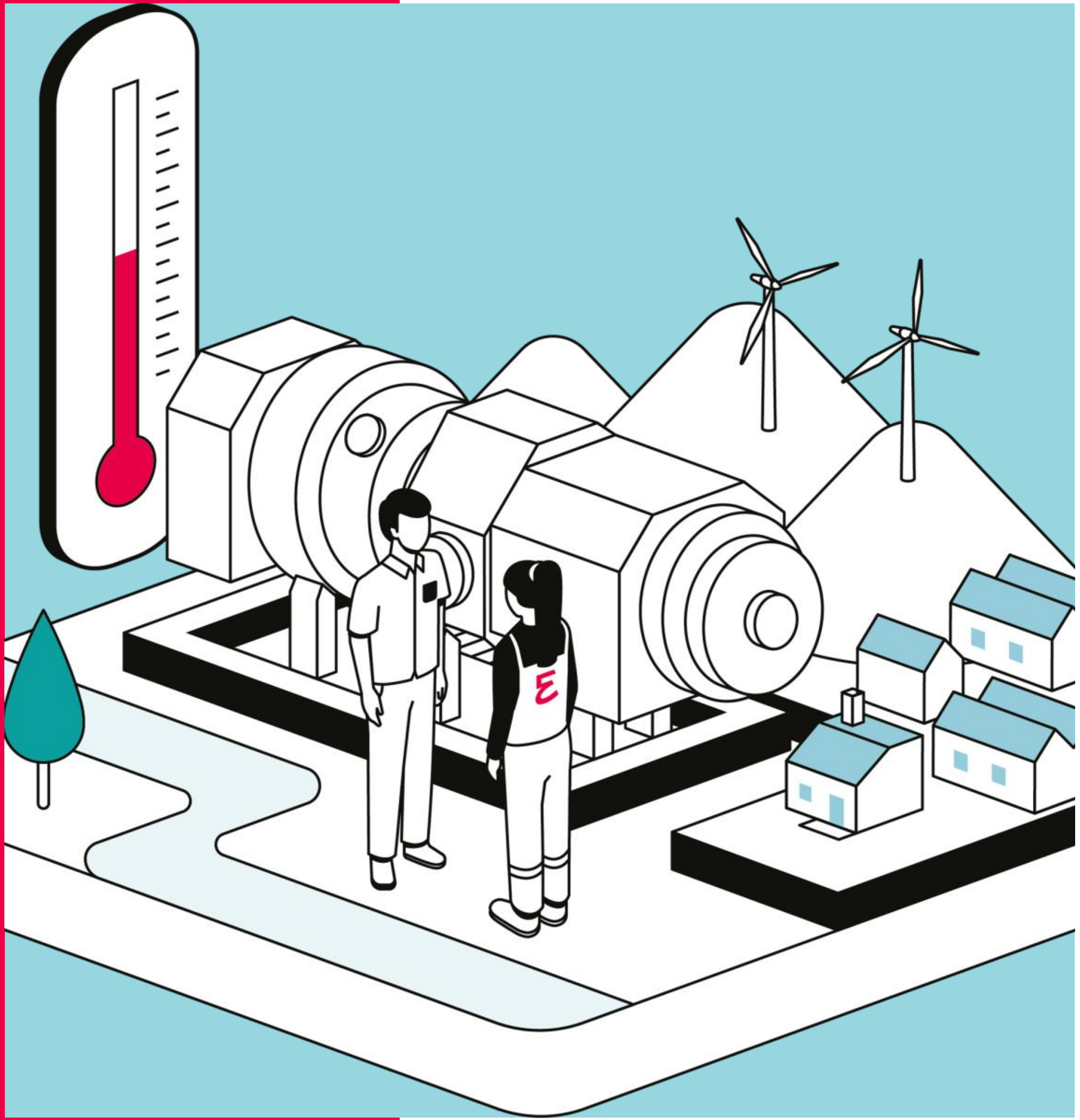
Everllence

Electrifying Industrial Heat Generation with High-Temperature Heat Pumps

IPER Workshop



Mobola Dosumu| Heat Pumps | February 10, 2026

Everllence in numbers

- **2025** MAN Energy Solutions becomes Everllence
- **2023** We sum up our strategy in our new purpose – 'Moving big things to zero'
- **2018** Our new strategy is launched, making decarbonization central to our business success

