

A man with short dark hair is shown in profile, sitting at a desk and looking at a computer monitor. He is wearing a dark shirt and a watch. The desk has a white mug, a pair of headphones, and a pen holder. The computer monitor displays a complex 3D schematic of a mechanical system, likely a CO2 heat pump. In the background, a large window looks out onto a factory floor where another person is visible working at a distant workstation. The entire image has a warm, reddish-brown color cast.

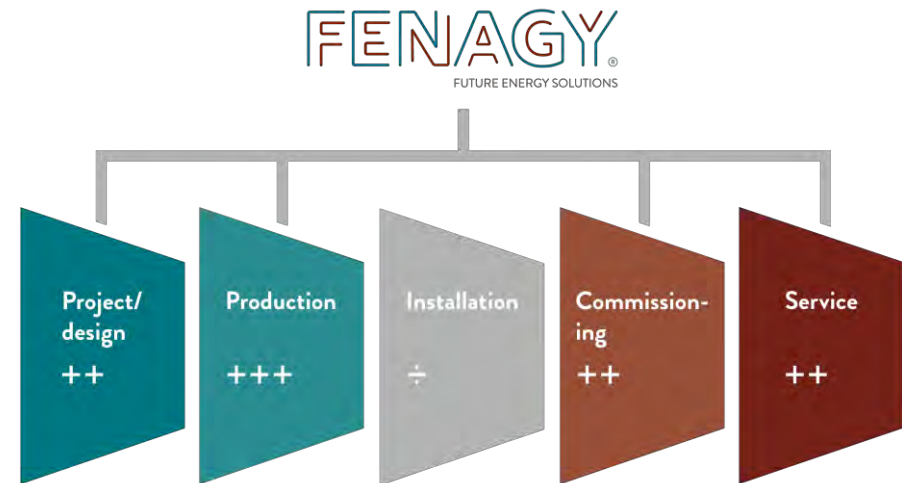
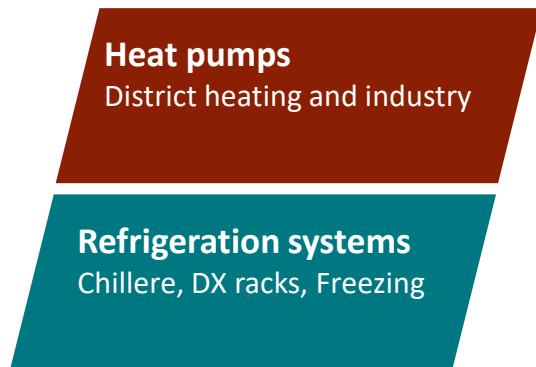
CO₂ Electrical Heat Pumps

H1800-AW-4+4D



FENAGY MANUFACTURER OF HEAT PUMPS AND REFRIGERATION SYSTEMS IN AARHUS

- Founded in 2020
- 4 founders + 35 employees
- +50 years of experience with refrigeration systems and heat pumps with CO₂
- Focus on CO₂ as refrigerant/ working fluid
- Heat pumps and refrigeration systems (200 kW – 10 MW)
- Office of engineers and production in Aarhus
- Focus is on **Projects**, where the need of the customer is key
- **Manufacturer** that produces the best industrial systems with support from the best subcontractors
- Plants that ensures the cheapest life-cycle costs and operating price



