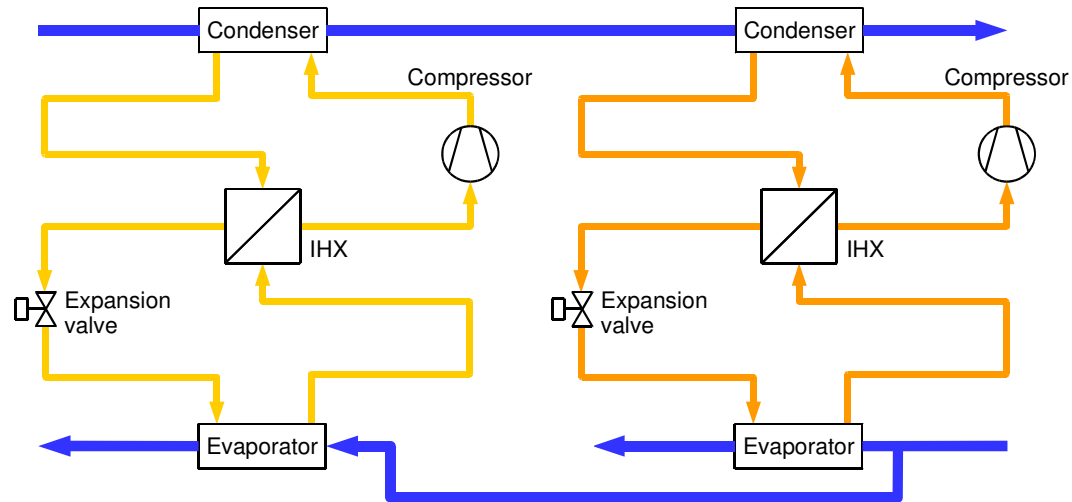
STARCH DRYING



BRICK DRYING

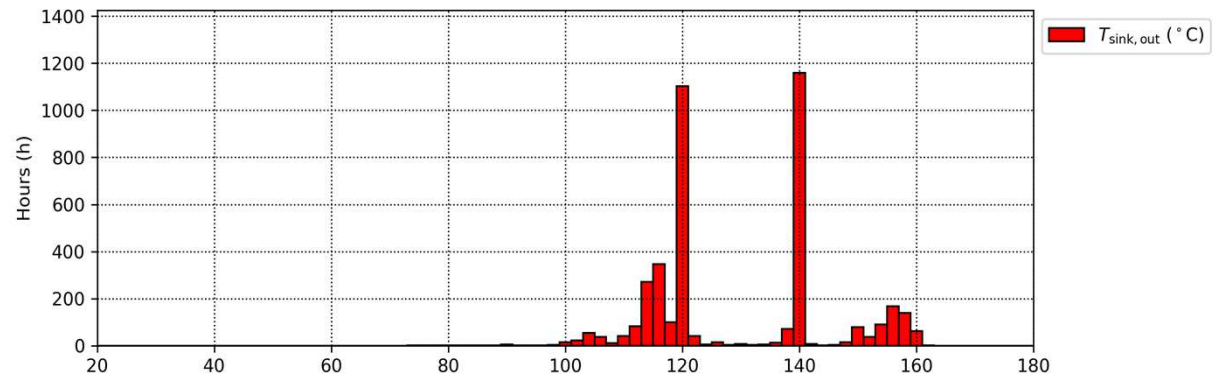


HEAT PUMP CYCLE LAYOUT