15,000 employees

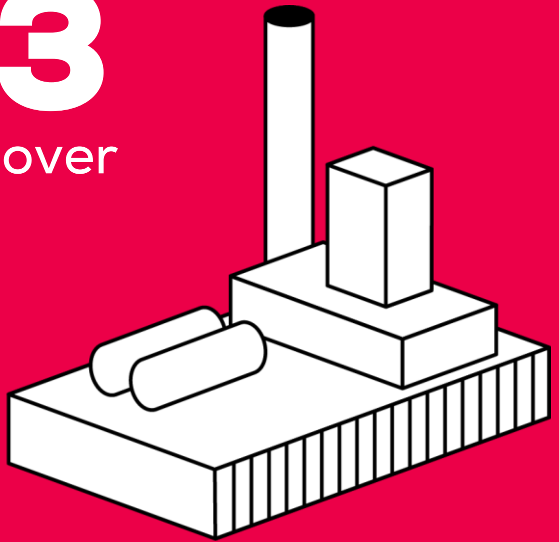
present in **50** countries

140 sites

260+ years of experience

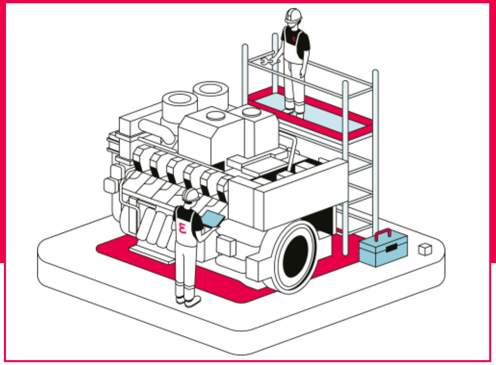
€4.3 bn turnover

50% reduction in CO_2 emissions in our production sites by 2030



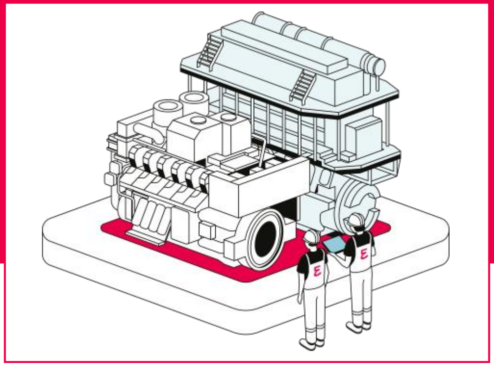
Our key technologies

for “Moving big things to zero“



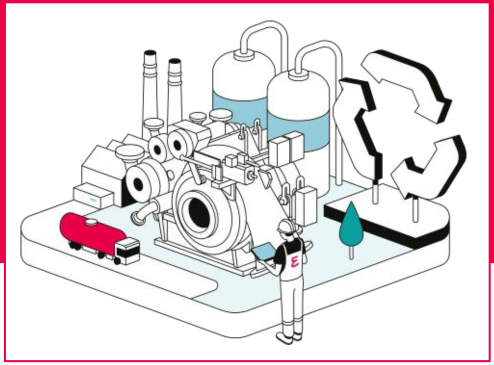
Retrofits

Ocean-going vessels and power plants are long-term investments. Through our retrofit programs, we convert engines to make them future-proof – so they can run on low-emission fuels.



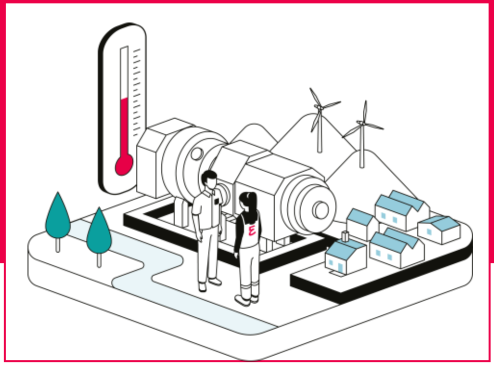
Future fuel engines

Our engines can run on a variety of climate-neutral fuels, including synthetic natural gas, methanol and ammonia.



Carbon Capture, Utilization & Storage

We offers technologies for processing CO_2 from industrial processes safely. Once it has been captured, CO_2 can be stored or reused, creating a circular carbon economy.



