

PANTOKRATOR

A better way

Decarbonising Low Temp Industrial Heat

Webinar 24 October 2024

PANTOKRATOR

A better way



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March 2023



May 2024



November 2024 (coming soon)



Registered attendees



Panel of experts



Andreï Klochko

CEO, Co-Founder



Blaine Collison

Executive Director



David Tearse

CEO, Co-Founder



Dolf Joeke

MD, Europe



Michael Bantle

CTO



Victor Weisberg

Director, Equity Investments



\$300bn

Market opportunity <200°C¹

20%+ GHG

Industrial heat²

2-5x

COP³

200°C+

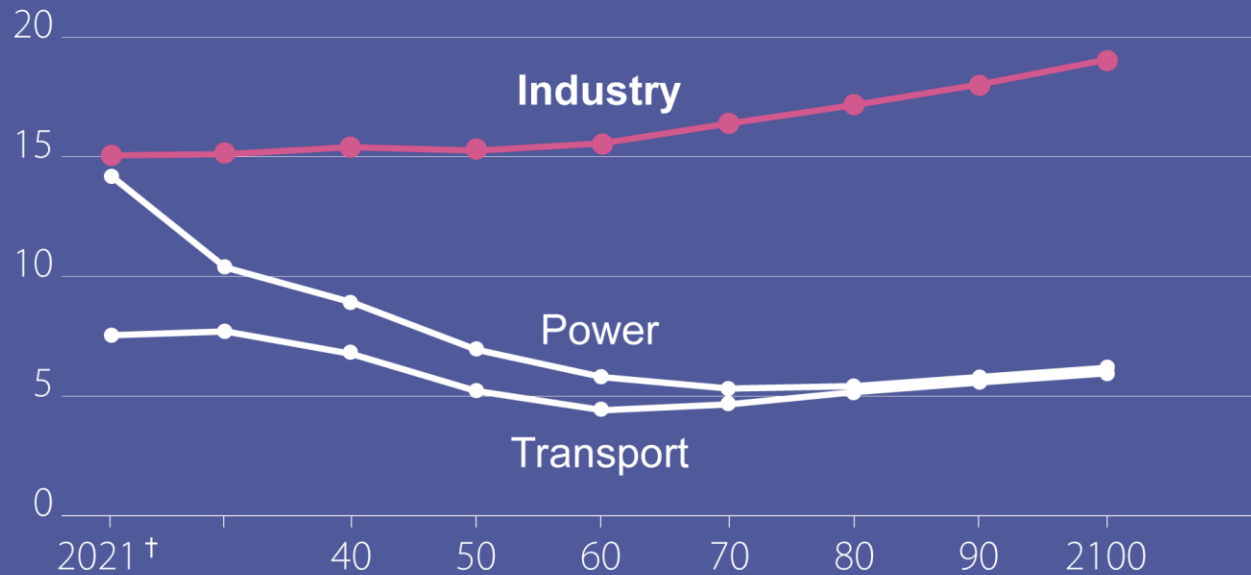
Available today via HP³

700k+

Gas boilers globally⁴

Industrial heat is an overlooked opportunity

Average **GHG** forecast (Gt)¹

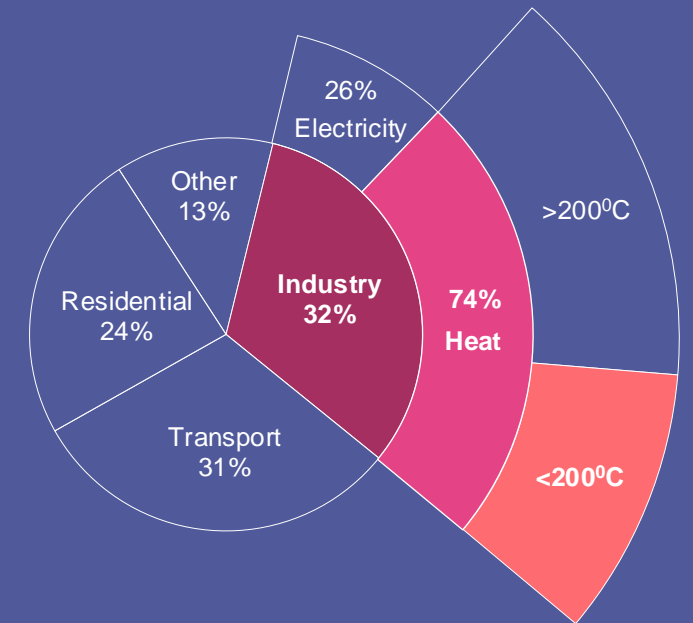


Source: Rhodium Group

*Energy-related

†Actual

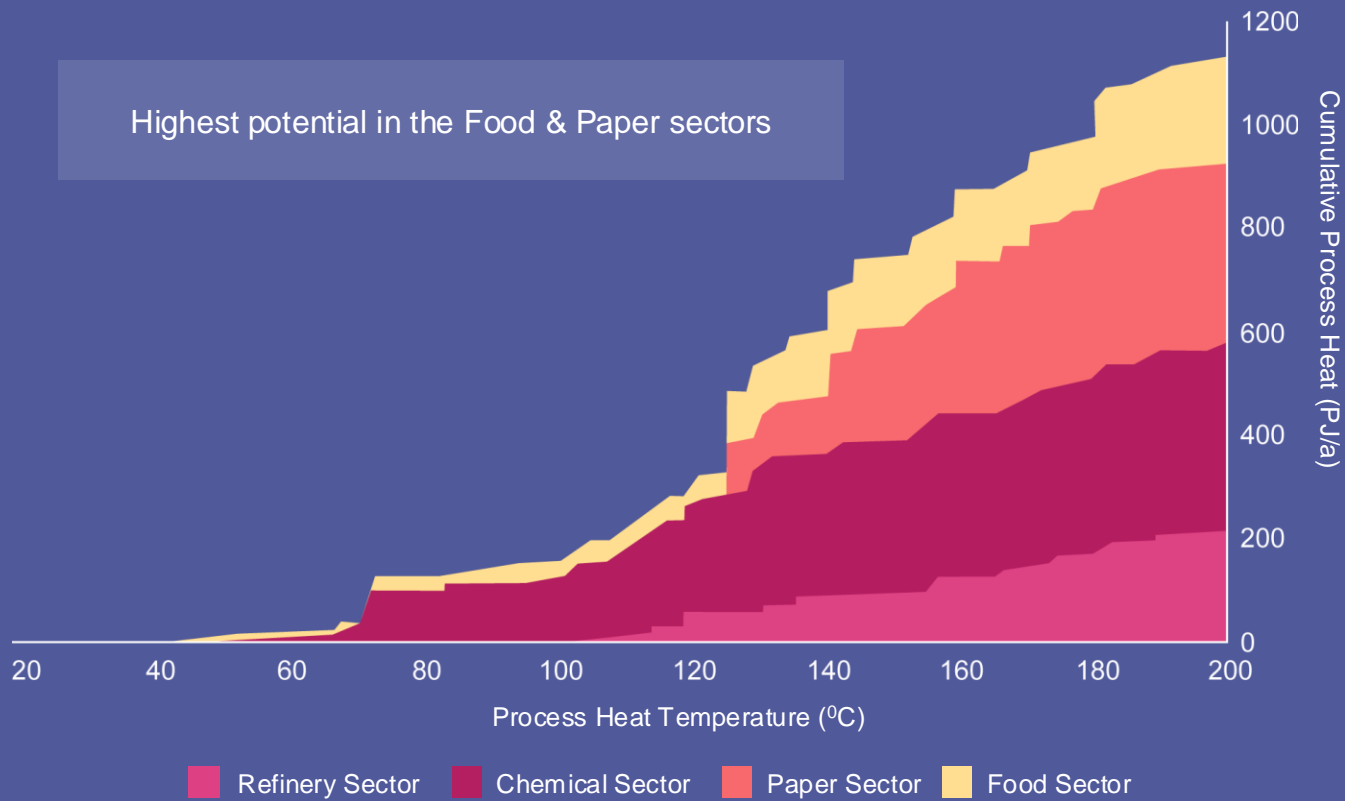
Industrial Heat: **c.40% <200°C²**



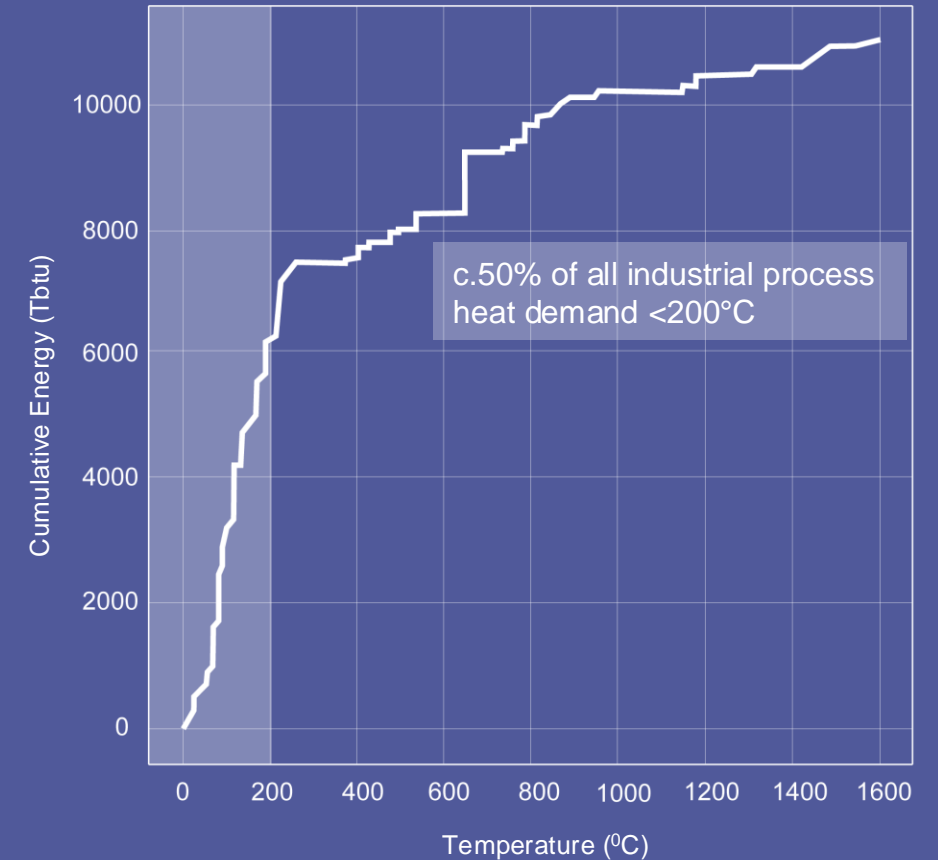
Market potential 100°C-200°C

EU28¹

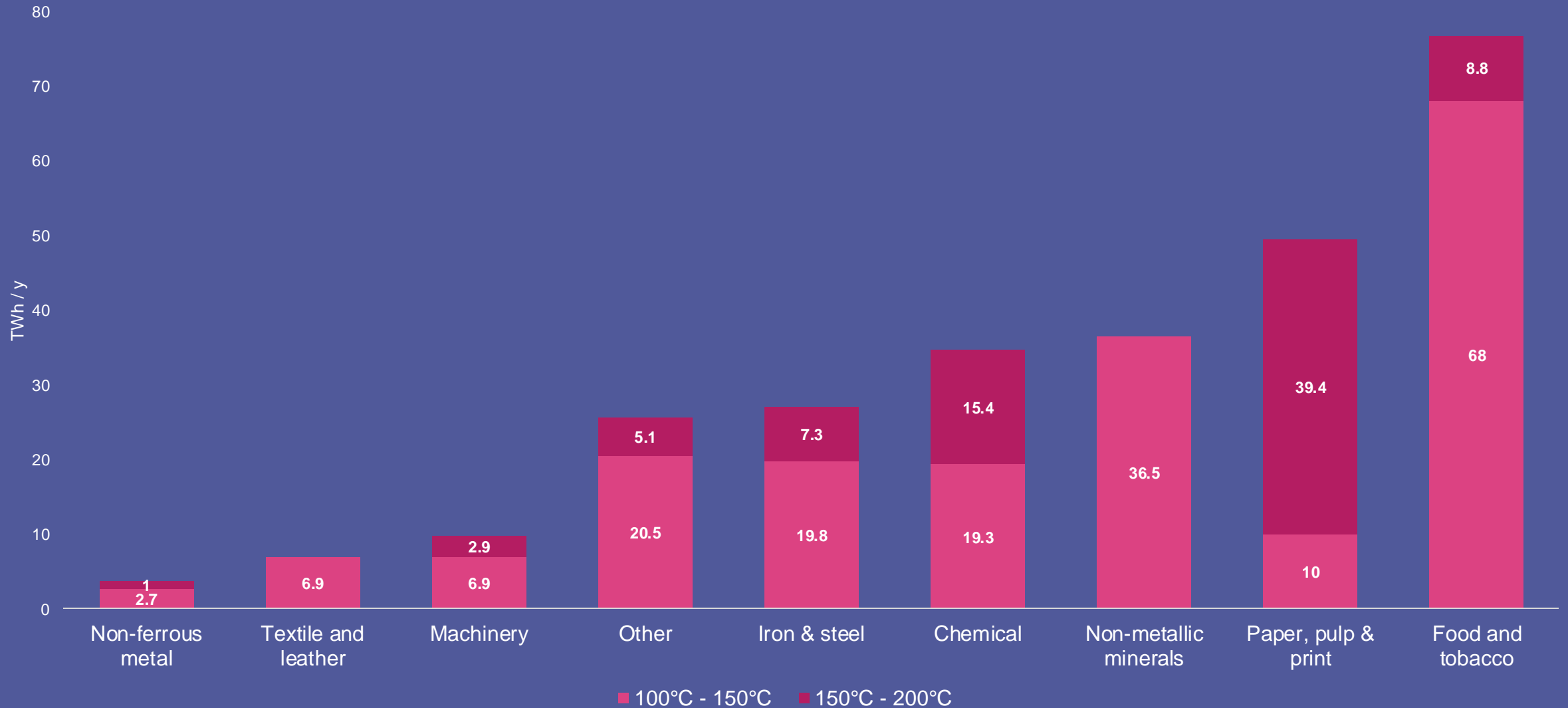
Highest potential in the Food & Paper sectors



