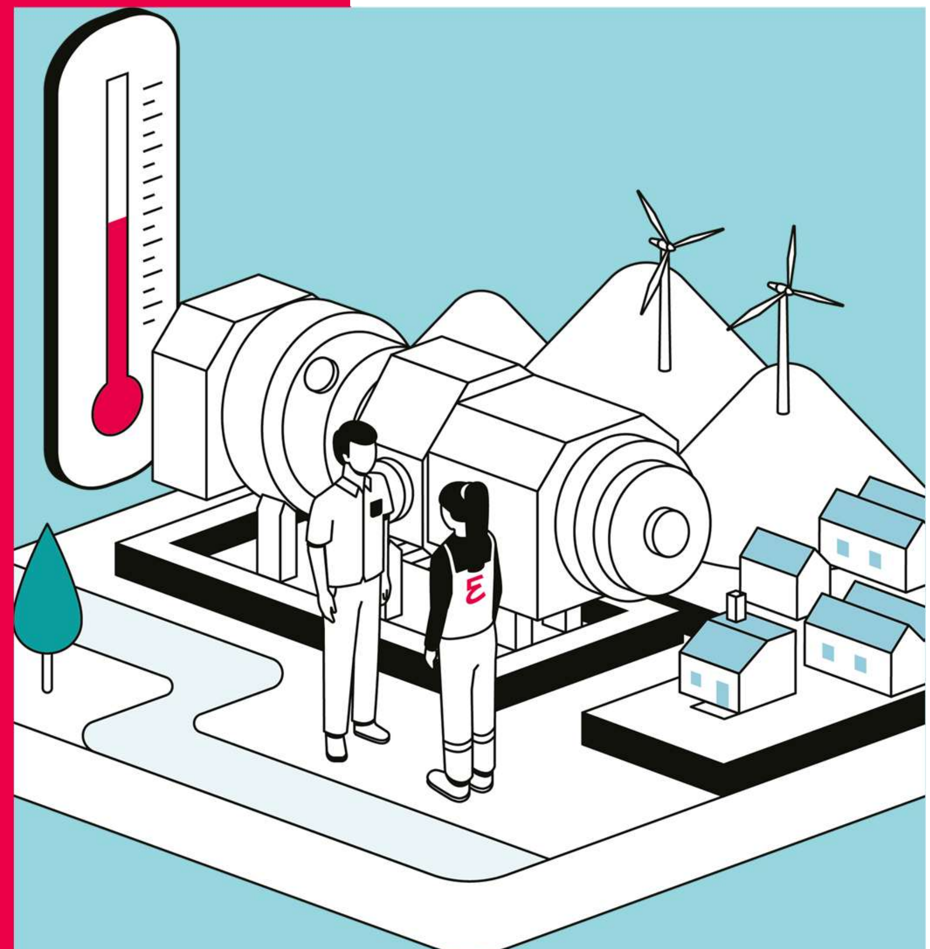
Everllence

High-Temperature Industrial Heat Pumps

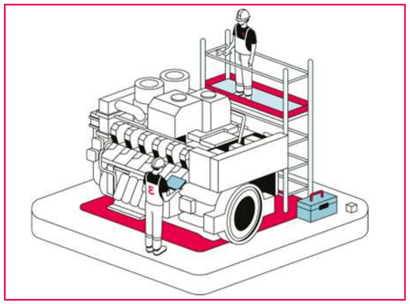
A Practical On-Ramp to Thermal Energy Storage



Mobola Dosumu | TMCES 2026 | July 30, 2026

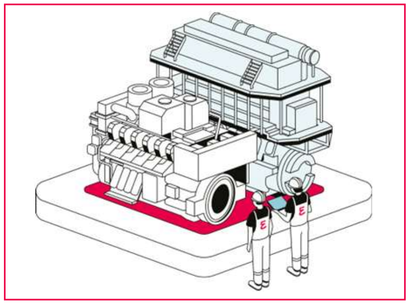
Everllence

- OEM of large-bore ship & power plant engines and turbomachinery
- Global HQ in Augsburg, Germany; Americas HQ in Houston, TX
- ~ 15.000 employees at more than 140 locations worldwide
- 50% of world trade is powered by our engines