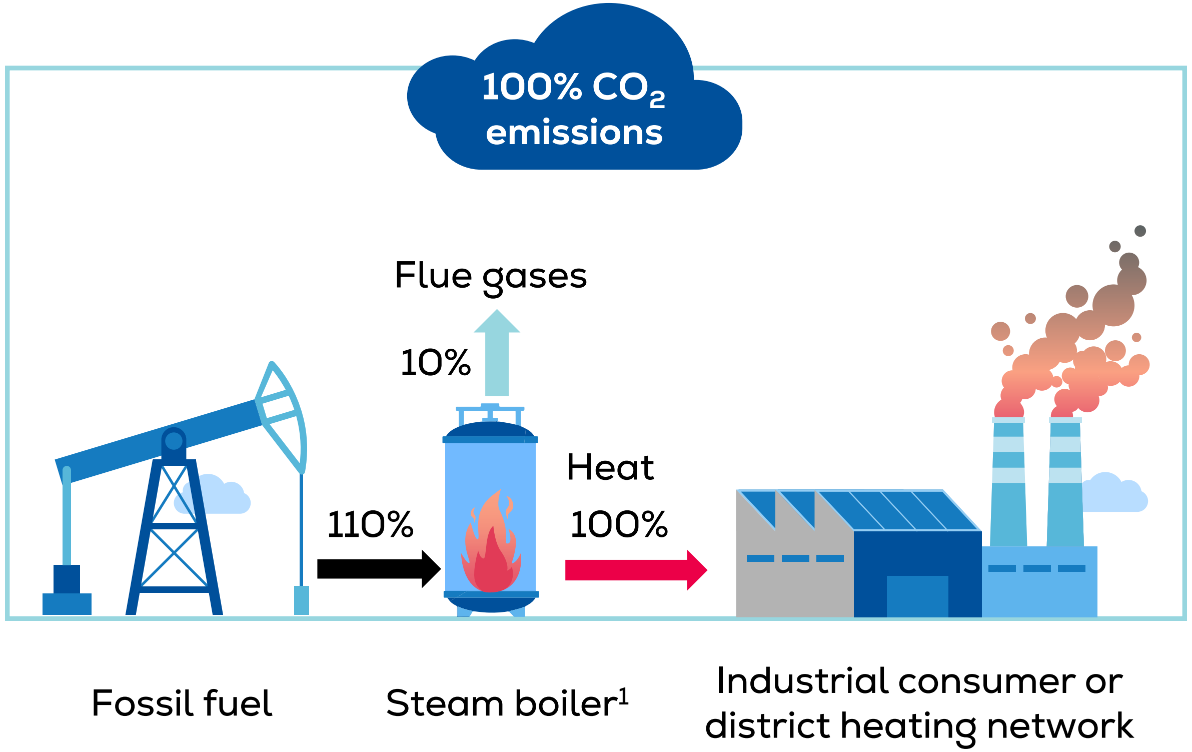
Large-scale heat pumps

Our large-scale heat pumps use heat sources such as rivers, oceans, industrial waste heat or ambient air to decarbonize industry and households.

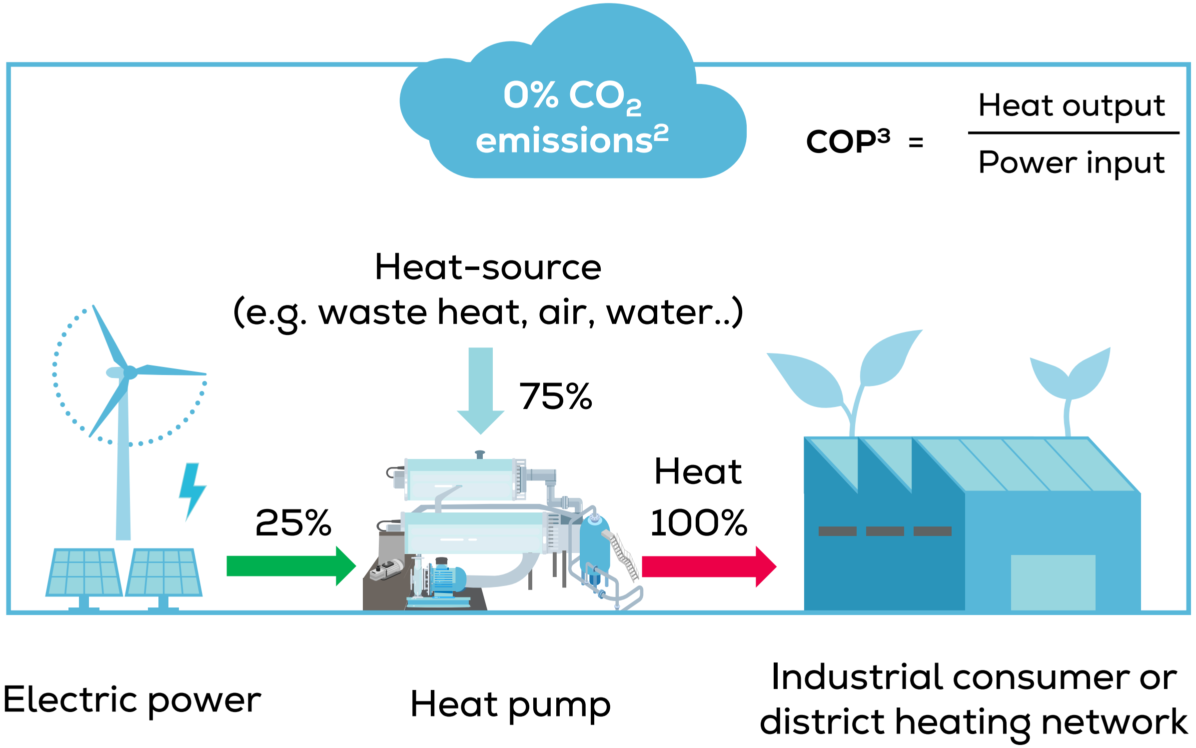
Heat Pumps – solution for zero emissions heat