FENAGY

References

1.5 years

40 MW Heat

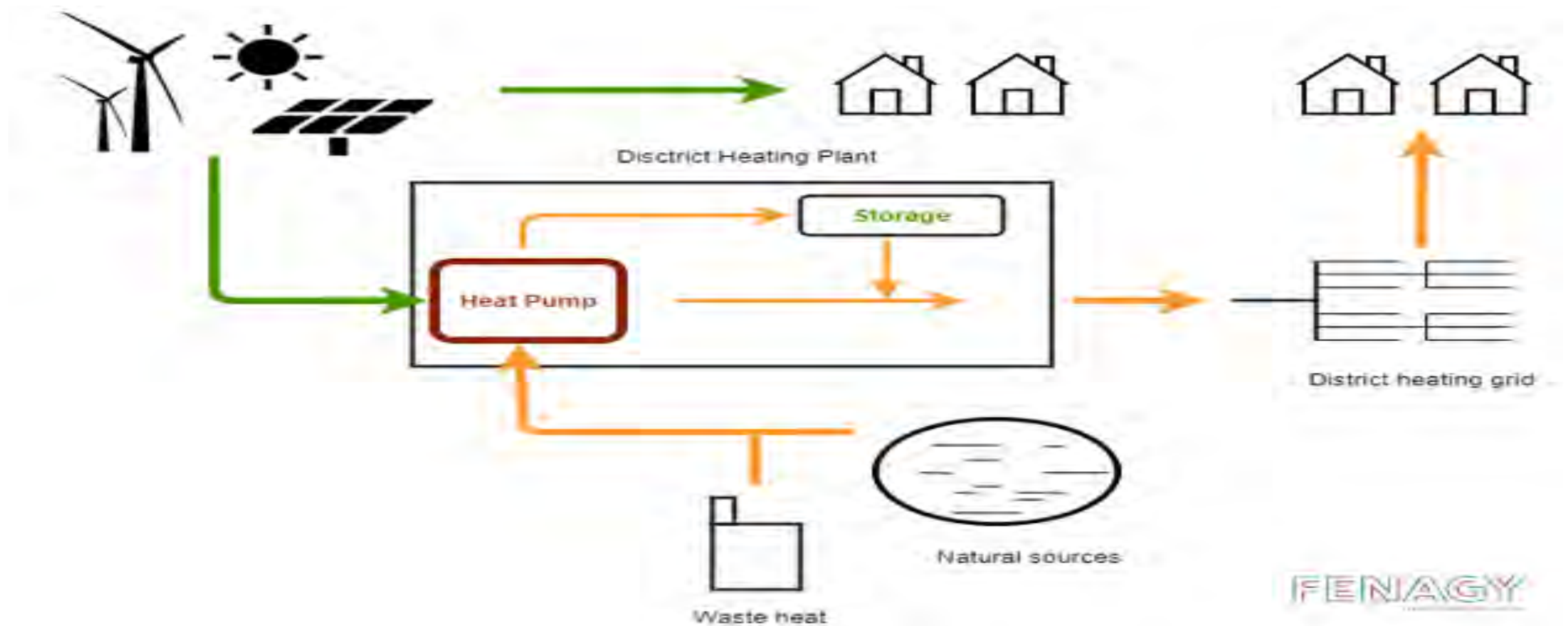
15 MW Electrical

Project	Year	Application	Fenagy model	Ejector tech	Defrost	Heat source	Heat sink	Heat cap	Cooling cap	Country
Description	-	Utility/ Industry	-	-	G/CG	A/W	A/W	MW	MW	-
Affaldsvarme (Utility Aarhus)	2020	Utility (HP)	1xH600-AW-2+1	NA	Glycol	Air	Water	0,6	-	DK
Feldborg	2021	Utility (HP)	1xH1200-AW-4+4	FenEject	Glycol	Air	Water	1,2	-	Dk
Haderup	2021	Utility (HP)	1xH1200-AW-4+4	FenEject	Glycol	Air	Water	1,2	-	DK
Liertoppen	2021	Industry (chiller)	2xC1000-WA-5+1	NA	NA	Glycol/ Water	Water/ Air	0,5	2	NO
Vestervig	2021	Utility (HP)	1xH1200-AW-3+3	FenEject	Glycol	Air	Water	1,4	-	DK
Bowhill	2021	Industry (HP)	1xH600-WW-3+1	NA	NA	Water	Water	0,6	-	UK
Greenwich	2021	Utility (HP)	1xH300-WW-2+1	NA	NA	Water	Water	0,4	-	UK
HOFOR (Utility Copenhagen)	2021	Utility (HP)	1xH300-AW-3+0	NA	Cold gas	Air	Water	0,3	-	DK
Bjørnholthagen	2021	Utility (HP)	1x1000-WW-4+1	E-jector	NA	Water	Water		-	NO
Havneby (Rømø)	2022	Utility (HP)	1xH600-AW-2+2	E-Jector	Cold gas	Air	Water		-	DK
Kronborg	2022	Industry (HP)	1xH600-AW-2+2	E-jector	Glycol	Air	Water	0,6	-	DK
Aalborg Forsyning (Utility Aalborg)	2022	Utility (CHC)	1xH1200-AW-4+4	FenEject	Glycol	Air/ Water	Water	1,2	0,8	DK
Mejlby	2022	Utility (HP)	1xH1200-AW-4+4	FenEject	Glycol	Air	Water	1,2	-	DK
Sdr. Felding	2022	Utility (HP)	2xH1800-AW-4+4	FenEject	Glycol	Air	Water	3,4	-	DK
Voerså Kraftvarme	2022	Utility (HP)	1xH1200-AW-4+4	FenEject	Glycol	Air	Water	1,2	-	DK
Østervraa	2022	Utility (HP)	1xH1200-AW-5+5	FenEject	Glycol	Air	Water	1,5	-	DK
Bedsted	2022	Utility (HP)	1xH1200-AW-3+3	FenEject	Glycol	Air	Water	1,4	-	DK
Laurbjerg	2022	Utility (HP)	1xH1200-AW-5+5	FenEject	Glycol	Air	Water	1,5	-	DK
Tarm	2022	Utility (HP)	3xH1800-AW-5+3	FenEject	Glycol	Air	Water	3,0	-	DK
Flauenskjold	2022	Utility (HP)	1xH1200-AW-5+5	FenEject	Glycol	Air	Water	1,5	-	DK
Jerslev	2022	Utility (HP)	1xH1800-AW-6+6	FenEject	Glycol	Air	Water	1,8	-	DK
BaneNor Skoppum Stasjon	2022	Industry (HP)	3xH300-WW-3+0	FenEject	NA	Water	Water	1,5	-	NO
Tårnby	2023	Industry (HP)	1xH1800-AW-3+3	FenEject	Glycol	Air	Water	2,0	-	DK
Ormen Lange	2022	Industry (Chill)	2xC1000-WW	-	NA	Water	Air	0,5	2,0	NO
Lubenes	2022	Industry (HP)	1xH600-WW	-	NA	Water	Water	0,6	-	NO
Brørup	2022	Industry (HP)	2xH1800-AW-2+2	FenEject	Glycol	Air	Water	4,0	-	DK
Sæby	2023	Utility (HP)	3xH1800-AW-4+4	FenEject	Glycol	Air	Water	6,0	-	DK
TLV - Mesballe	2022	Utility (HP)	1xH300-AW-3+0	NA	Cold gas	Air	Water	0,3	-	DK