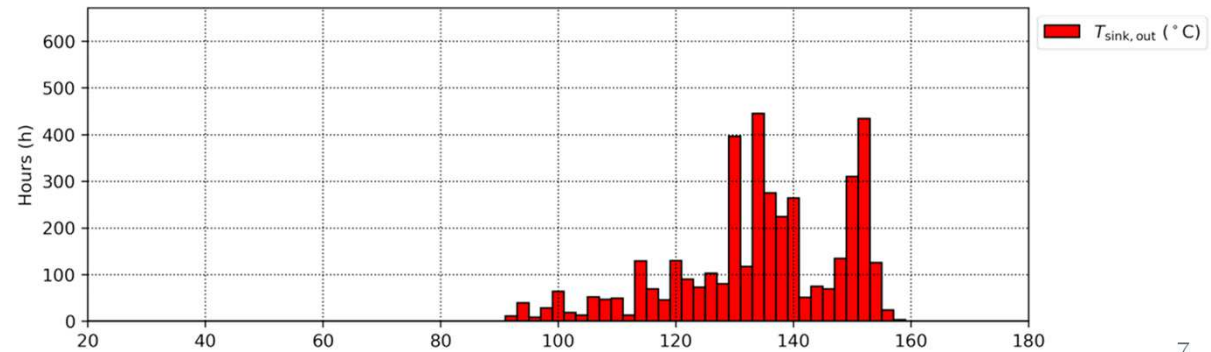


PERFORMANCE: OPERATING HOURS

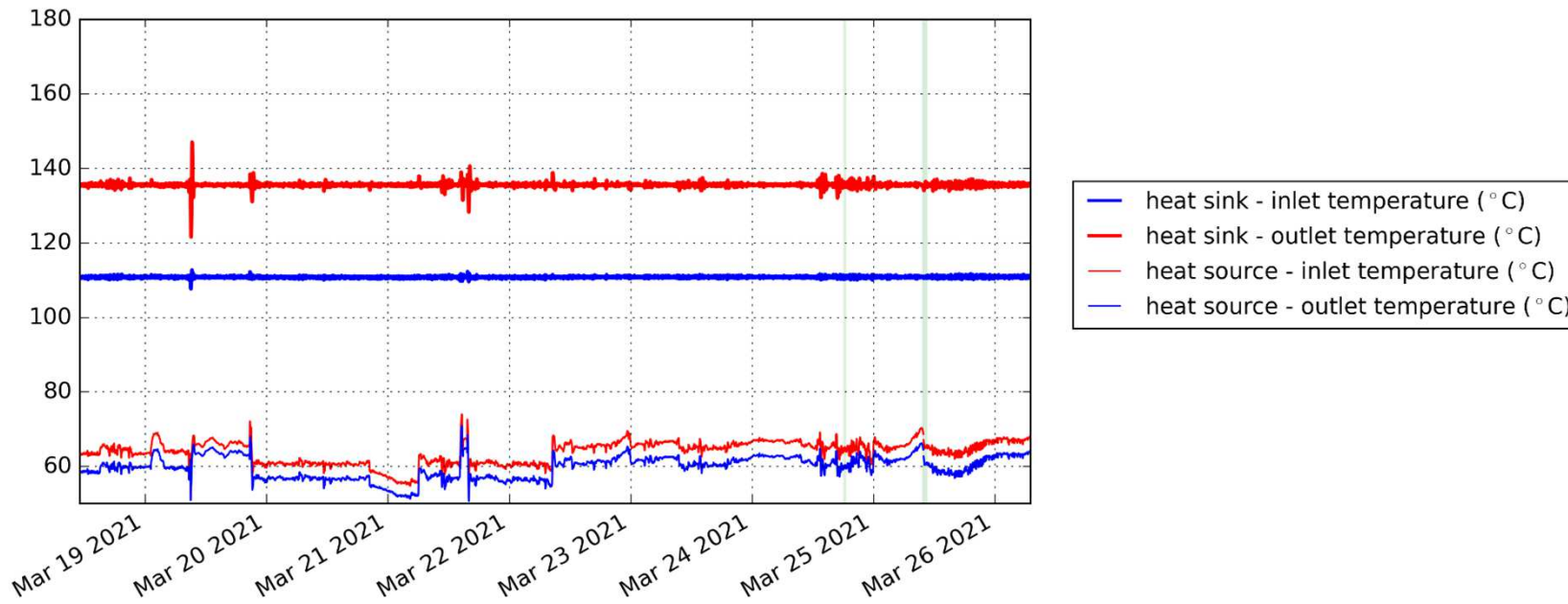
- WBG:
4020 h until 31.8.2021



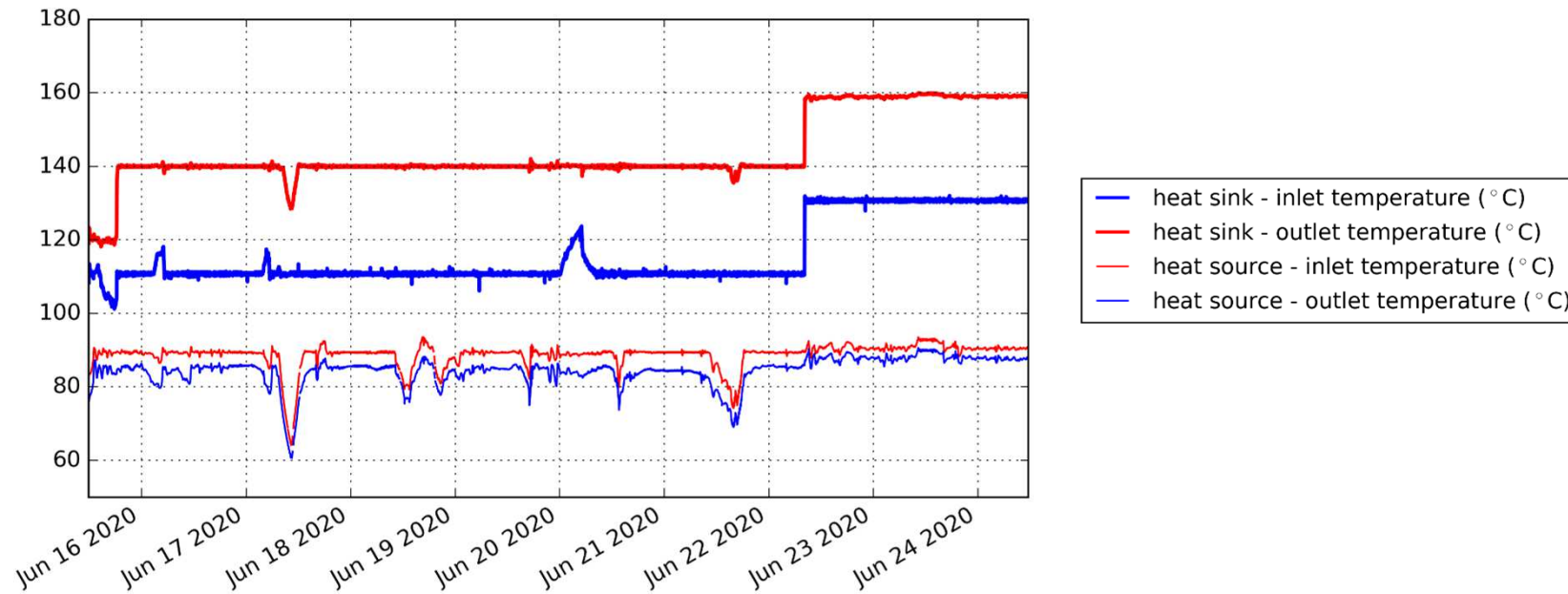