Eco-friendly heat generation

Fossil fuel driven heat generation



Heat pump driven heat generation

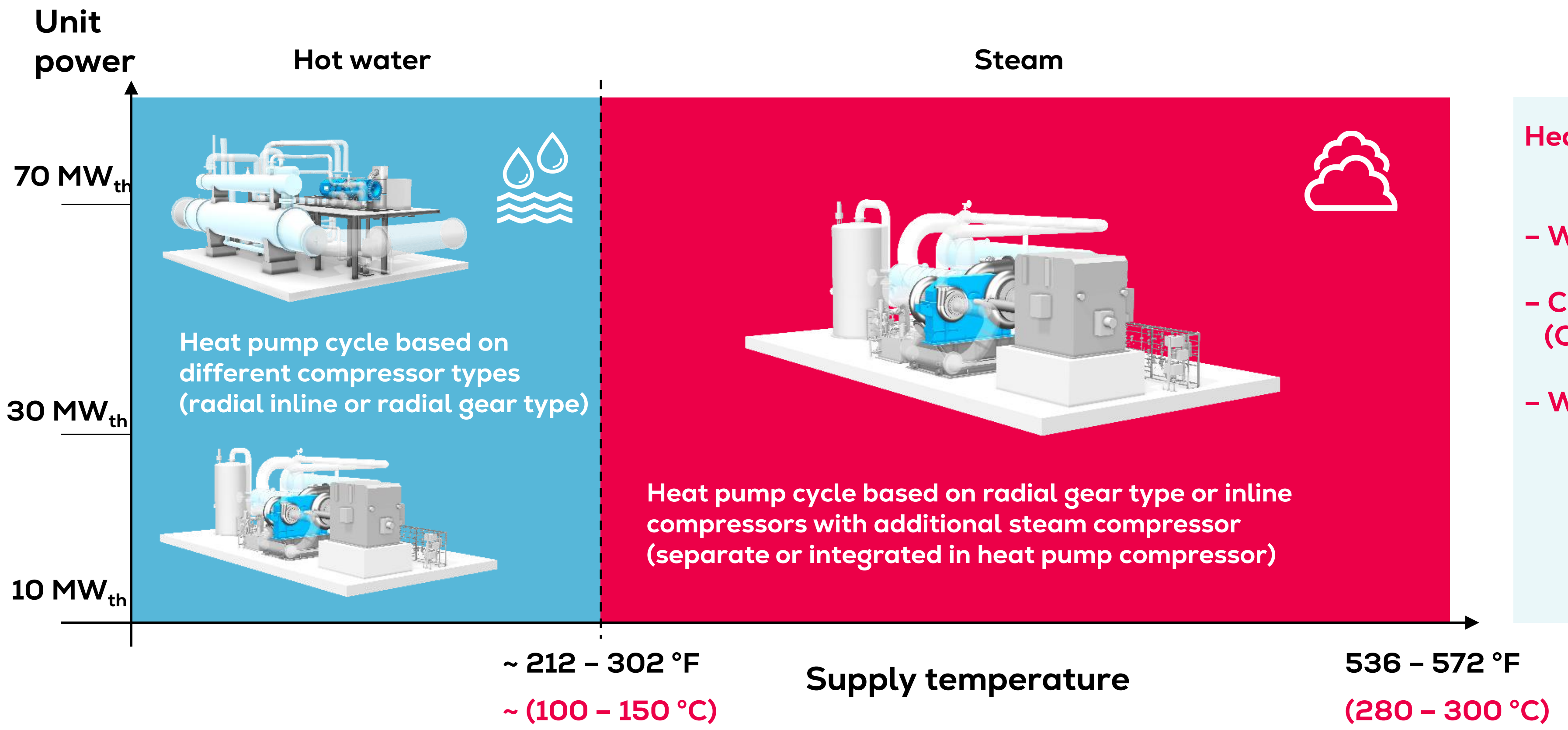


1.Efficiency of about 90%
2.Using renewable electricity, ~30% CO2 emissions based on current electricity mix
3. COP – Coefficient of Performance

Hot water and steam production >10 MWth

Powering heat pump solutions for various power and temperature ranges

Technology distribution according to existing compressor portfolio



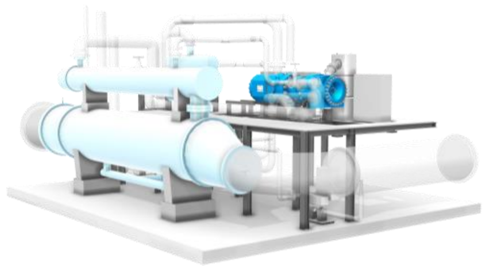
Heat pump cycle design based on different:

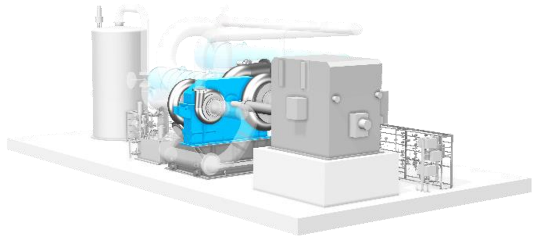
- Well proven compressors
- Conventional refrigerants (CO_2, hydrocarbons, synthetic)
- Working principles (VCC[1] or TCC[2])

*1 VCC: Vapour compression cycle; *2 TCC: Transcritical cycle

Three thermodynamic cycles – TCC, VCC, SC

Key customer use cases	Thermodynamic cycle	Properties
Hot water production	Transcritical cycle (TCC)	– Well suited for heating water at temperatures up to ~302°F (~150°C) – TCC may provide better performance than VCC for low return temp: <95 °F (35°C) or lower – Usually, CO_2 is used as natural refrigerant (non-flammable, non-toxic, cheap)