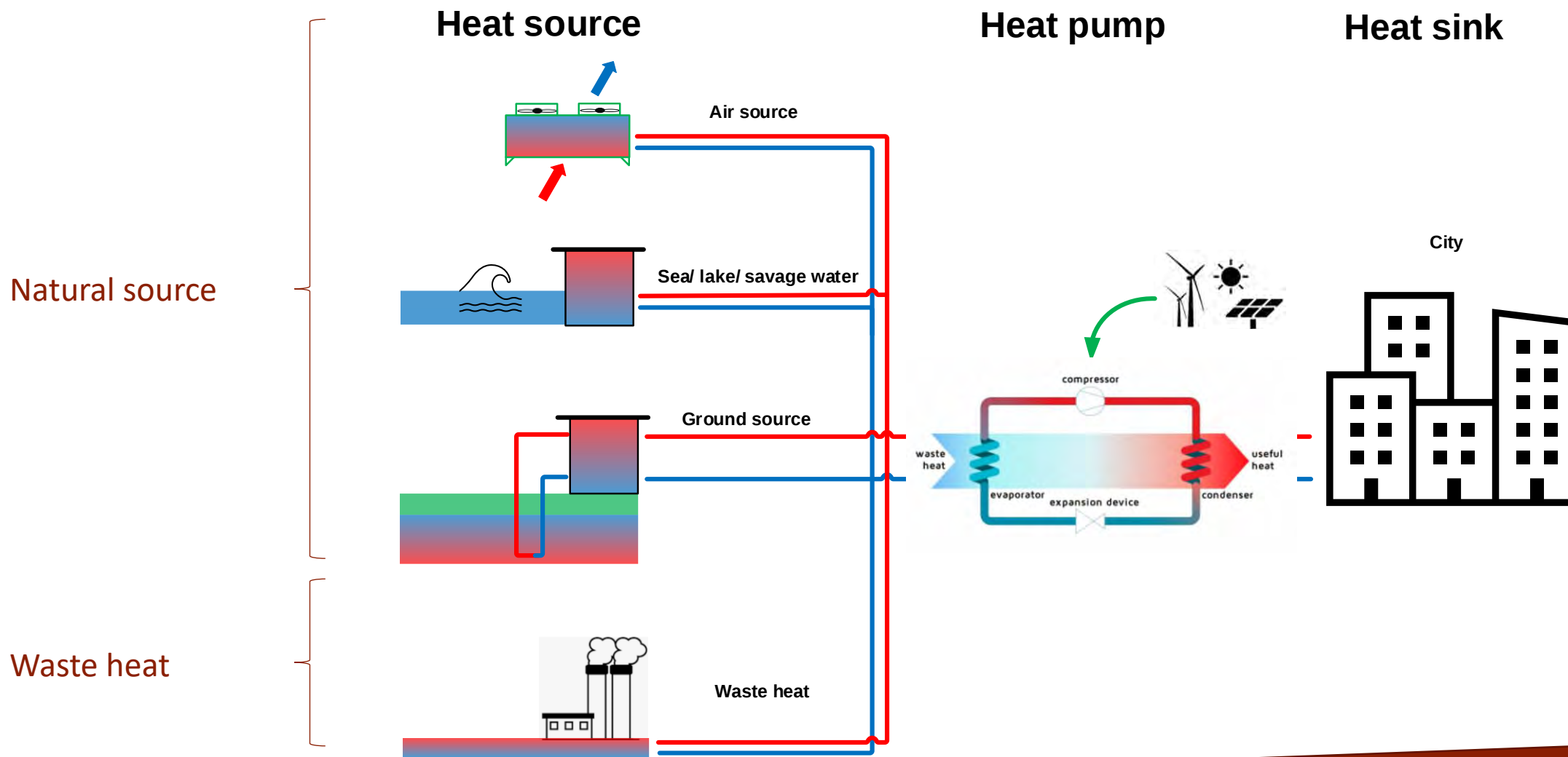
FENAGY Problems we solve

Challenge/ problem	Solution
No fossil fuels/ decarbonization	<u>Most sustainable solution</u> with electrical heat pump using green/ renewable electricity and using CO ₂ as refrigerant
Cheaper energy cost	<u>High efficiency</u> (SCOP > 3.2) of the heat pump delivers very low cost og heat (low TCO's) and saves money on heating
Easy conversion/ fast installation	<u>Factory prepared solution</u> for easy and fast installation with only little instructions from Fenagy
Safe and environmentally friendly	<u>Not flammable, non-toxic and natural</u> with CO ₂ as refrigerant. Fenagy have 50 years experience of CO ₂ refrigeration systems and heat pumps.
Robust and secure operation (98%RT)	<u>Perfect and robust design</u> with multiple compressors and no failure points makes the system failsafe
Service and help	<u>Full surveillance system 24/7</u> collect all alarms og data in the cloud. Fenagy service team will evaluation and supervise

FENAGY What is a heat pump?

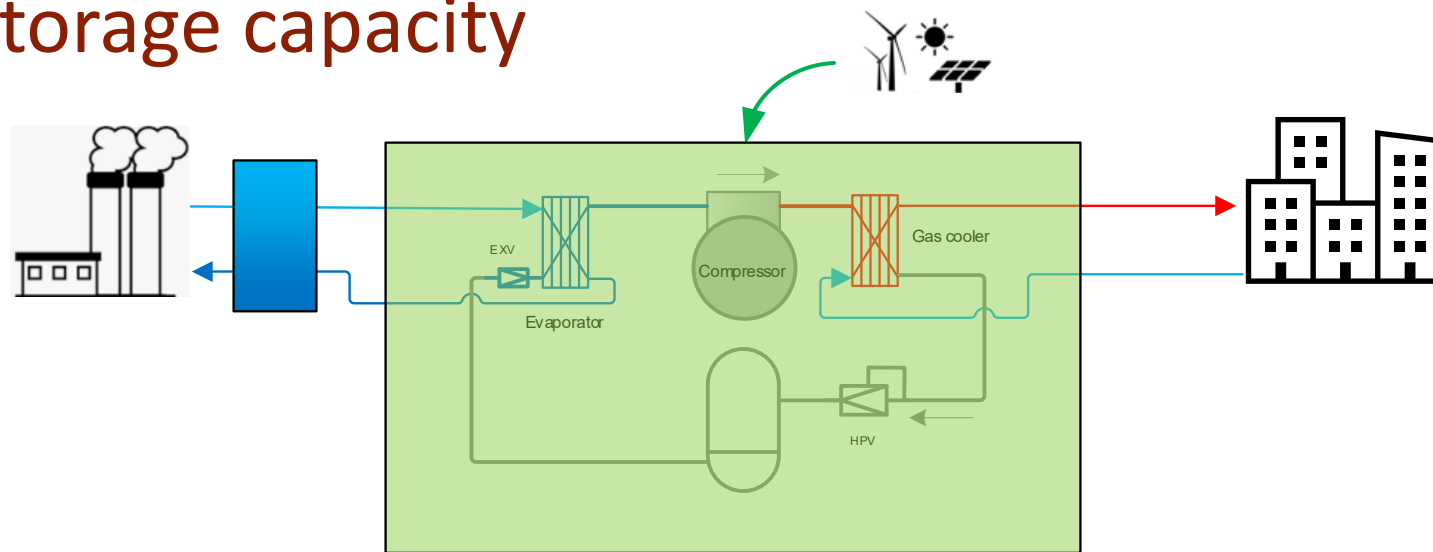


FENAGY What heat source can be used?