- AGA:
4008 h until 31.8.2021



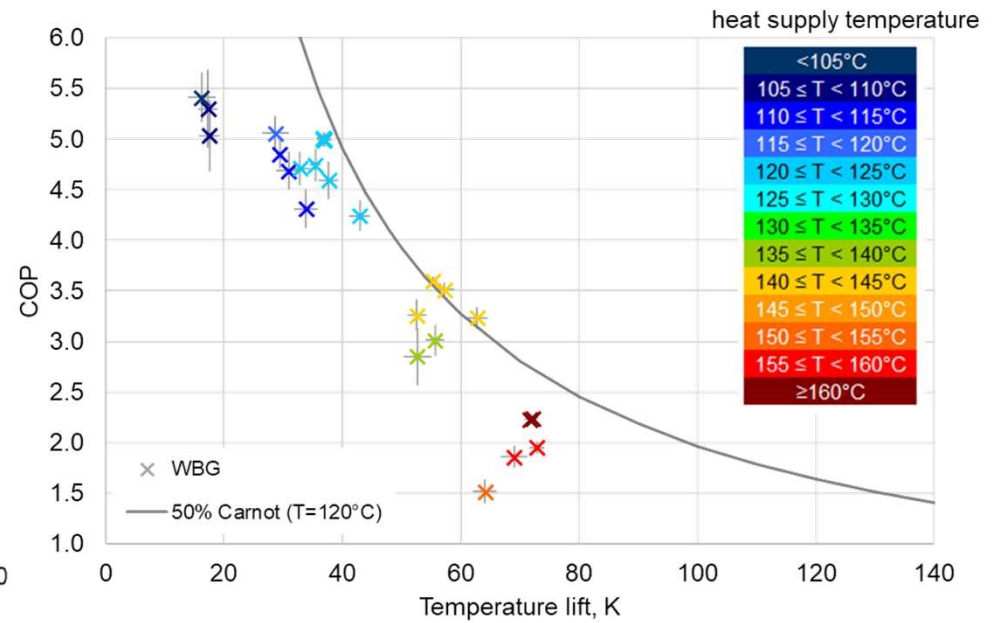
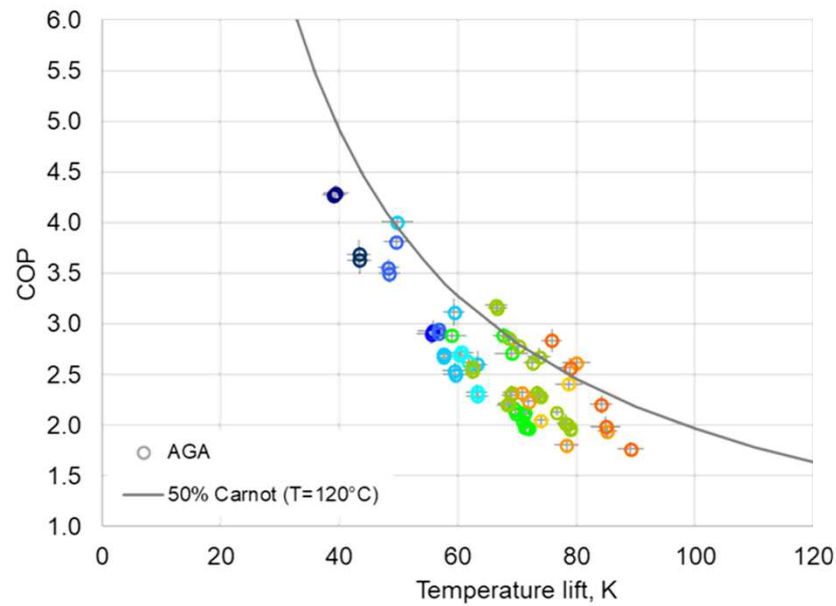
PERFORMANCE: AGRANA