Hot water production; Steam production	Vapour compression cycle (VCC)	– High efficiency for phase change, i.e., steam production – High efficiency for heating water – Different refrigerants feasible: Ammonia, Hydrocarbon (e.g., Butane) and synthetic refrigerants (e.g., R1234ze)
Steam production	Steam compression (SC)	– Most competitive option to increase steam temperature





VCC: Vapour compression cycle; TCC: Transcritical cycle; SC Steam Compression cycle

Overview of potential refrigerants

There is no “perfect” refrigerant, a balanced portfolio should cover several ones.

	Sustainability		Safety[3]		Technology		
	GWP[2]	Flourine	Toxicity	Flammability	Max. temp.	Steam prod.	Key advantage
CO_2 (R744)	1	no	A	1	~150 °C (302 °F)	no[1]	Non-toxic, non-flammable, non fluorinated refrigerant
Ammonia (R717)	0	no	B	2L	~120 °C (248 °F)	yes	High performing natural refrigerant
Synth. Refrigerants (e.g., R1234ze)	‹1	yes	A	2L	~135 °C (275 °F)	yes	Safe refrigerant
Hydrocarbons (e.g., Butane)	‹5	no	A	3	~135 °C (275 °F)	yes	Non-toxic natural refrigerant (no fluorine)