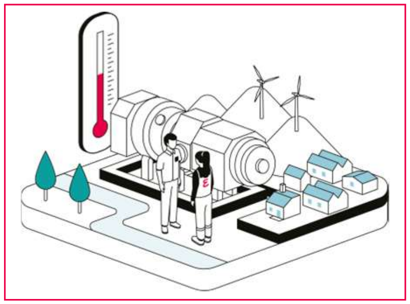
RETROFITS

LOW CARBON EMISSION UPGRADES



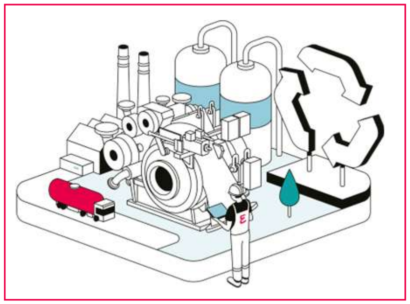
FUTURE FUEL ENGINES

NH_3, SYN-GAS, METHANOL



LARGE-SCALE HEAT PUMPS

DECARBONIZATION OF HEAT

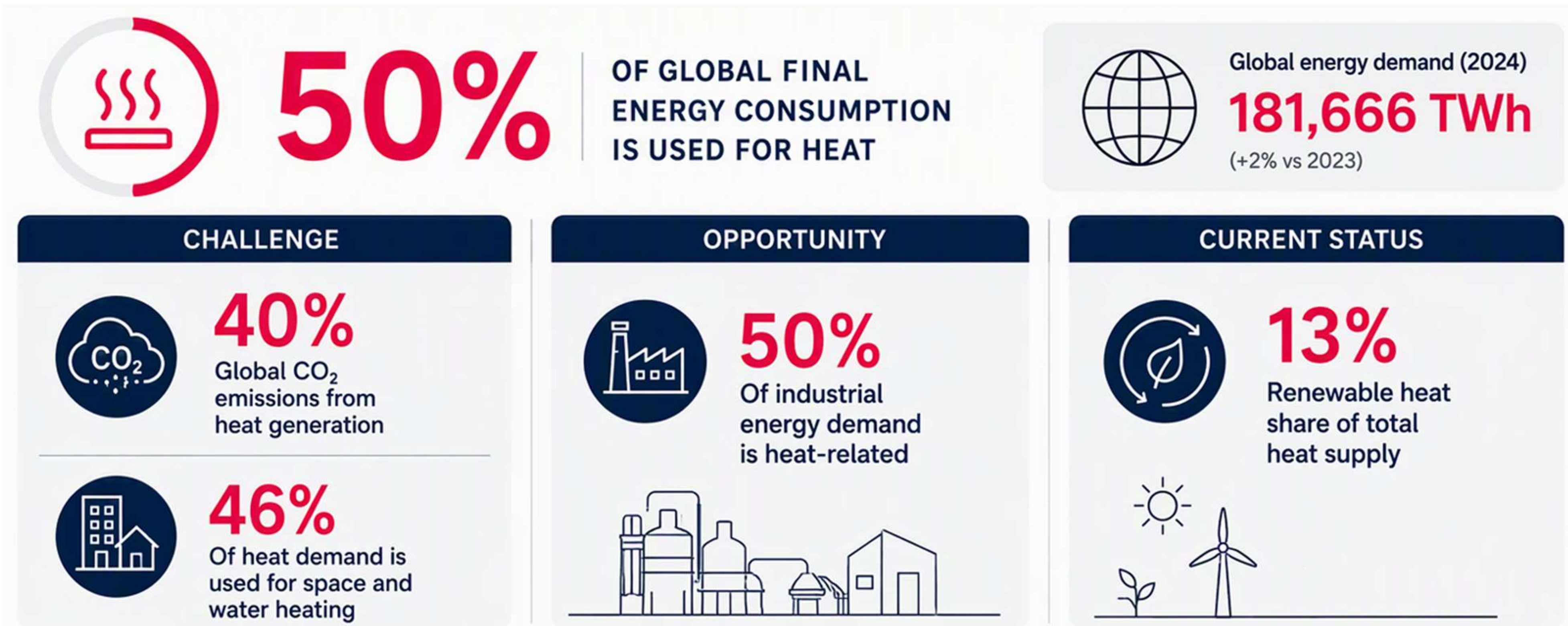


CARBON CAPTURE

COMPRESSORS FOR CO_2 TRANSPORT

Decarbonization of heat generation

Decarbonization of the heat sector requires electrification of heat supply and waste heat utilization



Source: IEA 2023
International Energy Agency | World Energy Outlook 2025

Typical Temperature Requirements Across Industries

TEMPERATURE RANGE	INDUSTRIES	TYPICAL APPLICATIONS
250 – 500°C High Temperature Process Heat	Steel Cement Glass	• Steel production (blast furnaces, EAF, reheating) • Clinker production in cement kilns • Glass melting, refining and forming
150 – 250°C Medium-High Process Heat	Chemical Paper & Pulp Food & Beverage	• Chemical reactions, distillation, drying • Pulp drying, paper drying • Food processing, cooking, pasteurization
80 – 150°C Medium Temperature Process Heat	Textile Pharmaceutical Automotive	• Dyeing, washing, bleaching • Clean steam, drying, sterilization • Parts cleaning, coating, pre-treatment
30 – 80°C Low Temperature Process Heat	District Heating Agriculture Commercial Buildings	• District heating networks • Greenhouse heating, soil heating • Hot water, space heating
< 30°C Low Temperature Heating & Cooling	HVAC Data Centers Refrigeration	• Space cooling and heat recovery • Server cooling, heat recovery • Refrigeration, cold storage

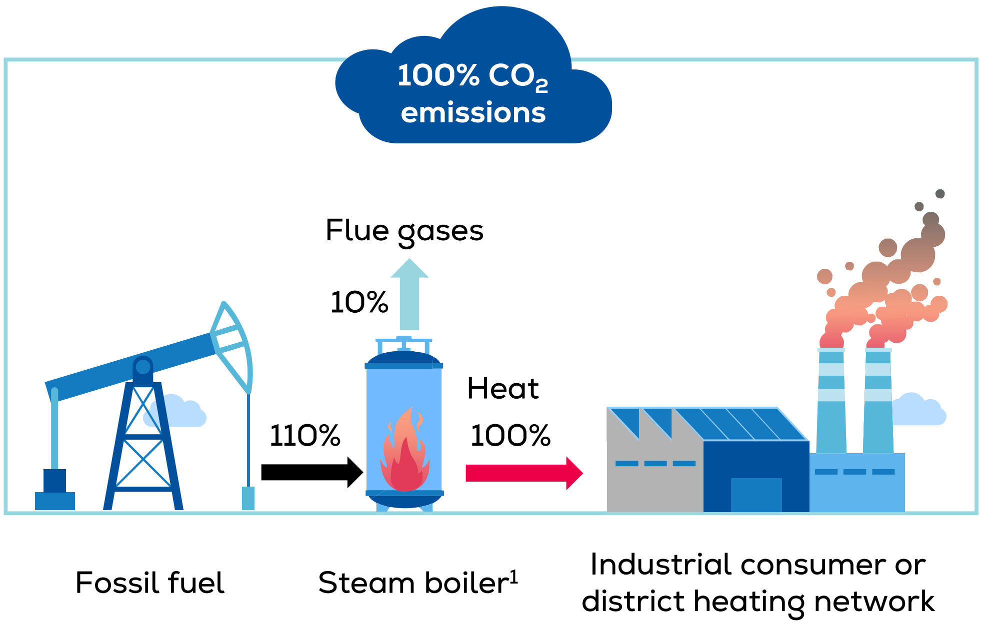
HOW HEAT PUMPS CAN DELIVER

- High temperature heat pumps for up to 500°C
- Industrial heat pumps for 150 – 250°C applications
- Heat pumps for 80 – 150°C processes
- Heat pumps for low temperature heating
- Heat pumps for cooling and heat recovery