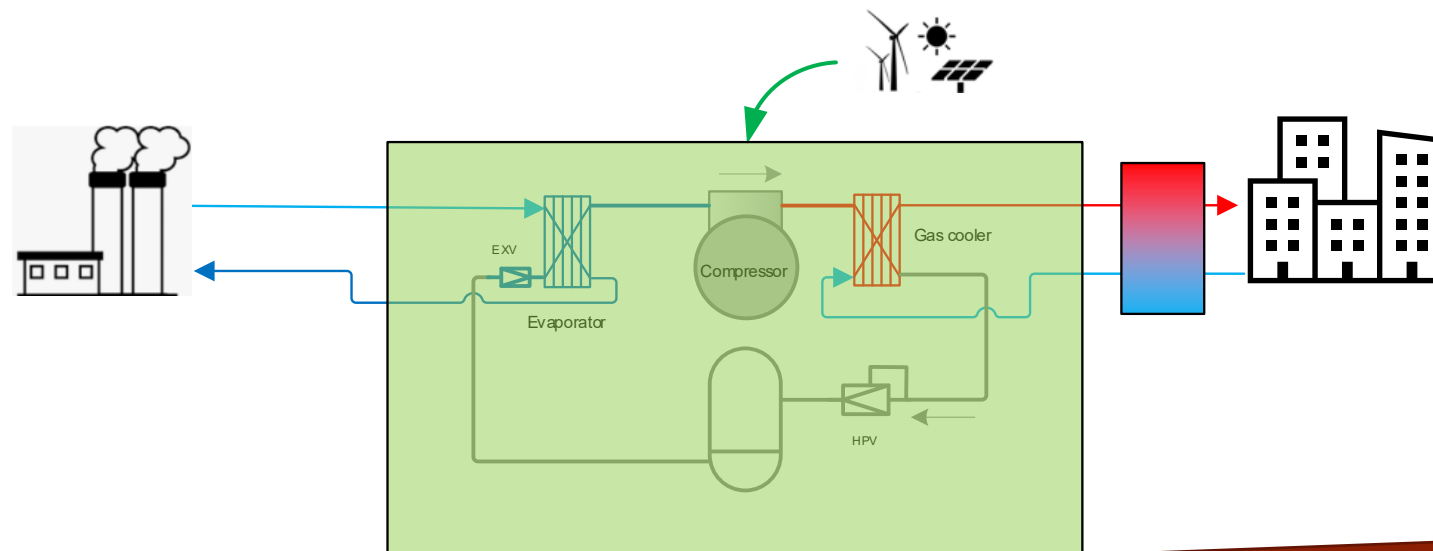


FENAGY Integration of storage capacity

Infinite sink

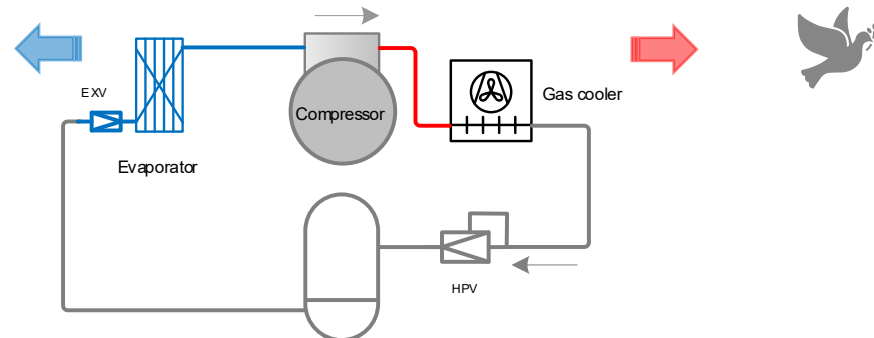


Infinite source

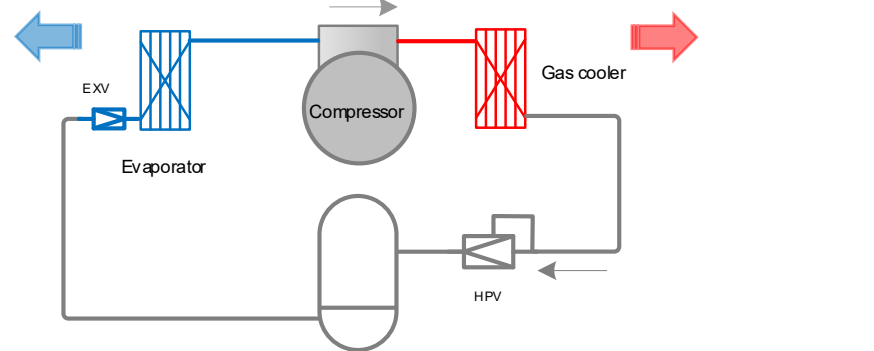


FENAGY System integration

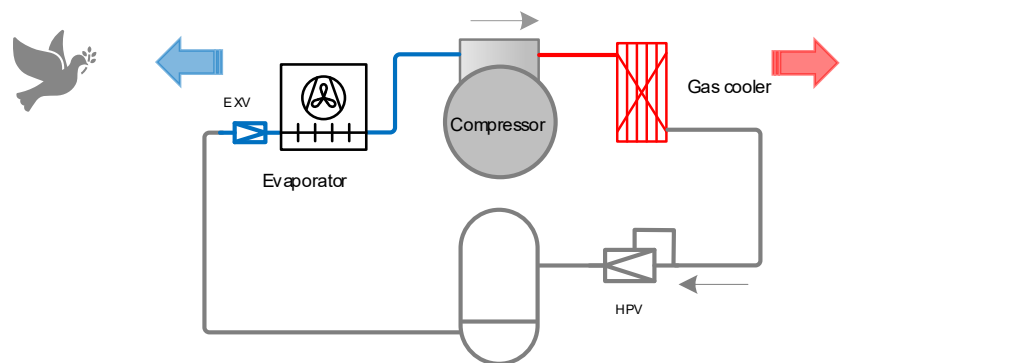
Air cooled chiller



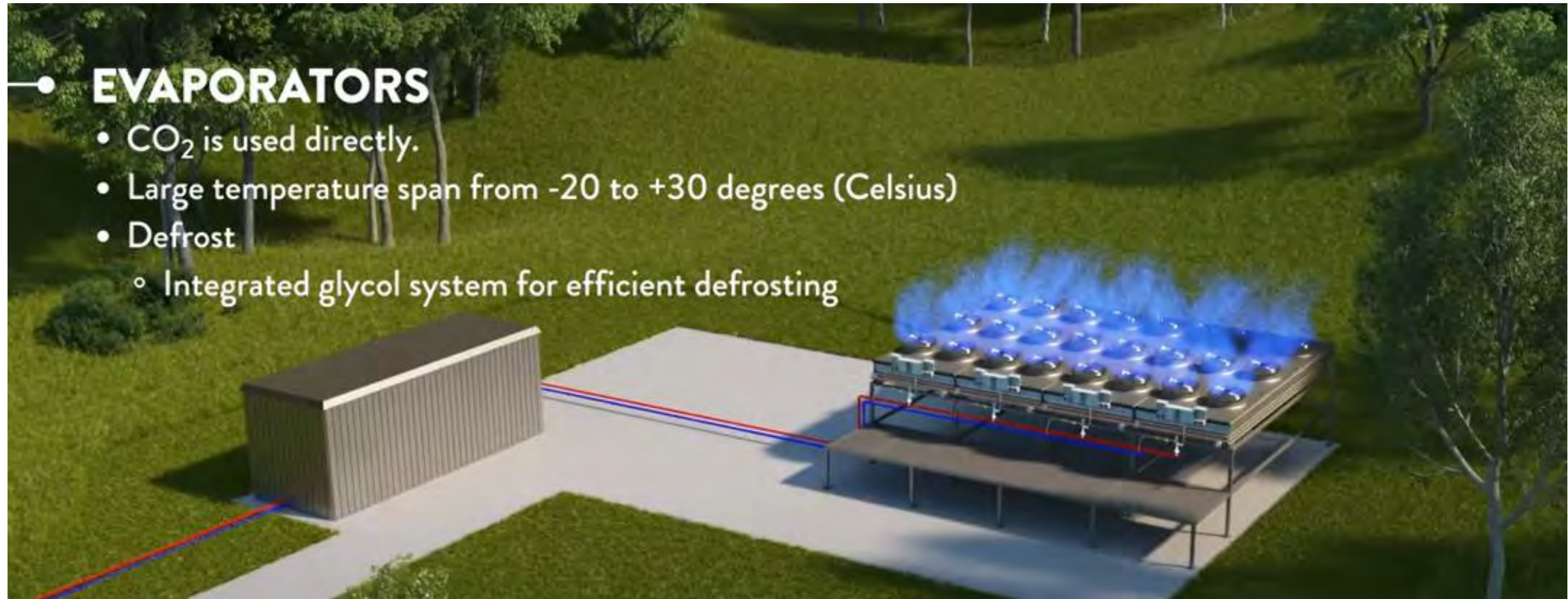
Integrated/ combined



Air to water heat pump



FENAGY Air to water heat pump



An aerial photograph of a suburban neighborhood with houses, green lawns, and trees. A semi-transparent white rectangular box is overlaid on the left side of the image, containing project details.