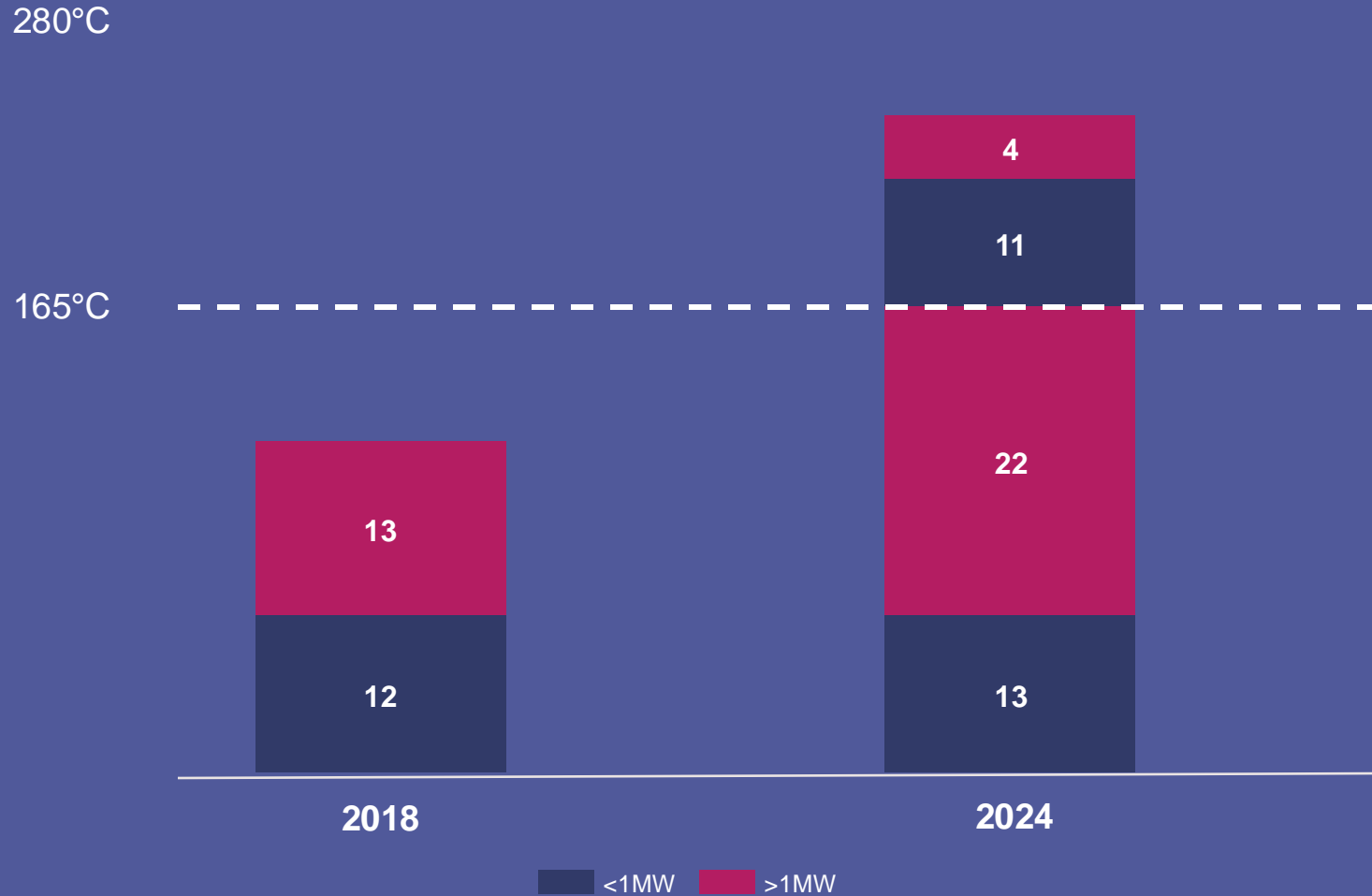
US²



Key target industries



Innovation in the sector 2018 - 2024



Temperature range

165°C → 280°C



Product size

>50% above 1MW

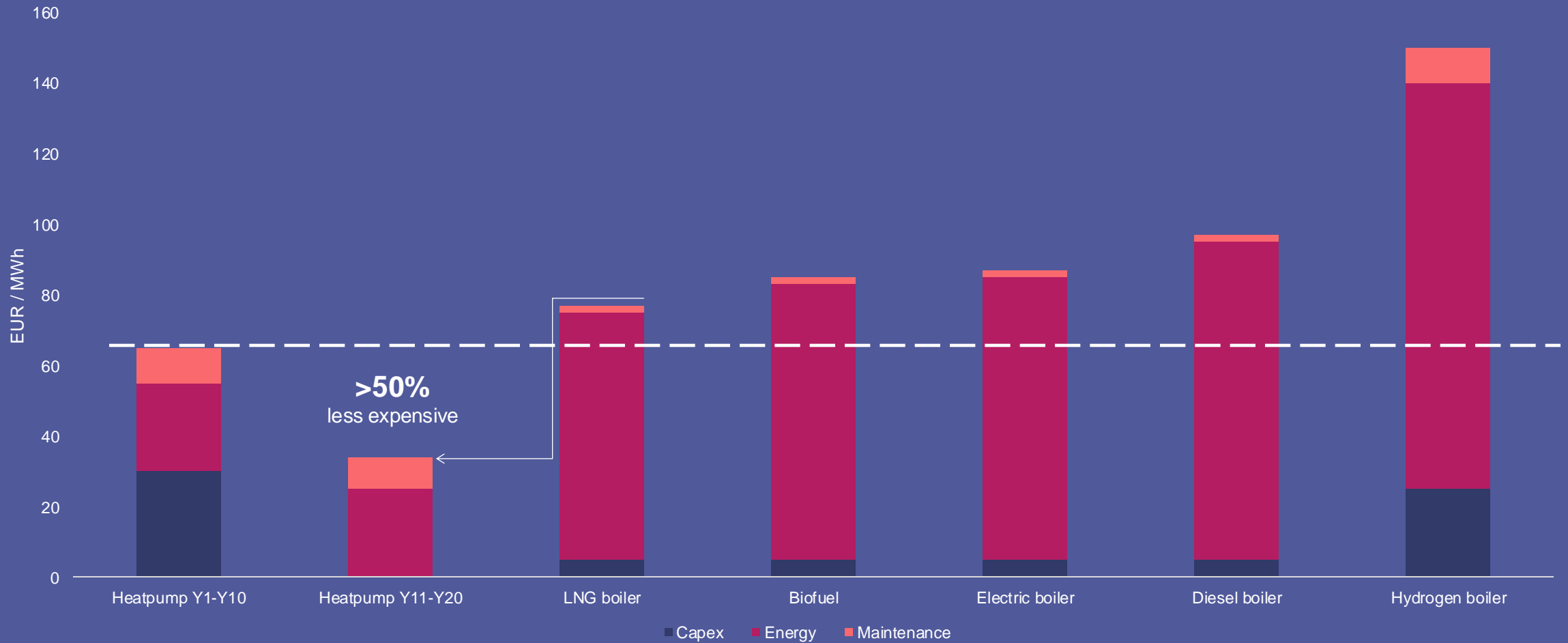


Companies

25 → 50

**List is non-exhaustive, not including all the companies in the market but more for illustrative purposes to showcase growth acceleration in the high temperature segment*

Heat pumps: less sensitive to energy price fluctuations (ANEEO)




*Results depend on country, location, HP performance, operational hours and local energy prices