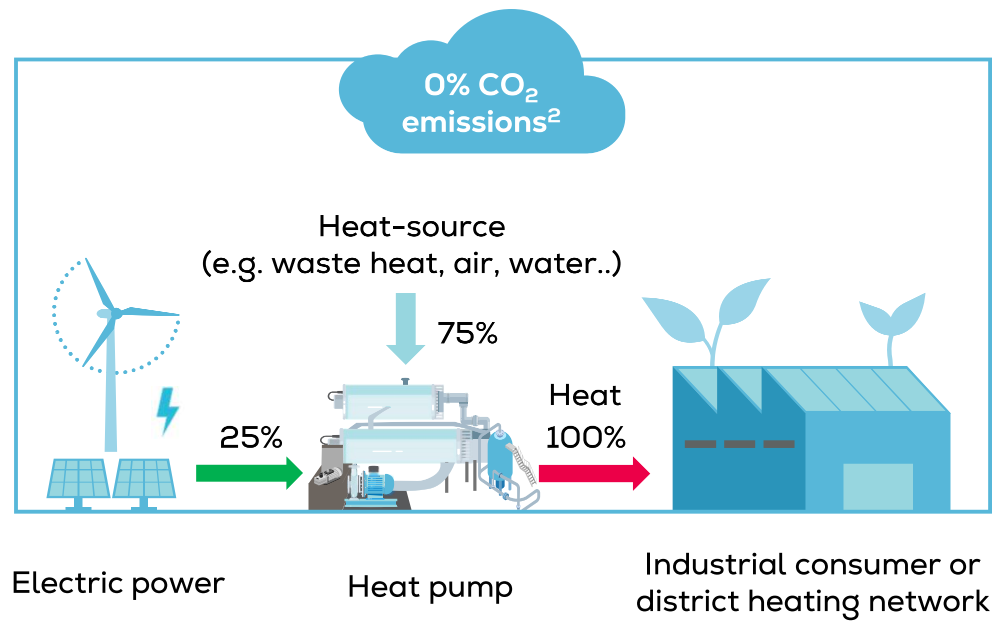
Heat Pumps – solution for zero emissions heat

Eco-friendly heat generation

Fossil fuel driven heat generation



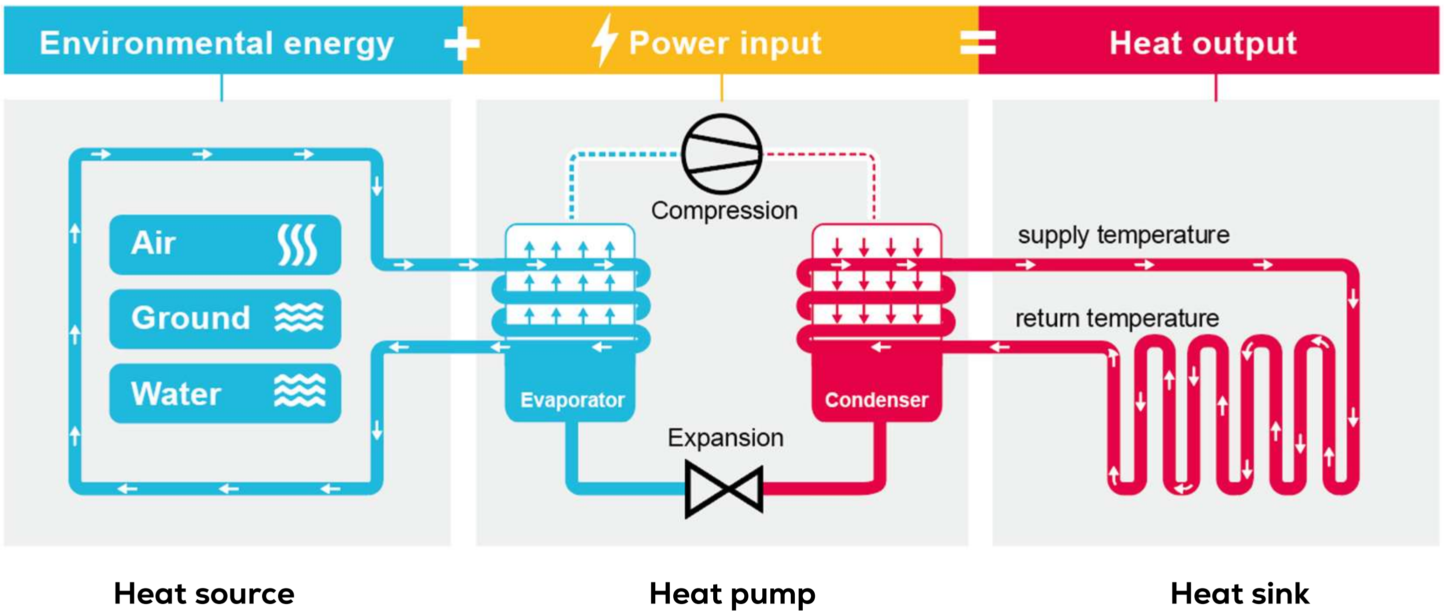
Heat pump driven heat generation



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

Functional principle of Heat Pump

Transfer energy from low to high temperature level by using power from the grid



$$\text{COP} = \frac{\text{Heat output}}{\text{Power input}}$$

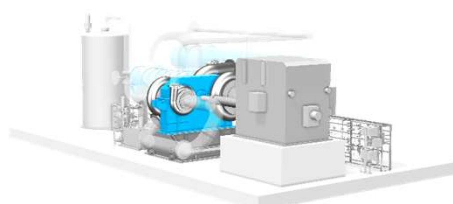
Heat Pump = electrification of heat

COP = coefficient of performance

Source: www.waermepumpe.de/waermepumpe/funktion-waermequellen/
https://www.iea.org/reports/the-future-of-heat-pumps/how-a-heat-pump-works