CASE: District heating for small danish city with 200 consumers

YEAR: 2022

MODEL: H1200-AW

APPLICATION: Air-to-Water Heat Pump

CAPACITY (HEAT): 1200 kW (5 °C Ambient, 32/75 °C Hot Water)



CASE: District heating for small danish city with 567 consumers

YEAR: 2021

MODEL: H1200-AW 3+3D

APPLICATION: Air-to-Water Heat Pump

CAPACITY (HEAT): 1200 kW (5 °C Ambient, 36/70 °C Hot Water)



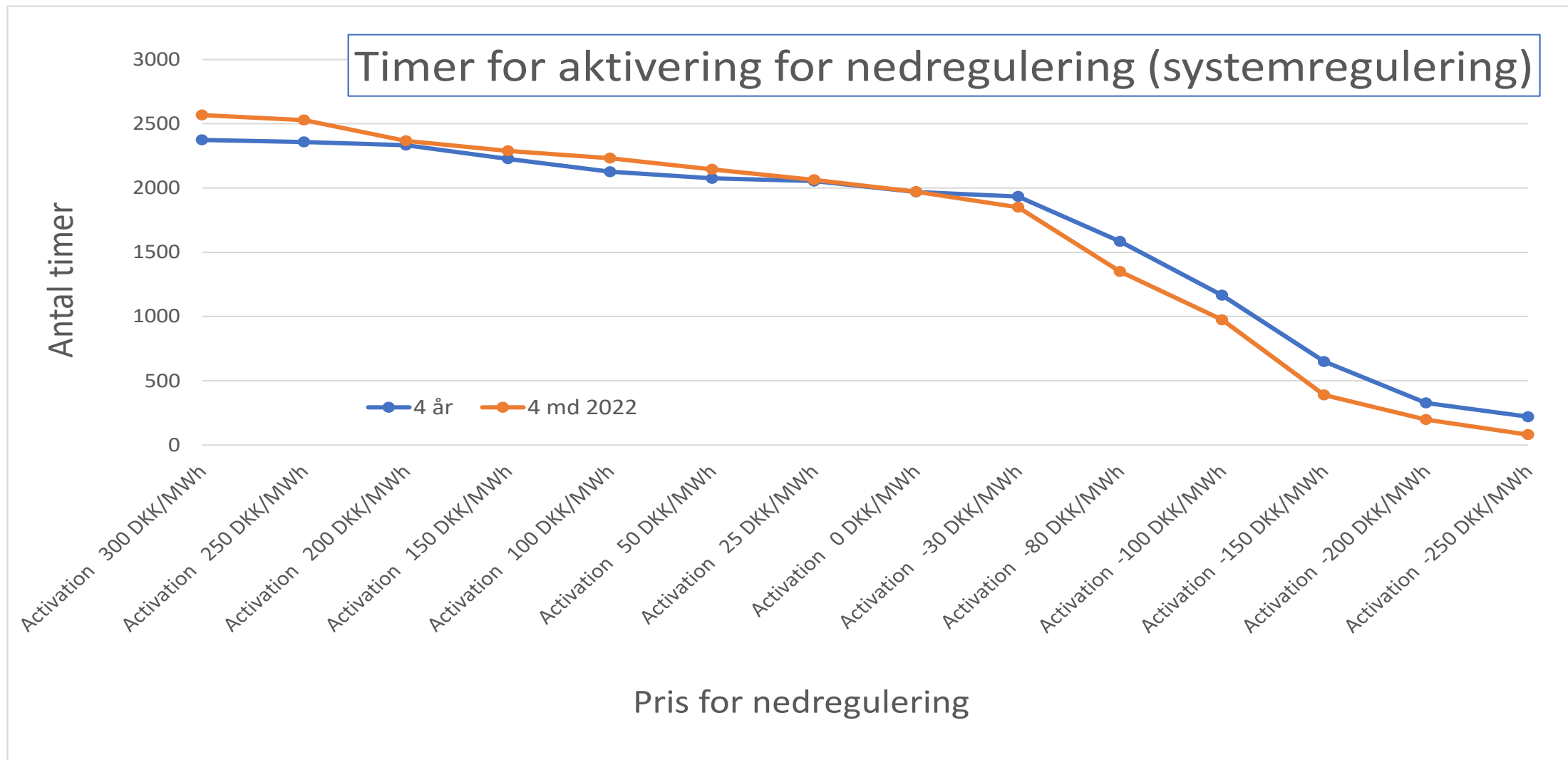


FENAGY Prices on electricity

- Volatility is high both on spot-market and system prices (balancing)
- But great possibilities in the market to operate the HP