**Assumed 5MW HP operating 7000h/y and using waste heat


*** Energy prices used for end of September (Norway)

Potential integration with Thermal Storage

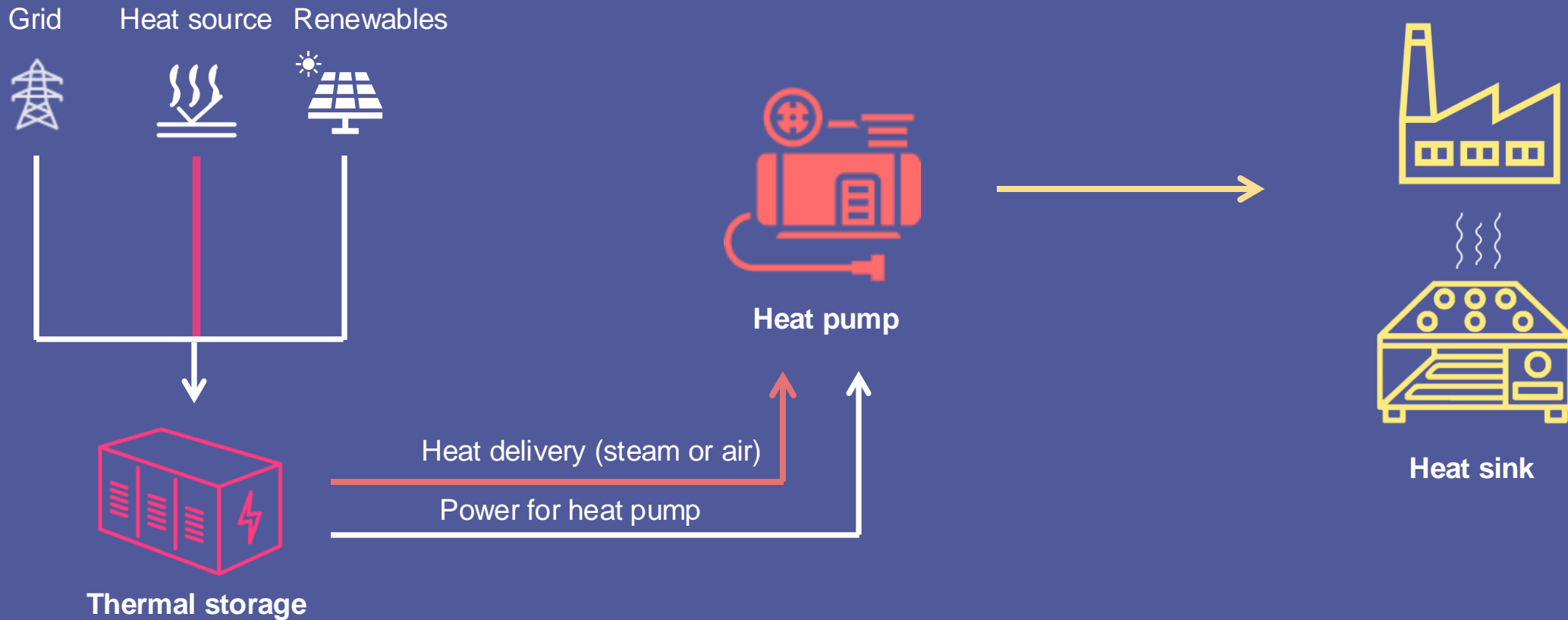
TES

 Charging at off-peak prices
=
Lower Opex

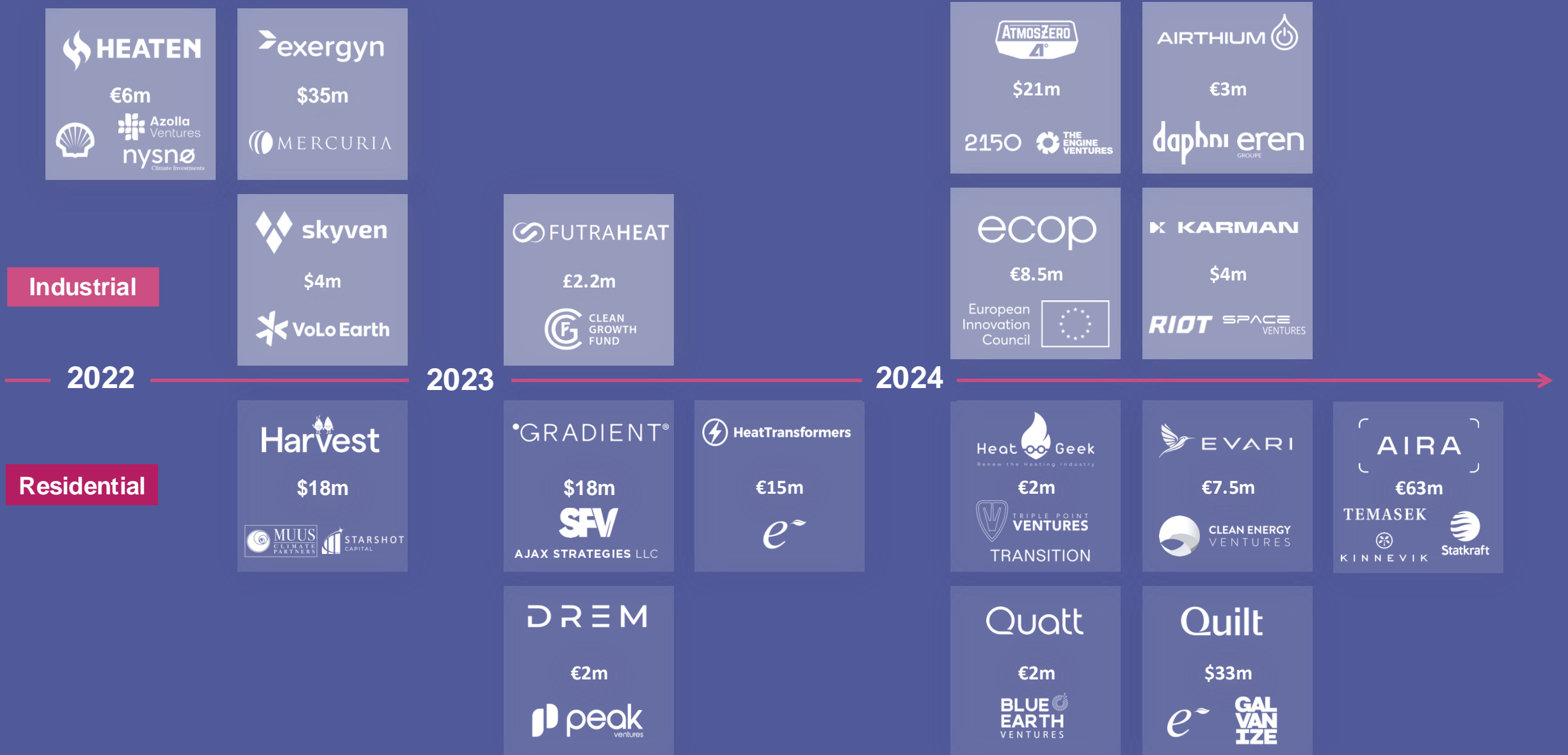
Heat Pumps

 Low-cost electricity + low lift
=
Highest COP & lowest LCOS

 Highly efficient, CO2 neutral process
=
Cost savings & Net Zero agenda



2022-YTD Heat Pump investment activity



Technology

- Higher capacity heat pumps (20MW+) remain challenging
 - Efficiency drops at higher temperatures

Costs

- Cost reduction via supplier network and standardisation
- Lower operating costs can benefit leased models (TCOH)

Awareness

- Customers unaware of the advances in technology
 - Resistance to switching away from boilers

Integration complexity

- Integrating heat pumps requires bespoke engineering
 - Custom designs limits commoditised deployment

Regulatory

- Refrigerants: uncertainty for long-term planning
- Limited grid capacity = bottleneck for widespread adoption

Risks

- Electricity price, and counterparty risk
- Market not ready for long-term off-take & HaaS

Panel of experts



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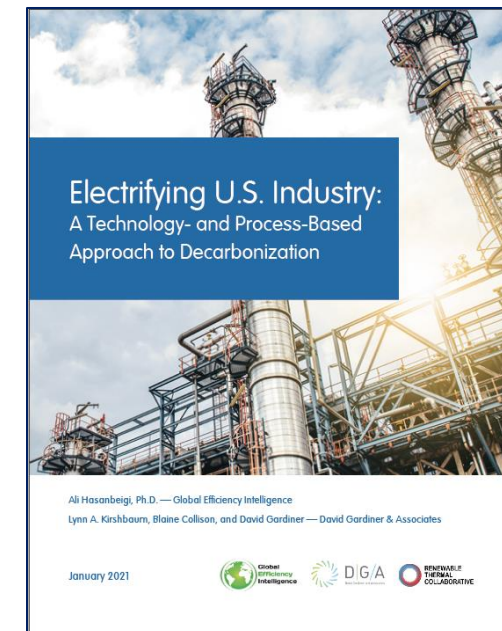
The RTC is the only global, buyer-led coalition focused on decarbonizing thermal energy with renewables.

We focus our work across the intersecting issues of **technology, market development, and policy.**

RTC Members (buy-side) and Solution Providers are invited to participate in multiple RTC workstreams to:

- Identify and address barriers;
- Accelerate solutions;
- Implement projects and policies.

Facilitated by:



RTC Members



Tomorrow starts today



Steel Dynamics, Inc.®



Unilever



Wisconsin Office of Energy Innovation

RTC Solutions Providers

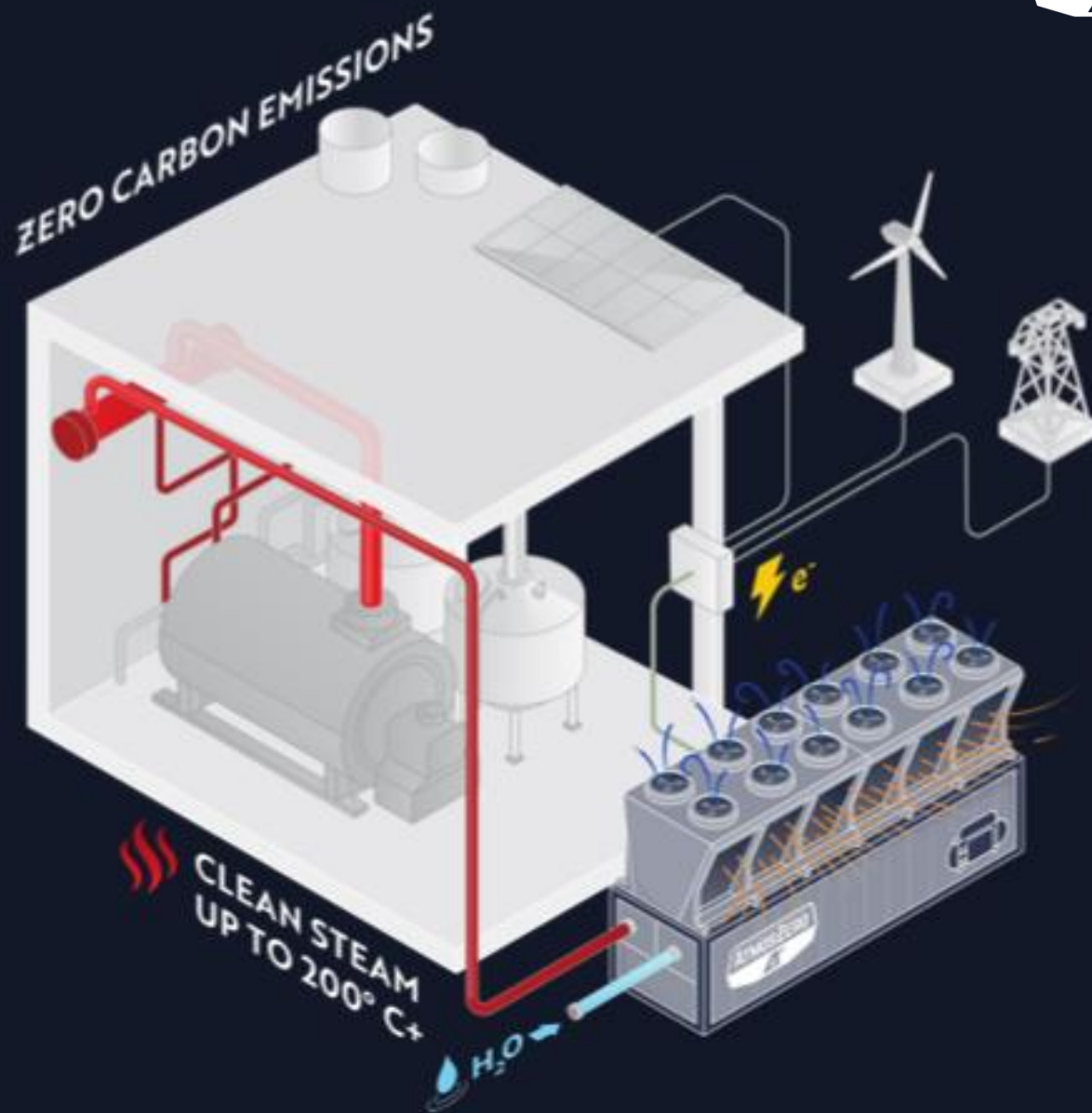


Introducing: Boiler 2.0

Modular Air-Sourced
Steam Heat Pump

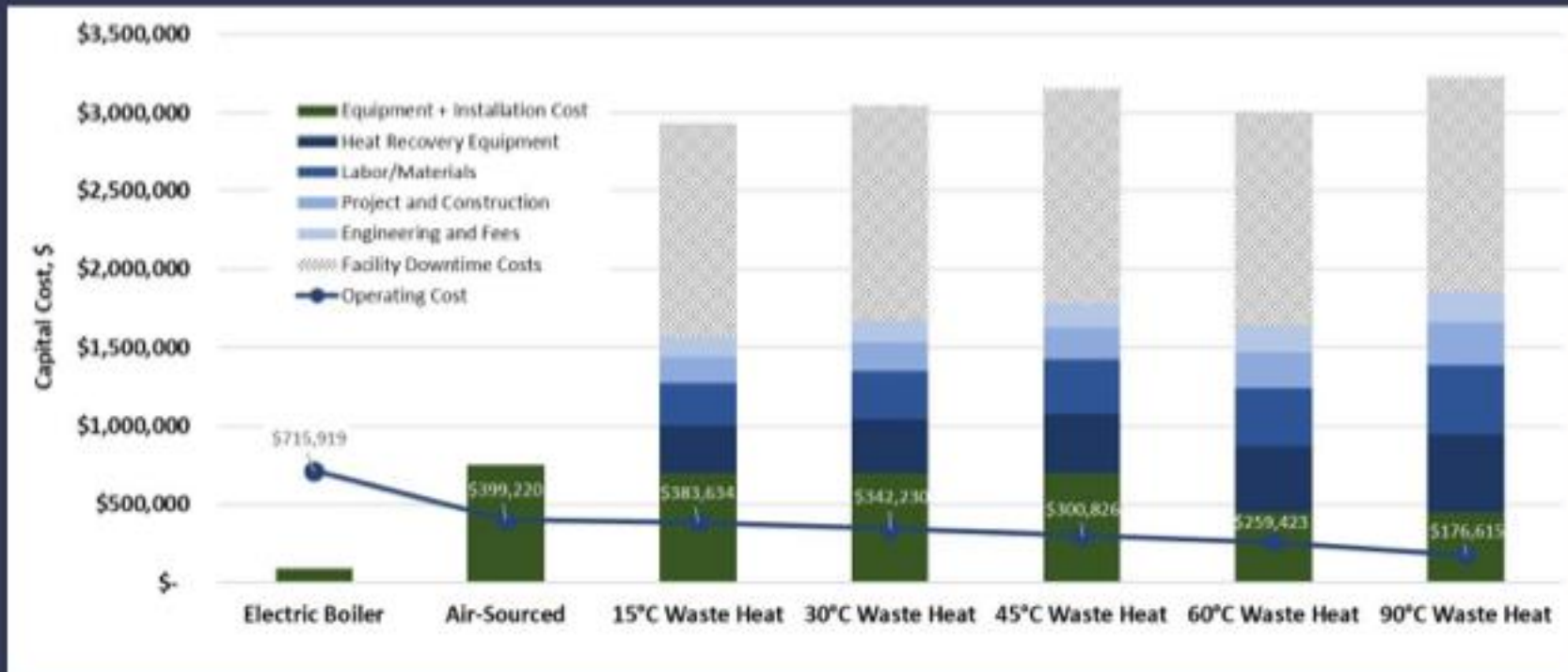
No waste heat required

A Product, not a Project



Redefining boiler capital efficiency

Boiler 2.0 eliminates the hidden cost of installing waste heat recovery equipment