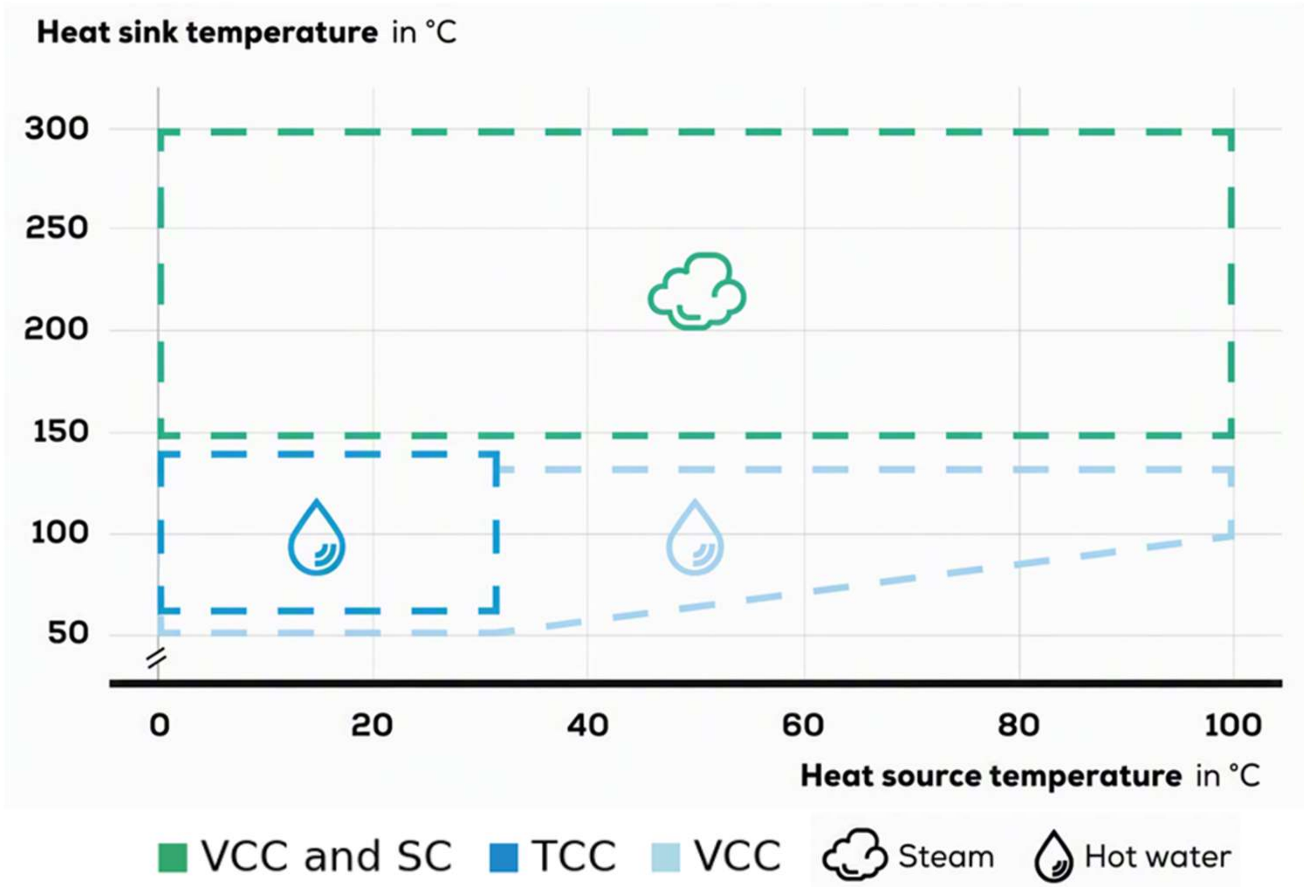
Three thermodynamic cycles – TCC, VCC, SC

Key customer use cases		Thermodynamic cycle	Properties
Hot water production		Transcritical cycle (TCC)	CO_2 refrigerant Hot water up to ~302°F (~150°C) Low sink return temperature: <95 °F (35°C) or lower
Hot water production	Steam production	Vapor compression cycle (VCC)	High efficiency for heating water and phase change for steam Refrigerant flexibility: Ammonia, Hydrocarbons or synthetic refrigerants
	Steam production	Steam compression (SC)	Steam compression up to 572°F (300°C)