FENAGY Forretningen omkring systemydelser



CASE: Urban district heating and cooling for large shopping center

YEAR: 2022

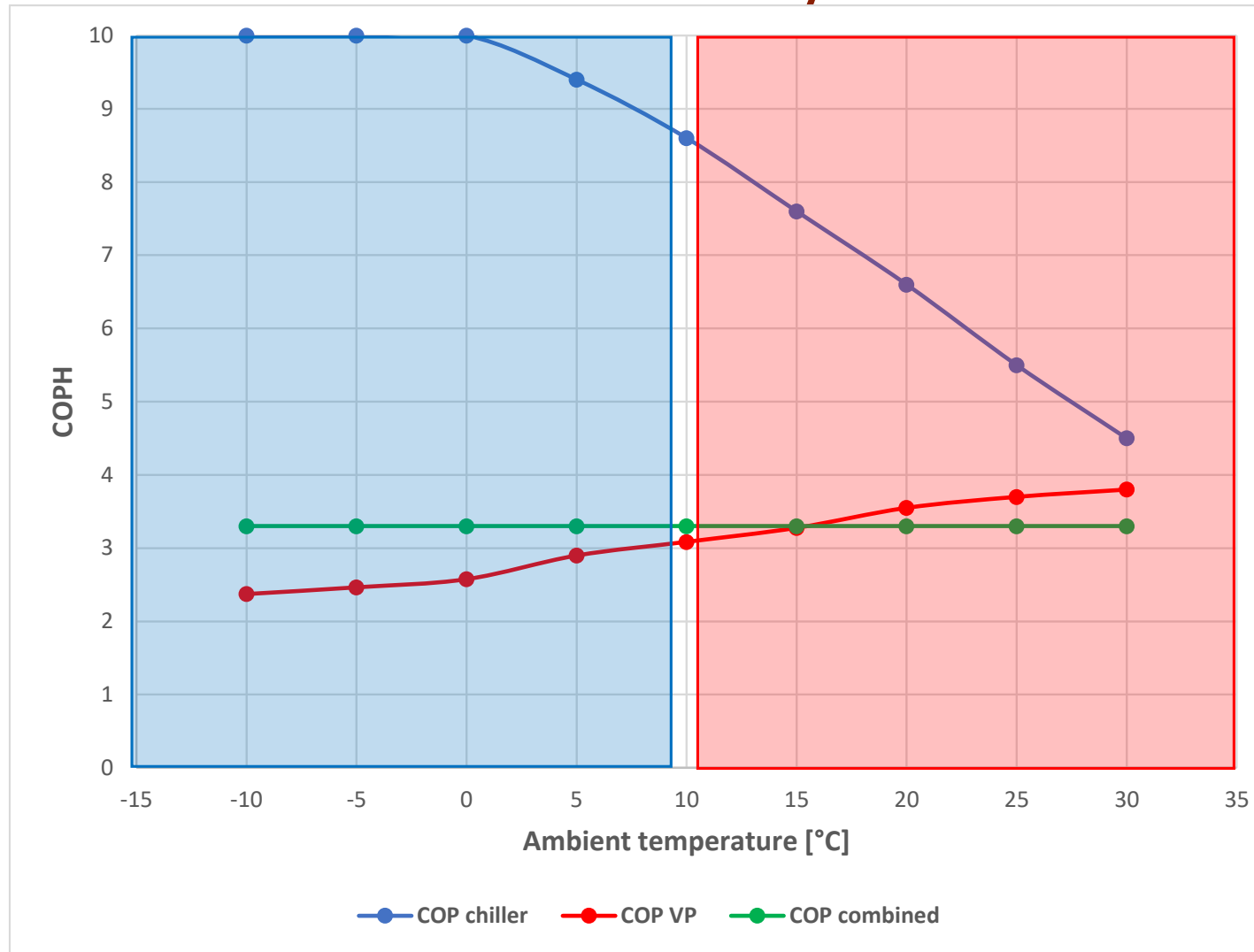
MODEL: H1200-AW/WW

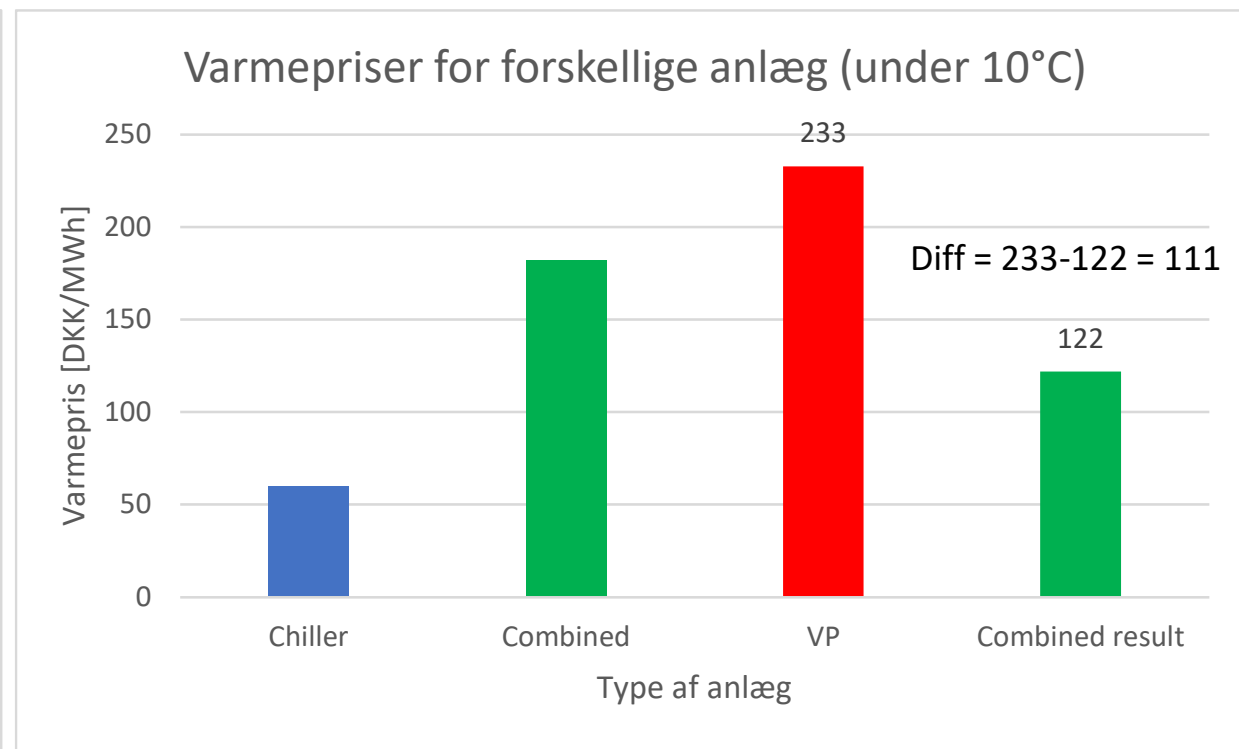
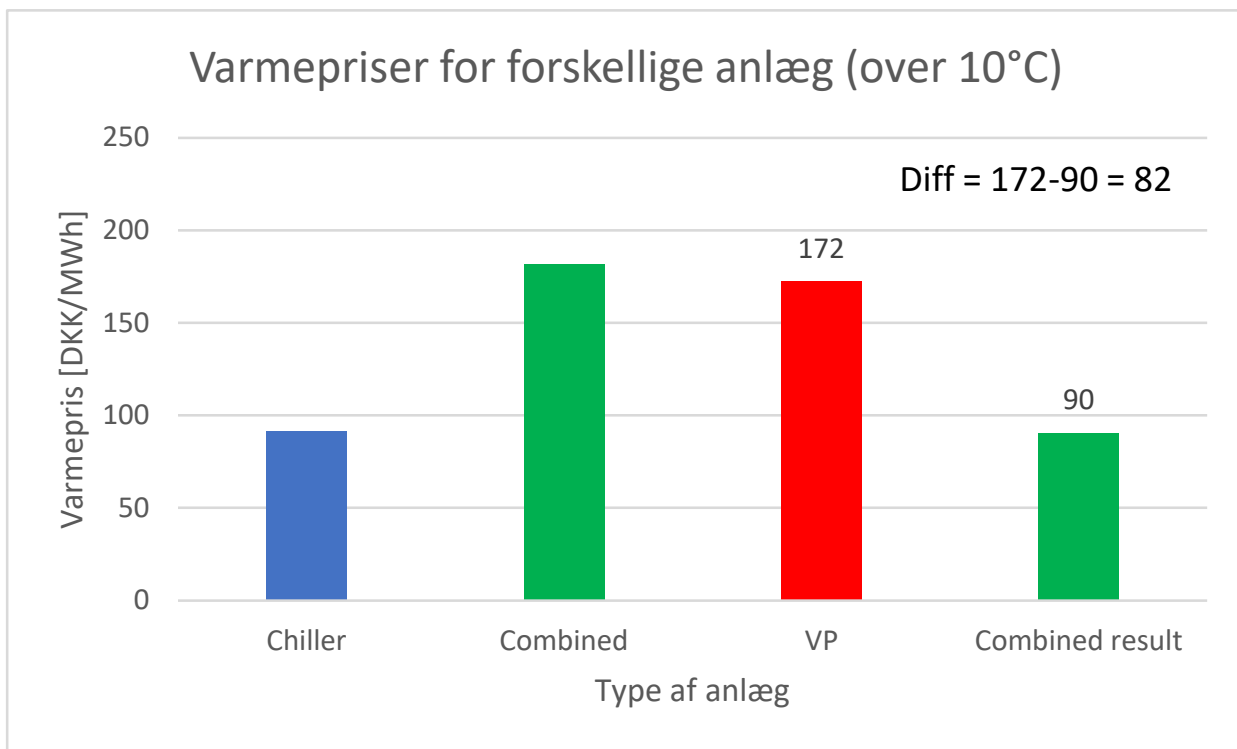
APPLICATION: Air-to-Water Heat Pump and Water-to-Water