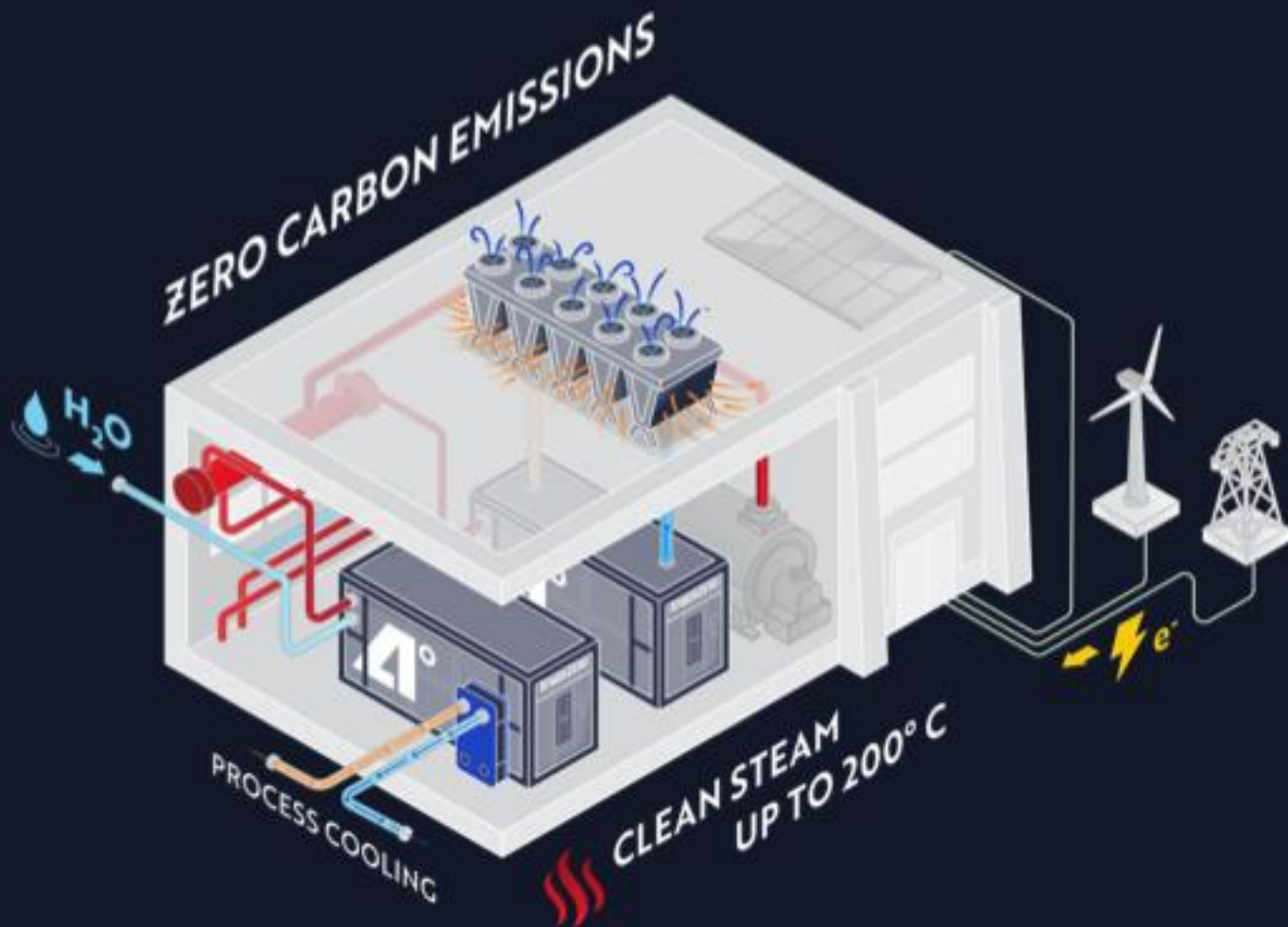


Boiler 2.0 bonus: Process cooling

200-300kW cooling power

Reduce cooling tower
water loss or reduce chiller
power consumption

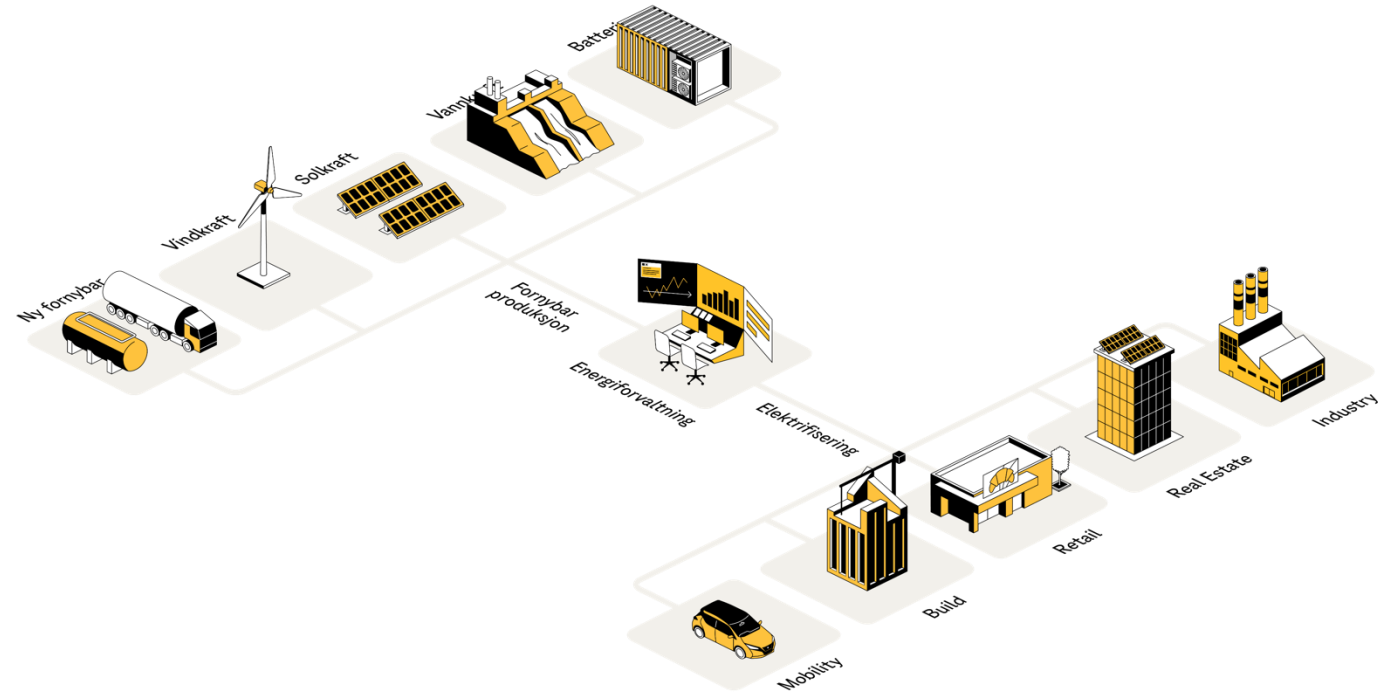
A Product, not a Project



About Aneo Industry AS

Aneo Industry in brief

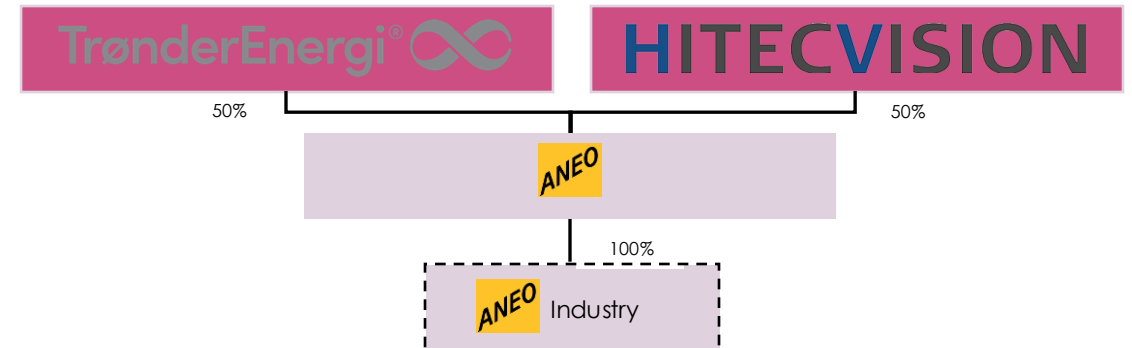
- Aneo Industry is an energy services company delivering complete solutions within waste heat recovery for industrial customers
- The company provides high temperature heat pump solutions resulting in increased energy efficiency and elimination of climate emissions for its customers
- Founded in May 2022 by Nordic renewable energy company Aneo



Aneo in brief

- Aneo is a nordic renewable energy company with operations within renewable energy production, electrification and energy efficiency
- Established in 2022 and owned jointly by Norwegian utility TrønderEnergi and private equity investor HitecVision

Corporate Structure



Steam-producing heat pump installed at Felleskjøpet Agri in Trondheim



- ✓ Produces 2 tons of steam per hour
- ✓ Recycles air-sourced waste heat
- ✓ Capacity of 1.4 – 1.8 MW
- ✓ Efficiency gain of 67%

Project FRIGG




ehpa 2024
DecarbIndustry award

**Award winning project:
World's first full-scale industrial steam-
supplying heat pump**



Aneo Industry enables industrial customers to achieve ambitious ESG targets



Energy
efficiency
60% - 80%

Reduces
climate
emissions
up to 100%

Releases grid
capacity
and reduces
expensive
power peaks

Natural
refrigerants
for future
proof
integration



01

Electric vehicle and aerospace-grade innovation

We're taking advantage of cutting-edge turbomachinery, high-speed power electronics, and advanced manufacturing innovations from SpaceX, Tesla, and Rivian to drive performance, standardization, size, and cost-reduction.