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

Everllence Heat Pump Operating Envelope



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

The heart of the heat pump – HOFIM® Compressor

for Transcritical Cycle

High Reliability

Oil-Free

API* 617 Standard

› 70 Installations

Low Maintenance

Magnetic Bearings

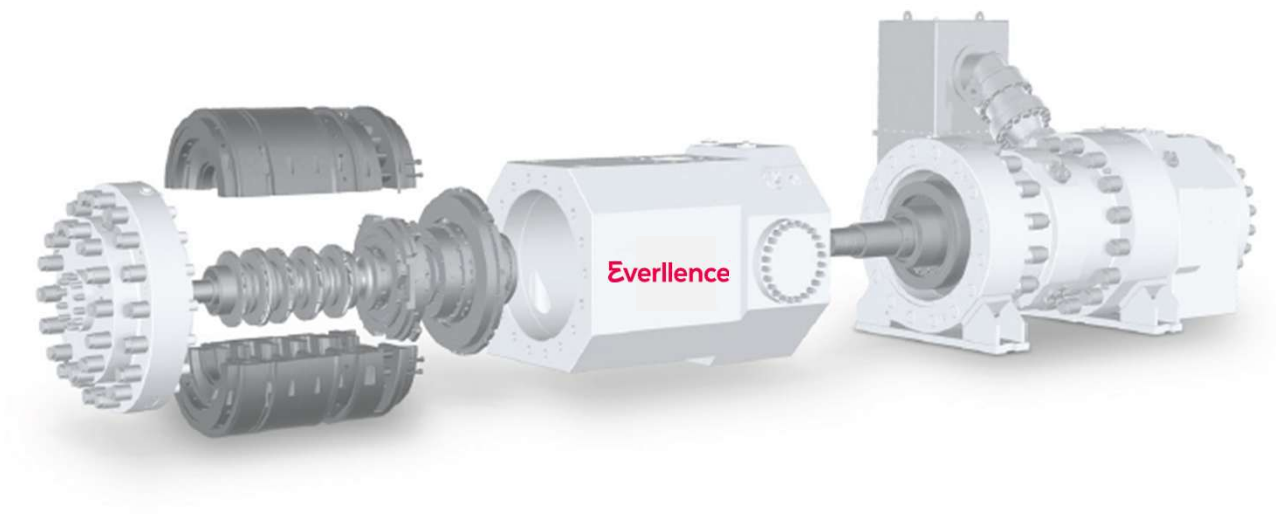
High Efficiency

Low Power Consumption

Hermetically-Sealed

No refrigerant loss

Key components



Dismantled HOFIM® Heat Pump core unit

*API – American Petroleum Institute

Integrally Geared (RG) & Horizontal Split (RH) Centrifugal Compressor

for Vapor Compression Cycle & Steam Compression

High Reliability

API* 617 Standard

› 1400 Installations

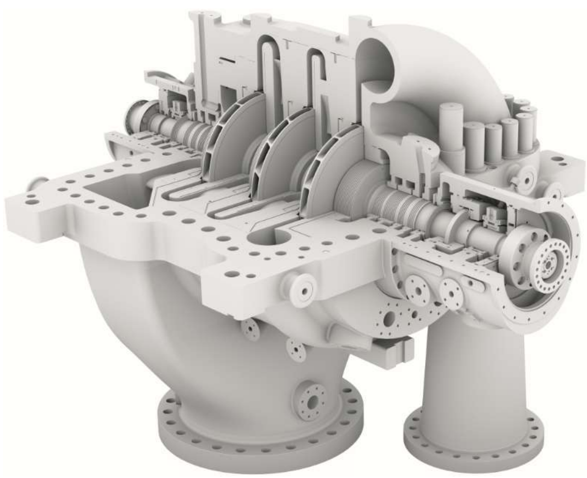
› 50,000,000 operating hours

High Efficiency

Low Power Consumption

Scalable

Up to 50 MW



High Reliability