PERFORMANCE: WIENERBERGER

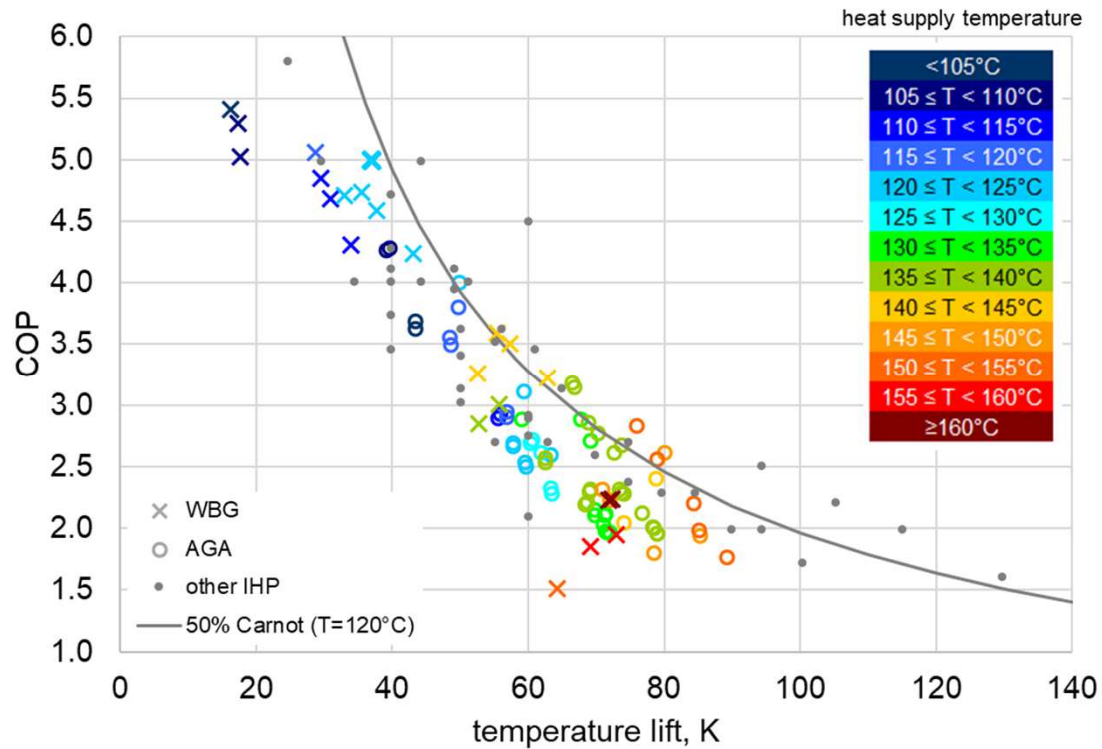


OVERVIEW ON HEAT PUMP OPERATION



data points represent >10h of stationary operation





OVERVIEW ON HEAT PUMP OPERATION



other IHP from Arpagaus et al. High temperature heat pumps: Market overview, state of the art, research status, refrigerants, and application potentials, Energy (152), p.985-1010, 2018.