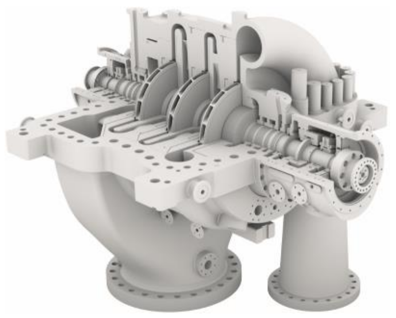
Good | Medium | Unfavorable

1. Only possible with low performance 2. Global warming potential 3. According to ASHRAE standards

Heat Pump Compressors

1495 Centrifugal compressors (RH) since 1970

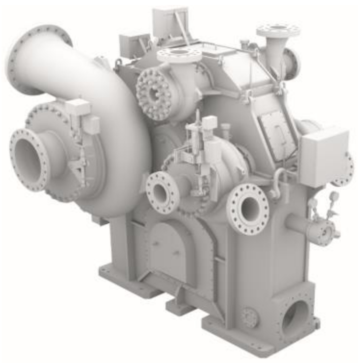
- 135 with hydrocarbons
- 124 with ammonia
- 23 with CO_2
- 3 with steam



Discharge pressure:	**14.5 - 1755 psi (1.0 -121 bara)**
– For ammonia:	up to 305 psi (21 bara)
– For hydrocarbons:	up to 638 psi (44 bara)
Drive power:	up to 50 MW per casing
– For ammonia:	8 MW
– For hydrocarbons:	9 MW

1364 Integrally geared compressors (RG) since 1970

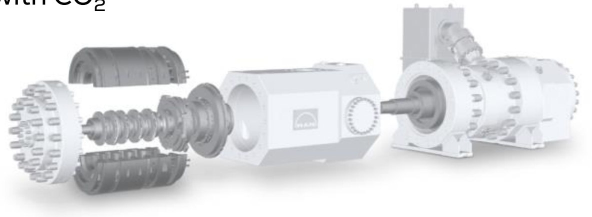
- 151 with hydrocarbons
- 126 with steam
- 36 with CO_2
- 4 with ammonia



Discharge pressure:	**5.4 – 3191 psi (0.37 – 220 bara)**
– For ammonia:	up to 75.4 psi (5.2 bara)
– For steam:	up to 203 psi (14 bara)
Drive power:	up to 63 MW per casing
– For ammonia:	2 MW
– For steam:	11.5 MW

142 Highspeed motor compressors since 1990

- 70 Highspeed oil-free integrated motor compressors (HOFIM®)
- 72 integrated motor-driven pipeline compressors (MOPICO®)
- 137 with hydrocarbons
- 5 with CO_2



Discharge pressure:

- For CO_2: up to 3263 psi (225 bara)

Drive power:

- up to 16 MW per casing

Status: 12/2023 counted from 1970 and 1990

Industrial Use Cases

We deliver solutions for various industrial segments

District Heating

Chemical & Petro-Chemical industries

Food & Beverage

Industrial Waste Heat Recovery

Pulp & Paper

Carbon Capture & Storage

District Heating – City of Esbjerg, Denmark

CO_2-based Large-scale Heat Pump

Key Facts:

End customer: DIN Forsyning (Denmark)

Scope of delivery: 2 heat pump units with HOFIM® compressors with CO_2 refrigerant

Heat source: seawater at 1 – 20 °C | 34 – 59°F

Heat sink: 60 – 90 °C | 140 – 194°F

COP: ~ 3 – 3.7

Heat output	Heat for	CO_2 savings
Up to 65 MW	25‘000 households	120‘000t p.a.

Transfer energy from the seawater to the district heating using renewable energy from the grid