CAPACITY (HEAT): 1200 kW (5 °C Ambient, 40/70 °C Hot Water)



COP values for different systems – varying ambient



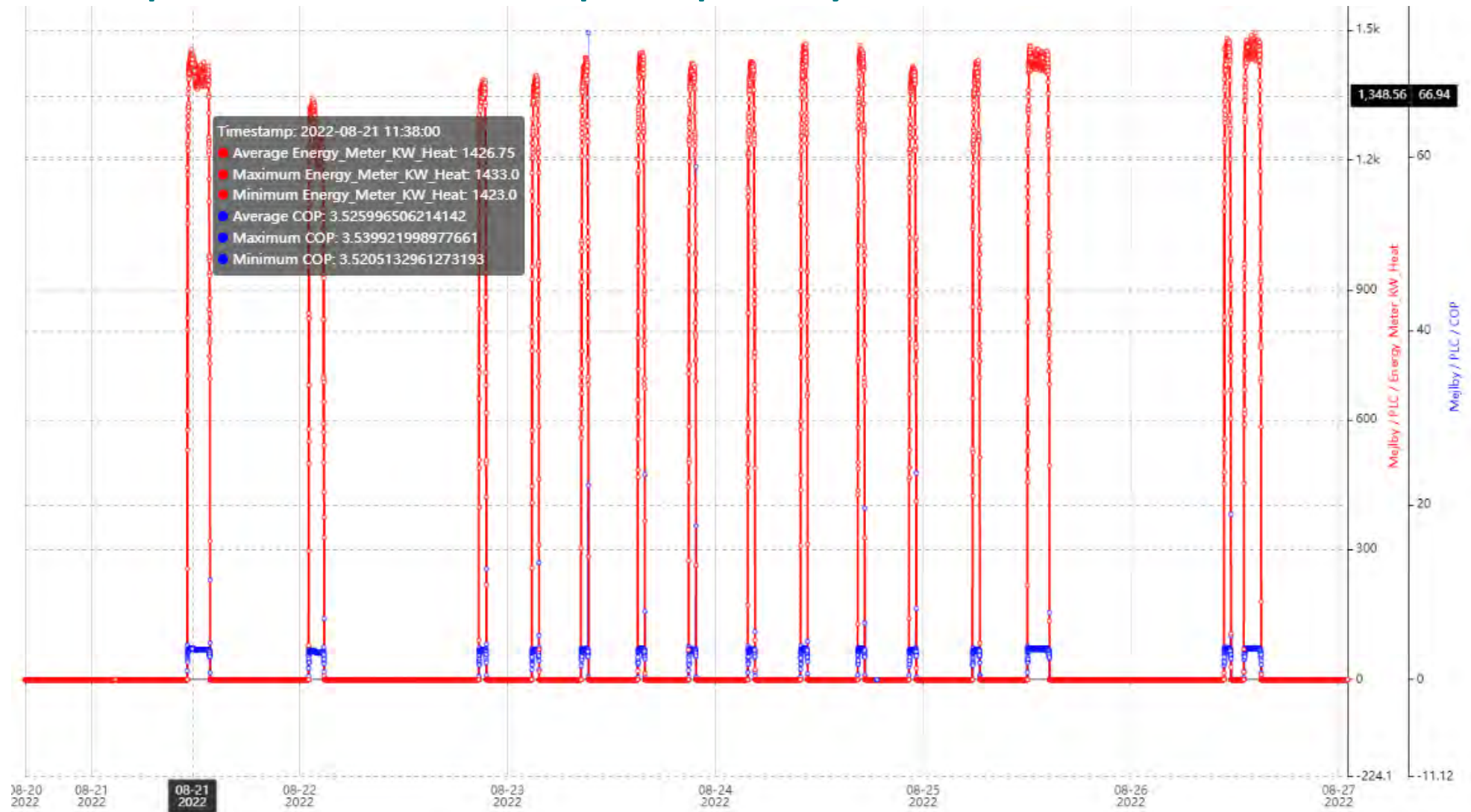


District heating: 40/70°C

Chiller: 12/7°C

Electricity: 600 DKK/MWh

FENAGY Operation of heat pumps - system balance



Products (H-serie and C-serie)