API* 617 Standard

› 1300 Installations

› 98,500,000 operating hours

High Efficiency

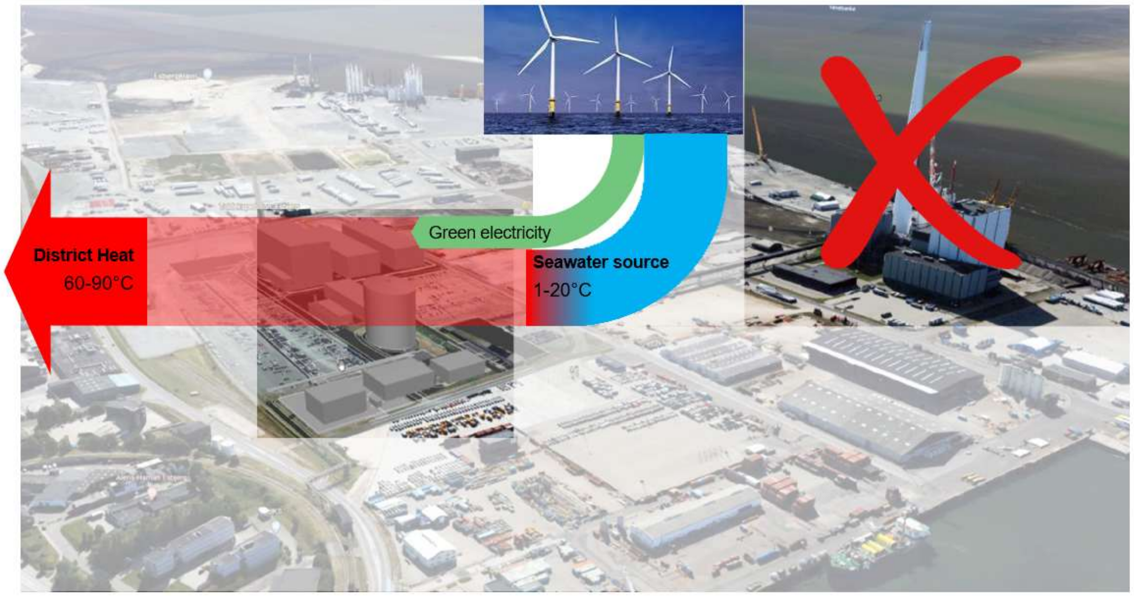
Low Power Consumption

Scalable

Up to 60 MW

*API – American Petroleum Institute

Esbjerg: CO_2 Mega Heat Pump for district heating



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

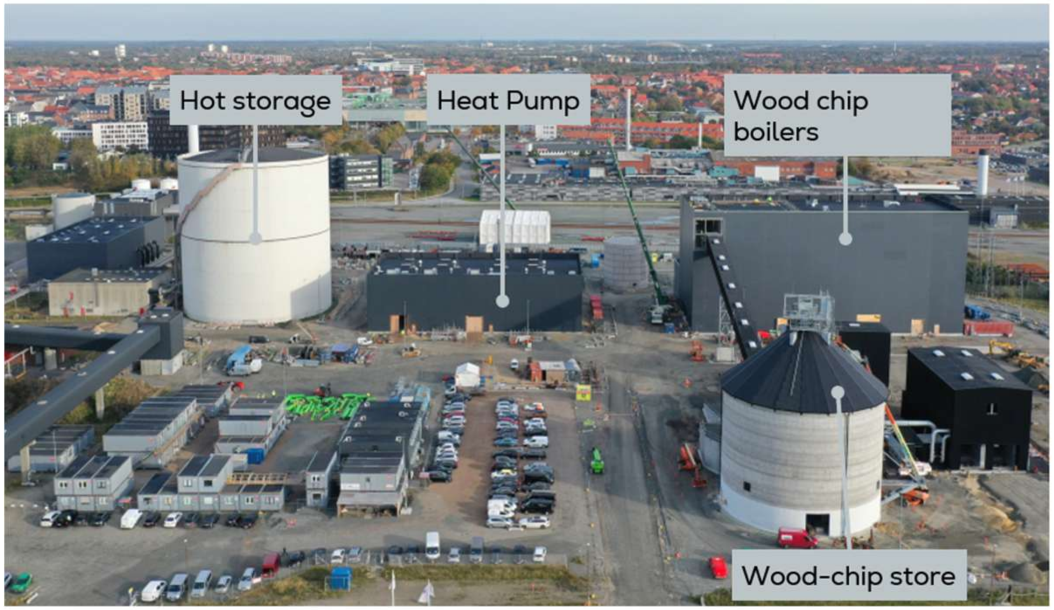
Heat sink: 60 – 90 °C | 140 – 194°F

COP: ~ 3.3 – 4

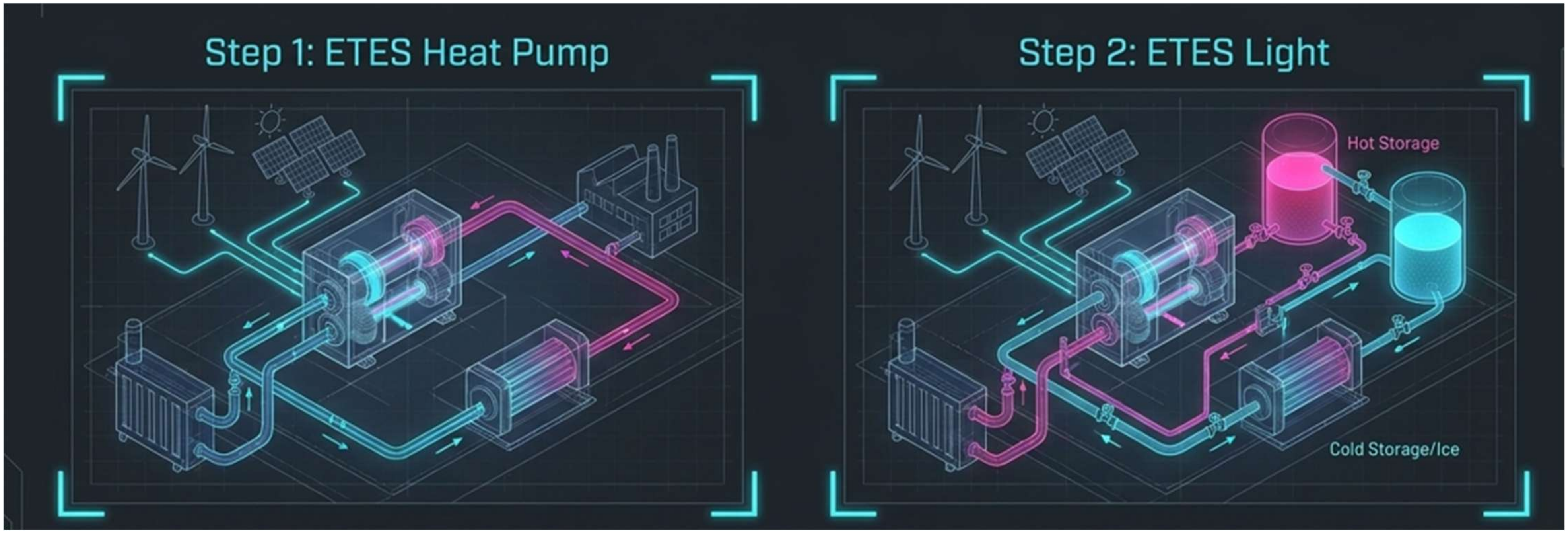
Heat output	Heat for	CO_2 savings
Up to 65 MW	25'000 households	120'000t p.a.

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

Esbjerg Site Layout



From Heat Pump to Thermal Buffer



An industrial heat pump paired with thermal storage becomes an active, revenue-generating, grid-balancing thermal battery.

*ETES – Electro-Thermal Energy Storage

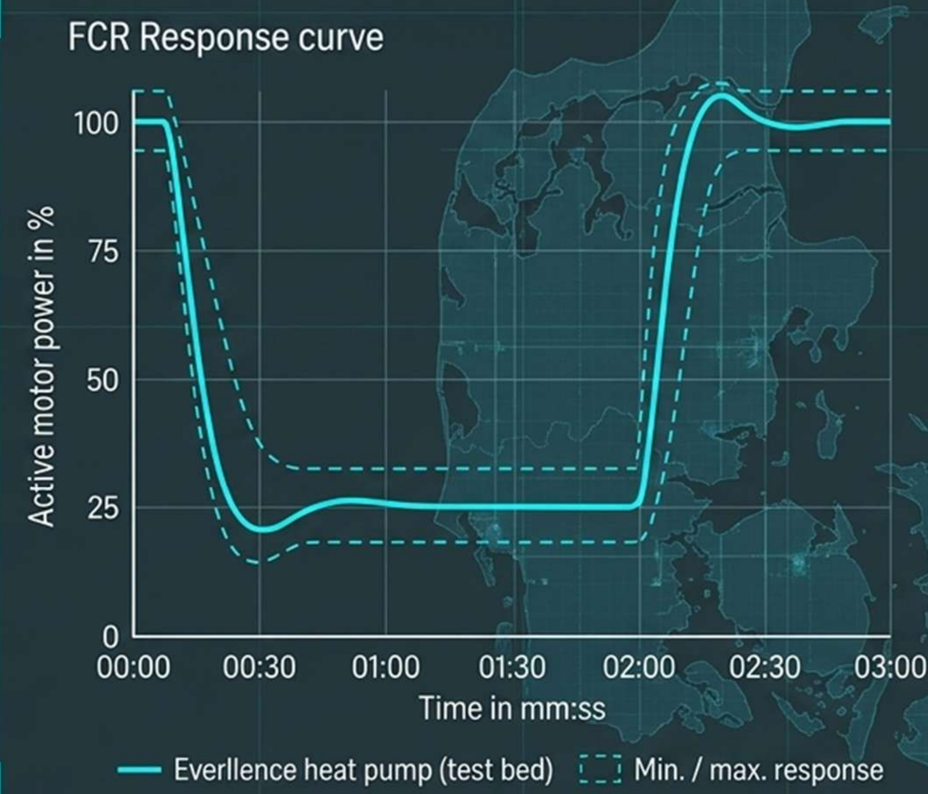
FCR in Action: The Esbjerg Demonstration