IMPACT OF THE DEMONSTRATORS

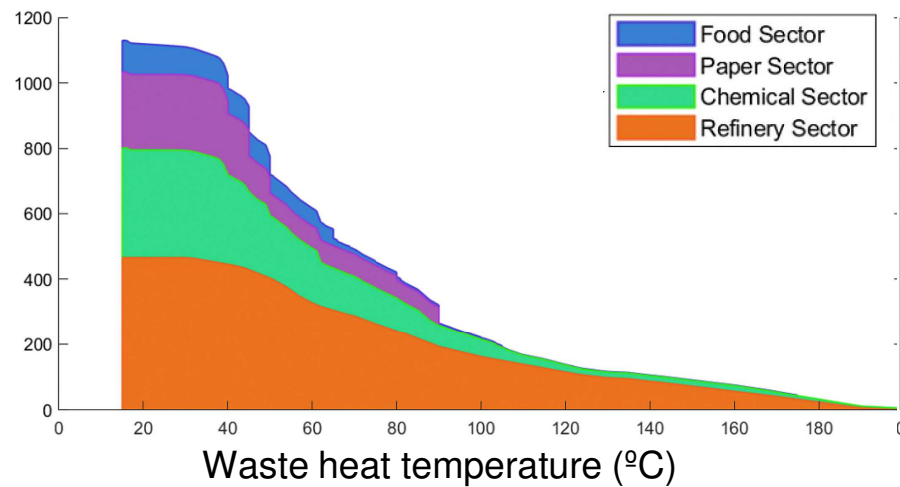


		Agrana	Wienerberger
heat supply temperature		138°C	120°C
final energy reduction		2388 MWh/a = 72%	2163 MWh/a = 82%
primary energy reduction		1690 MWh/a = 46%	1904 MWh/a = 66%
CO ₂ emissions reduction		659 t/a = 73%	592 t/a = 83%

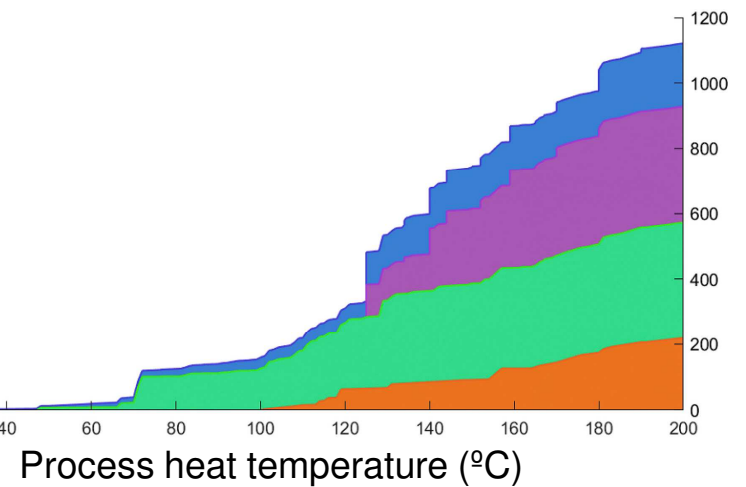
REPLICABILITY TO OTHER PROCESSES

- Steam generation with heat pumps
- Combination of heat pump and steam compression
- High lift applications due to process optimization

Cumulative waste heat (PJ/a)



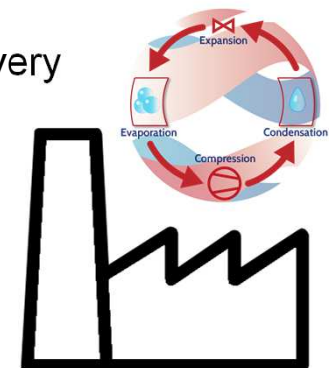
Cumulative process heat (PJ/a)



SUMMARY



- DryFiciency
 - successful component and system development for high temperature applications
 - well suited compressors, lubricant and refrigerant
 - stationary operation of the demonstrators with satisfying performance
 - ca. 8000 h operation hours achieved for both demonstrators until 08/2021
- heat pumps are a future proof process heat supply technology
 - lower energy consumption and reduced CO₂ emissions by waste heat recovery
- large multiplication potential for processes with process heat of up to 160°C
 - process integration is decisive to realize efficient solutions



AIT'S DRYFICIENCY TEAM



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Michael Lauermann



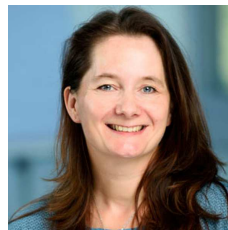
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www.dryficiency.eu



THANK YOU!

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