Esbjerg 1st Heat – December 2024

District Heating – Vicinity Energy, Boston
Transformation to eSteam™

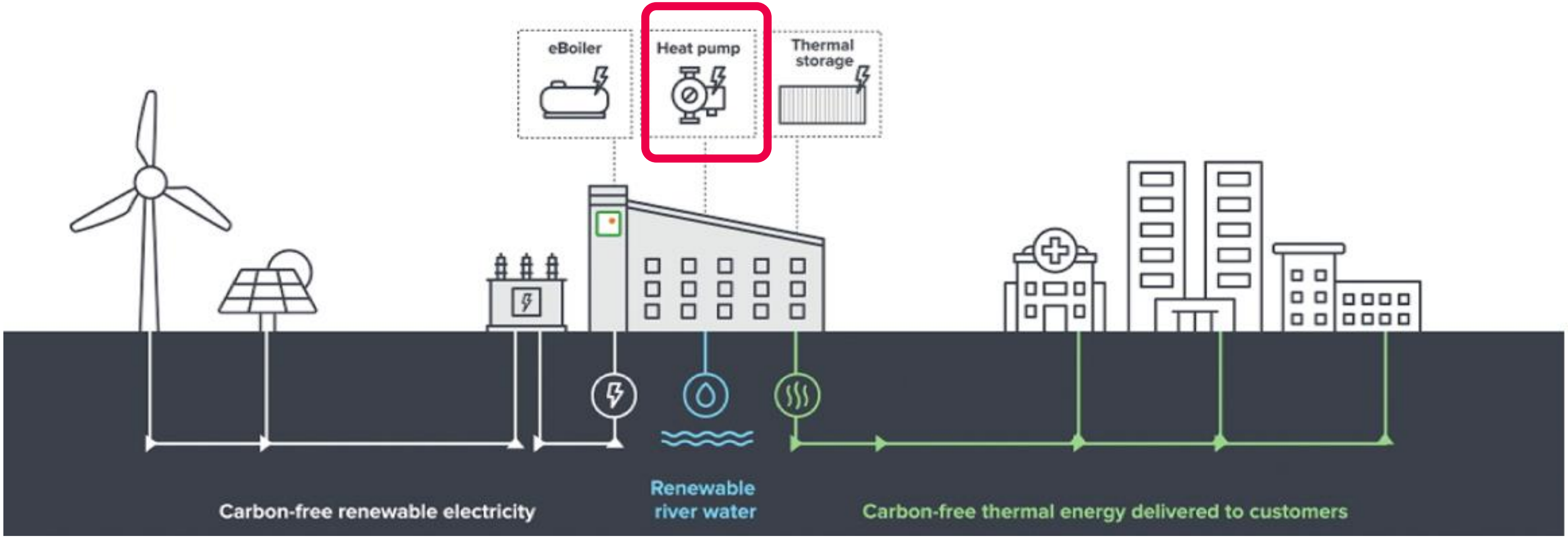


Image courtesy of Vicinity Energy

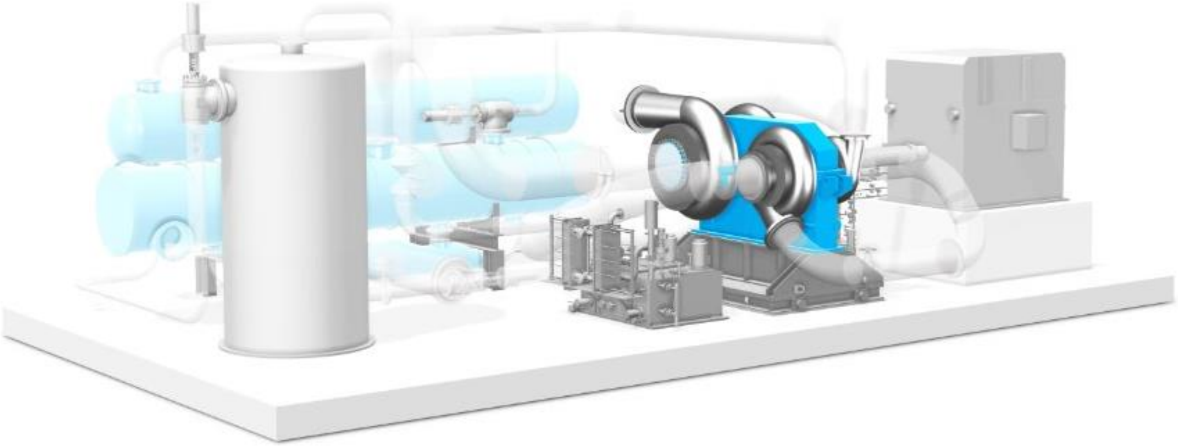
Kendall Station Heat Pump

Project targets:
- Produce baseload carbon-free eSteam™
- Supplement electric boiler installed in Phase 1

Heat pump size:
- Heating capacity: 35 MW_{th}
- Steam production: > 100,000 lbs./hr. @ P > 200 psig

Location:
- Kendall Station in Cambridge, Massachusetts

System boundaries:
- Natural Refrigerant; sustainable & future-proof
- Multi-stage compressor for compact design & optimized footprint
- Electrical Drivers
- Baseload operation



Conceptual drawing only. Not representative of Kendall Station.