The Challenge:

Provide automatic Frequency Restoration Reserve (aFRR) to stabilize the Danish grid amid fluctuating wind power.

The Performance:

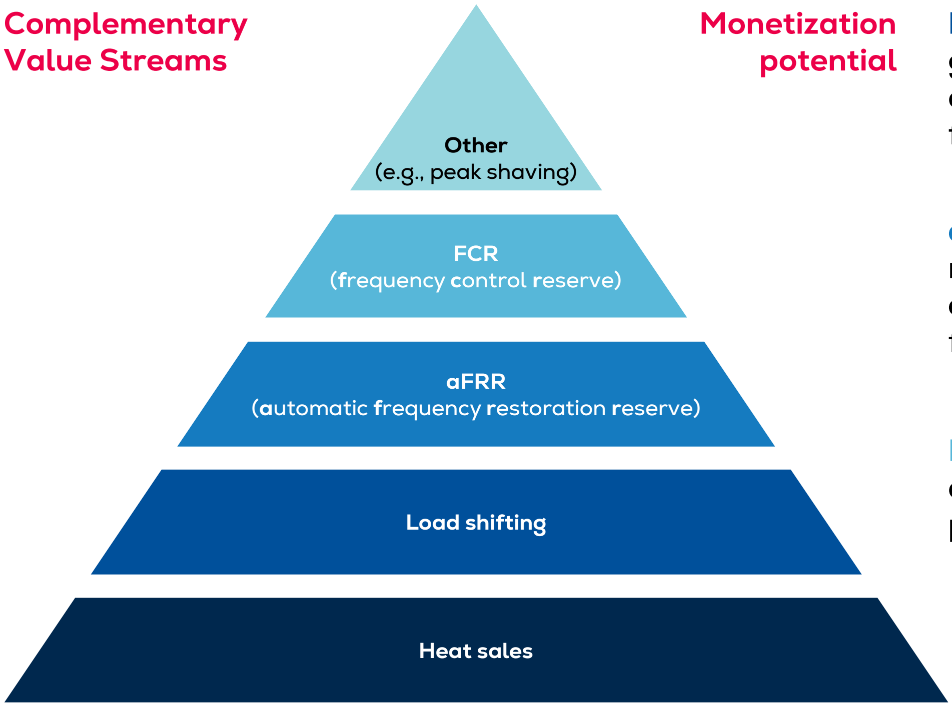
- **Speed:** Regulates power within seconds.
- **Capacity:** Demonstrates 12 MW regulation within 30 seconds.
- **Scale:** Largest units can produce up to 80 MW_{th} in a single stage (0-150°C).
- **Impact:** Actively decarbonizes Esbjerg's district heating (replacing coal) while generating secondary revenue via European balancing power markets.



Monetization of grid services – Everllence's TCC heat pumps offer flexibility to utilities – example for HPU 33

Complementary Value Streams

Monetization potential



Load shifting: In combination with hot-water storage or other generation assets, our highly flexible heat pumps **support load shifting**, enabling electricity cost reductions of **~10%**, or **~€680k p.a.** for a **23MW$_{th}$** heat pump in Germany.

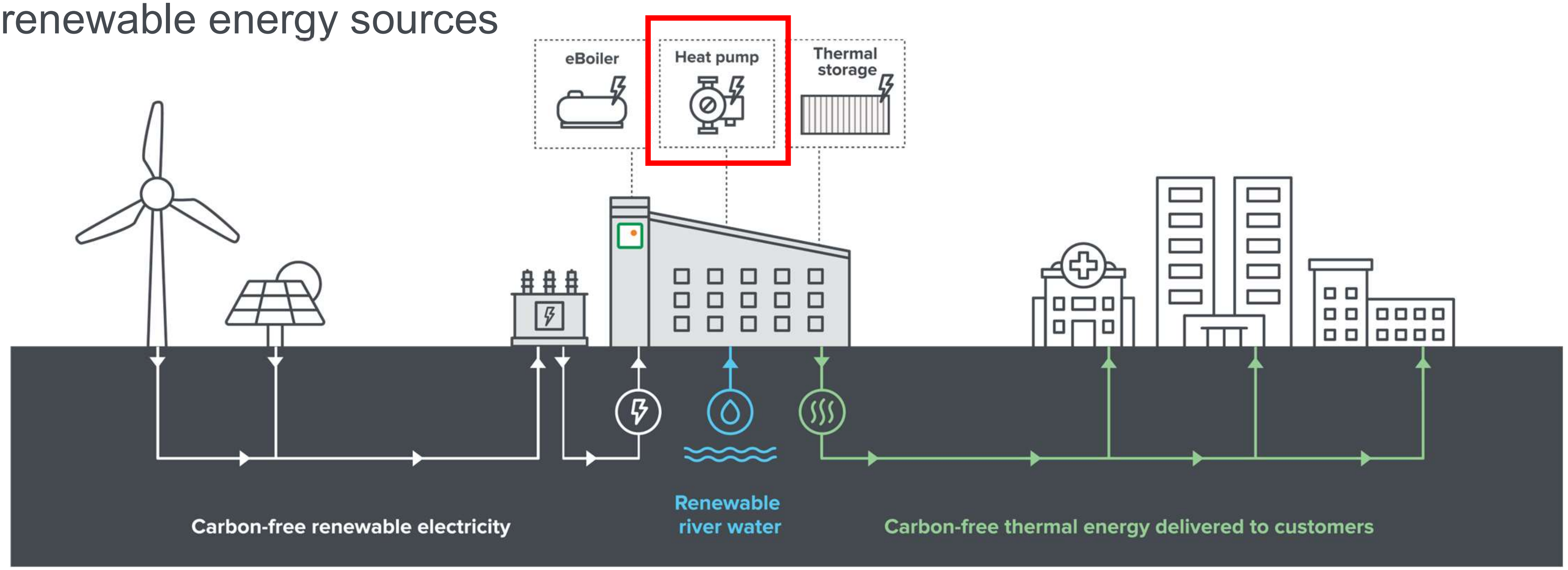
aFRR: Our flexible heat pumps **enable offering "aFRR up"**—the ability to reduce consumption swiftly—to the local **TSO when the heat pump is operating**, enabling capacity and energy payments of **~€445k p.a.** for a **23MW$_{th}$** heat pump in Germany.