H300



H600



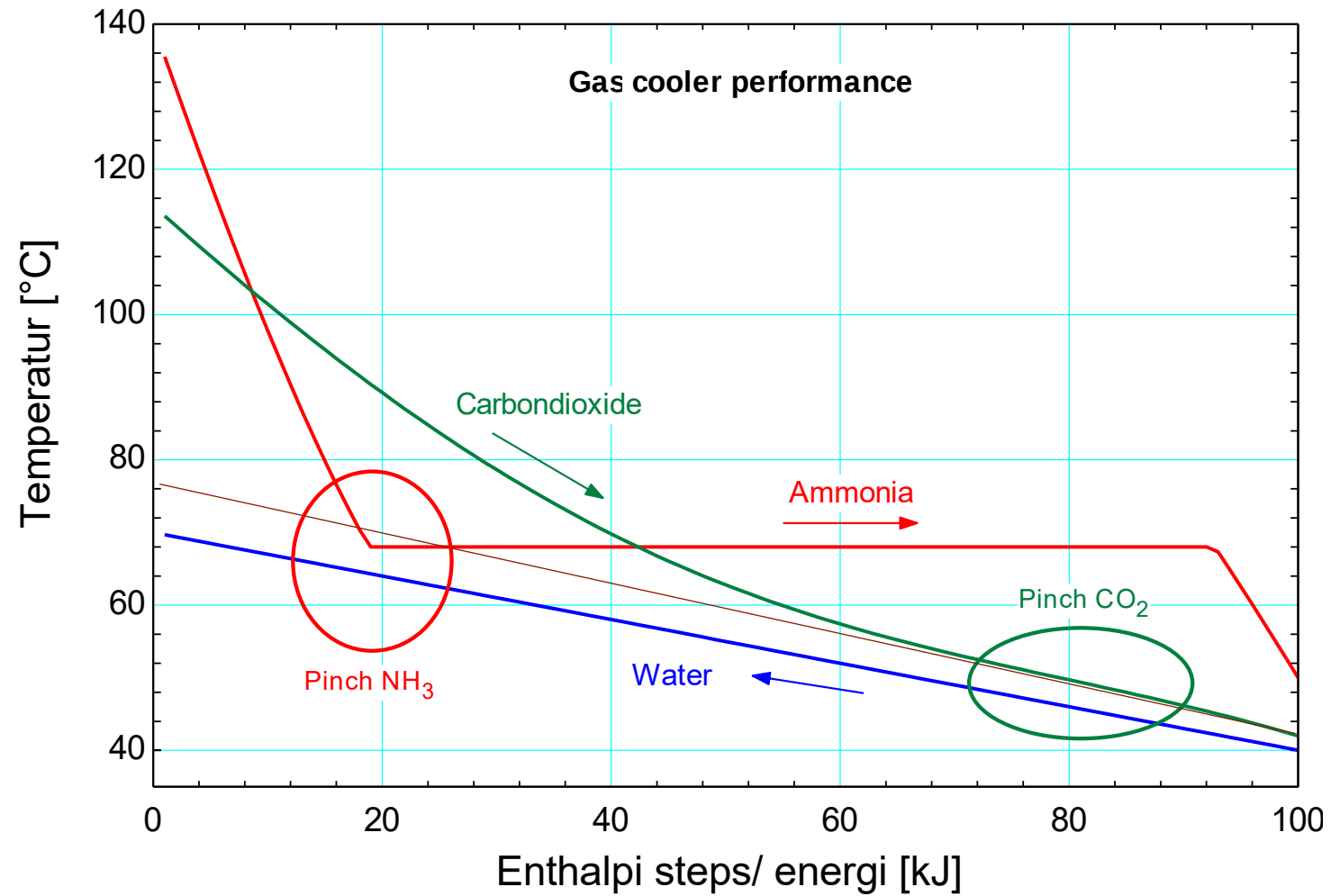
H1200



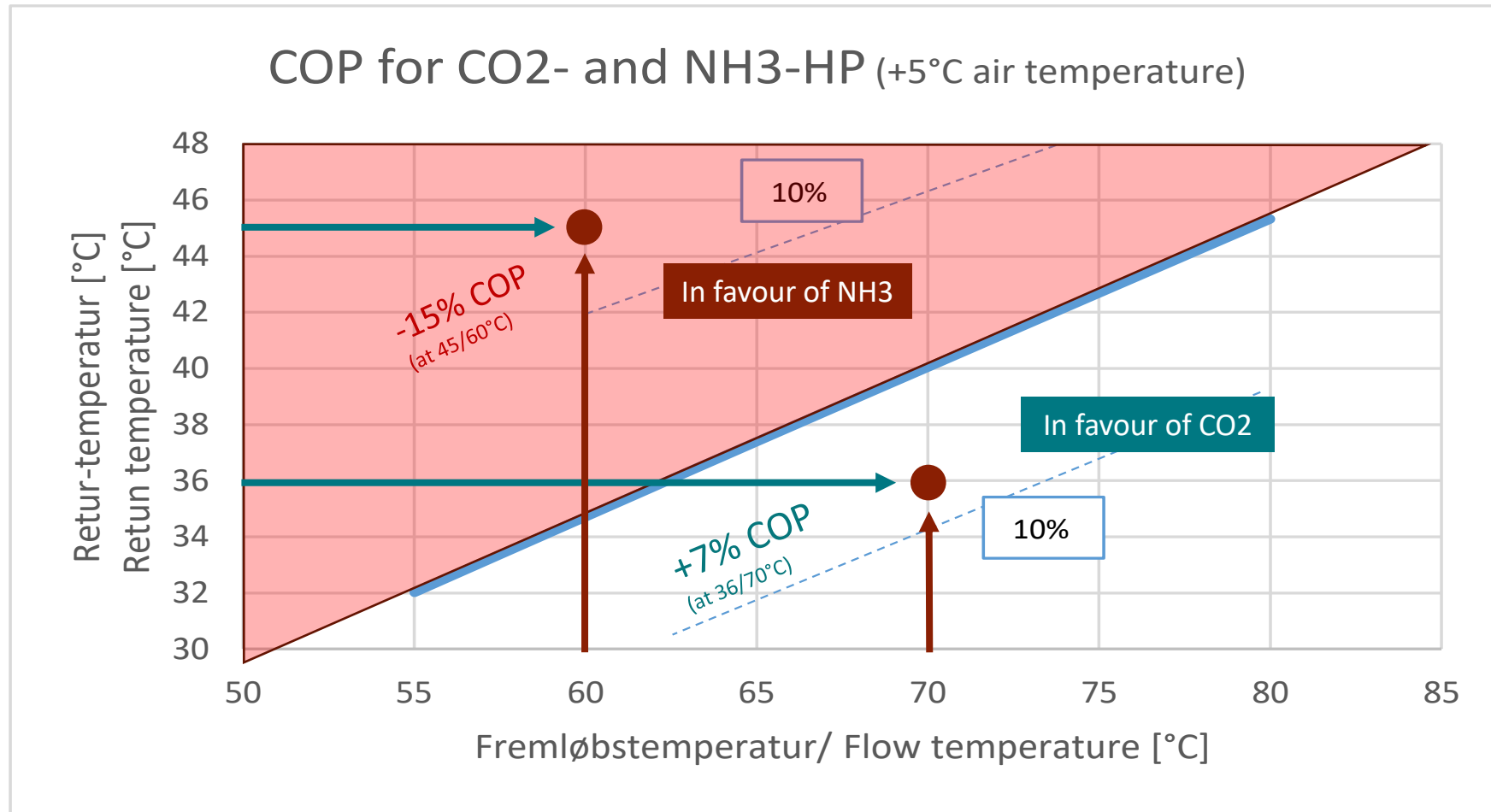
H1800



FENAGY HEAT REJECTION FROM A CO₂ HEAT PUMP



FENAGY COMPARISON BETWEEN CO₂ AND NH₃ HEAT PUMPS





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