Location of Heat Pump

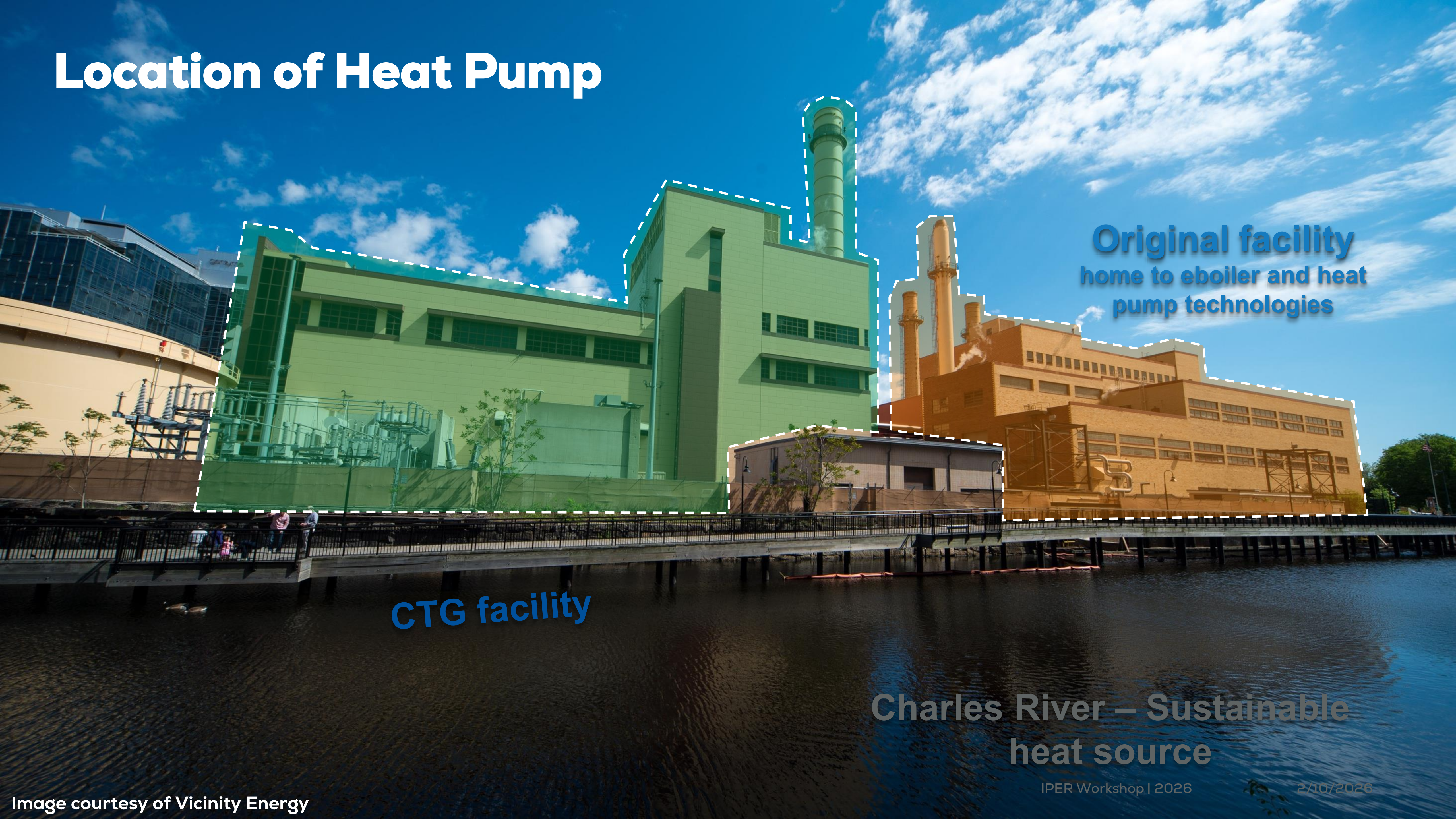


Image courtesy of Vicinity Energy

Kendall Station HP Parameters & Performance

Thermal Duty (MW_{th})	› 35
COP_{total}	› 2
Heat Sink	
Supply Temperature (°F)	› 380
Supply Pressure (psig)	200
Steam Mass Flow (lbs./hr.)	› 100,000
Heat Source – River Water	
Source Inlet Temperature (°F)	38 - 85
Source Flow (gpm)	› 17,000
Electric Motor Rating for Heat Pump (hp)	16,000
Commercial Operation Date	Scheduled for early 2028

Thank You!

Mobola Dosumu

National Sales Manager – Heat Pumps

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Disclaimer

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This data serves informational purposes only and is especially not guaranteed in any way. Depending on the subsequent specific individual projects, the relevant data may be subject to changes and will be assessed and determined individually for each project.

This will depend on the particular characteristics of each individual project, especially specific site and operational conditions.