FCR: When the heat pump is **operating below full load** and aFRR prices are low, our flexible heat pumps can also **provide FCR**, enabling extra payments of **~€115k p.a.** for a **23MW$_{th}$** heat pump in Germany.

Σ ~€1'240k p.a.

Note: All data provided is non-binding. This data serves informational purposes only and is especially not guaranteed in any way. Potential depends on operating mode, market prices, and bidding strategy.

Vicinity Energy Carbon-free eSteam™: Integrating innovative technologies with renewable energy sources



1 Procure
Vicinity will procure electricity from renewable, carbon-free energy sources and import the power through a co-located electric substation.

2 Produce
Powered by renewable electricity, electric boilers and industrial-scale heat pumps will transform water into eSteam™.

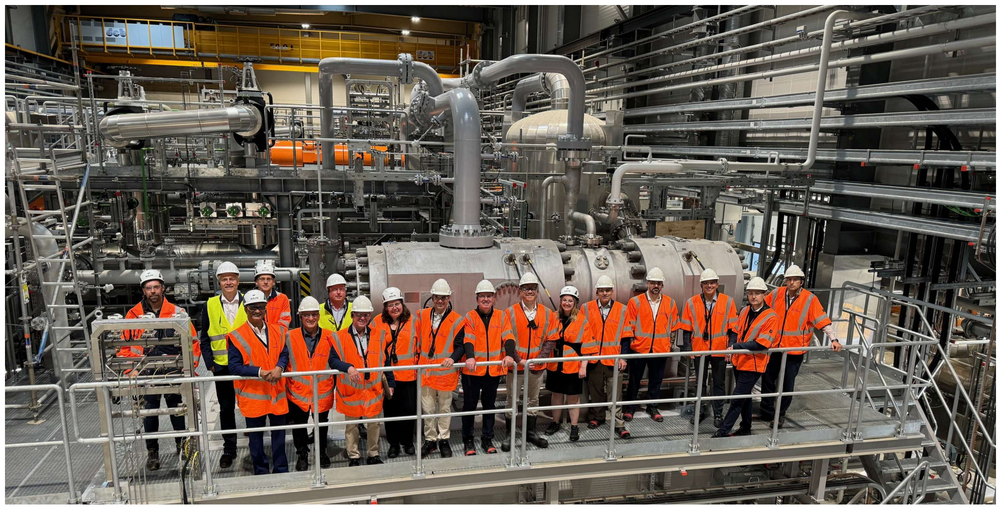
3 Optimize
Thermal storage provides on-demand eSteam™ production from stored, off-peak renewable electricity.

4 Distribute
Carbon-free eSteam™ distributed to customers through existing underground piping infrastructure.

Electrification pathway: Boston and Cambridge system

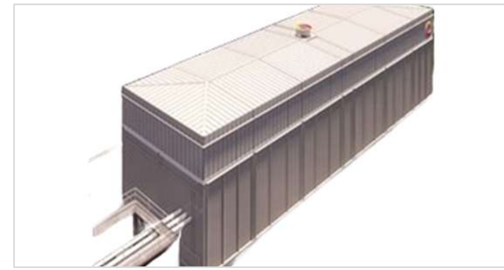
42MW Electric boiler

- Entered service in November 2024.
- Enhances reliability and reduces emissions and grid demand.
- Operates in surplus renewable energy (solar & wind) events
- Relegated to back-up/peaking capacity behind heat pump in 2028



38MW Steam heat pump

- Enters service in 2028 and 2032.
- Circulates up to 49 million gallons of water daily from the adjacent Charles River/Broad Canal.
- Water sourced, high efficiency and reliability to meet high demand for consistent thermal energy production.
- Reduces reliance on traditional fossil-fuel based energy sources.



Thermal storage

- Enables valley surfing for better renewable pricing.
- Relieves grid stress by reducing power consumption during peak periods.
- Links offshore wind generation surplus periods (overnight) with district energy peak use period.

vicinity

Kendall station heat pump

Heat Pump Key Descriptive + Performance Metrics	
Thermal Duty (MW_{th})	> 35
COP_{total}	> 2
Heat Sink	
Supply Temperature (^oF)	> 380
Supply Pressure (psig)	200
Steam Mass Flow (lbs./hr.)	> 100,000
Heat Source – River Water	
Source Inlet Temperature (^oF)	38 - 85
Source Flow (gpm)	> 17,000
Electric Motor Rating for Heat Pump (hp)	16,000

Thank You!

Everllence

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Disclaimer

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