02

Aligned with the customer

Customers want to save money as well as cut emissions. We are the only solutions that solves both. With our industry low OPEX and CAPEX, customers can quickly payback the asset many times over the life of the asset as well as eliminate scope 1 emissions.

03

Aligned with government

There is significant government funding available for decarbonization projects to help accelerate deployment and dramatically reduce costs to customers on top of the costs savings they'll already be receiving. Wind in our sails.



Founding Team

Backed by

RIOT



David Tearse

Co-Founder and CEO



Dr. CJ Kalra

Co-Founder and CTO



Vincent Tarantini

Mechanical Systems Lead



Dr. Willem Landman

Thermal Systems Lead



Tadeh Avetian

Turbomachinery Lead



Vinaey Kalyan

Power Electronics Consultant



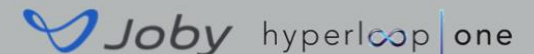
Shiva Bernath

Modeling & Simulation



Andrei Starobin

Engineering Analyst



Our Company

We are an independent, Swiss-based, specialist investment manager.

15

Years of Activity

7

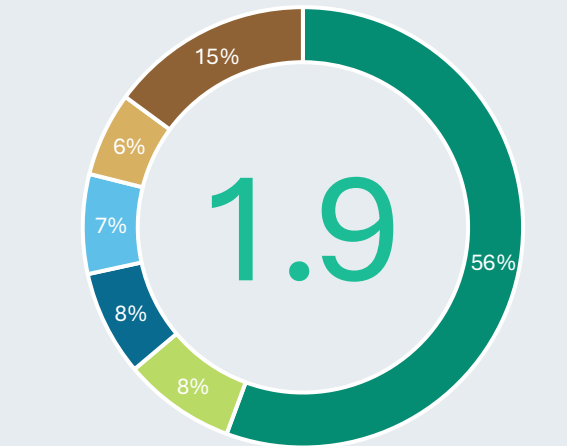
Funds under Management

- Headquartered in Switzerland
- Presence in Europe and Singapore
- Seasoned and committed team (93% retention rate**)
- Covering 14 languages

Our Clients

We manage investments on behalf of institutional investors and their beneficiaries.

Total Commitments by Type (EURbn)



■ Pension Fund ■ Endowment ■ Bank
■ Investment Co. ■ Insurance ■ Other

Our Investments

Energy transition infrastructure investments are our sole focus since inception.

1.8

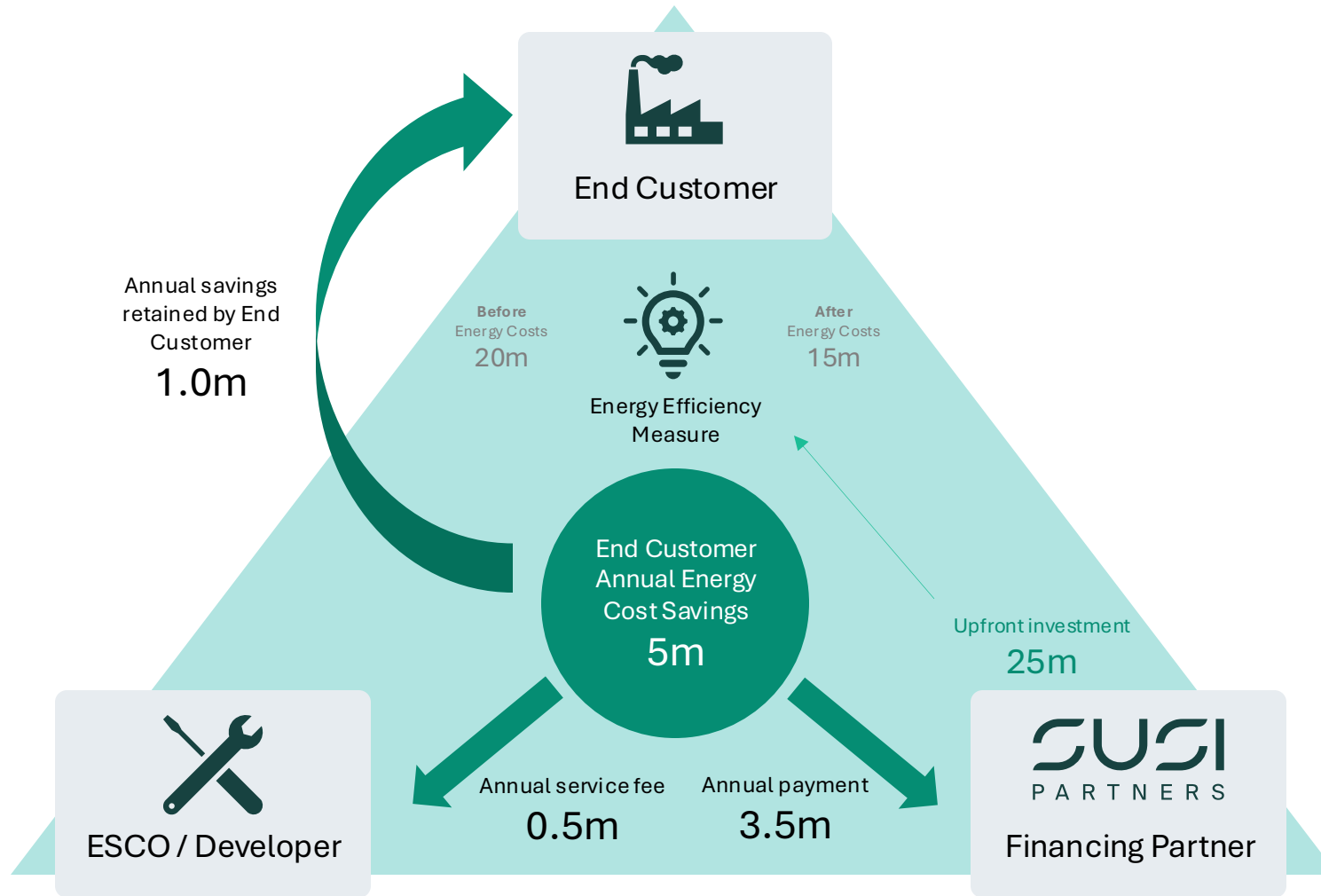
EURbn Invested

3.6

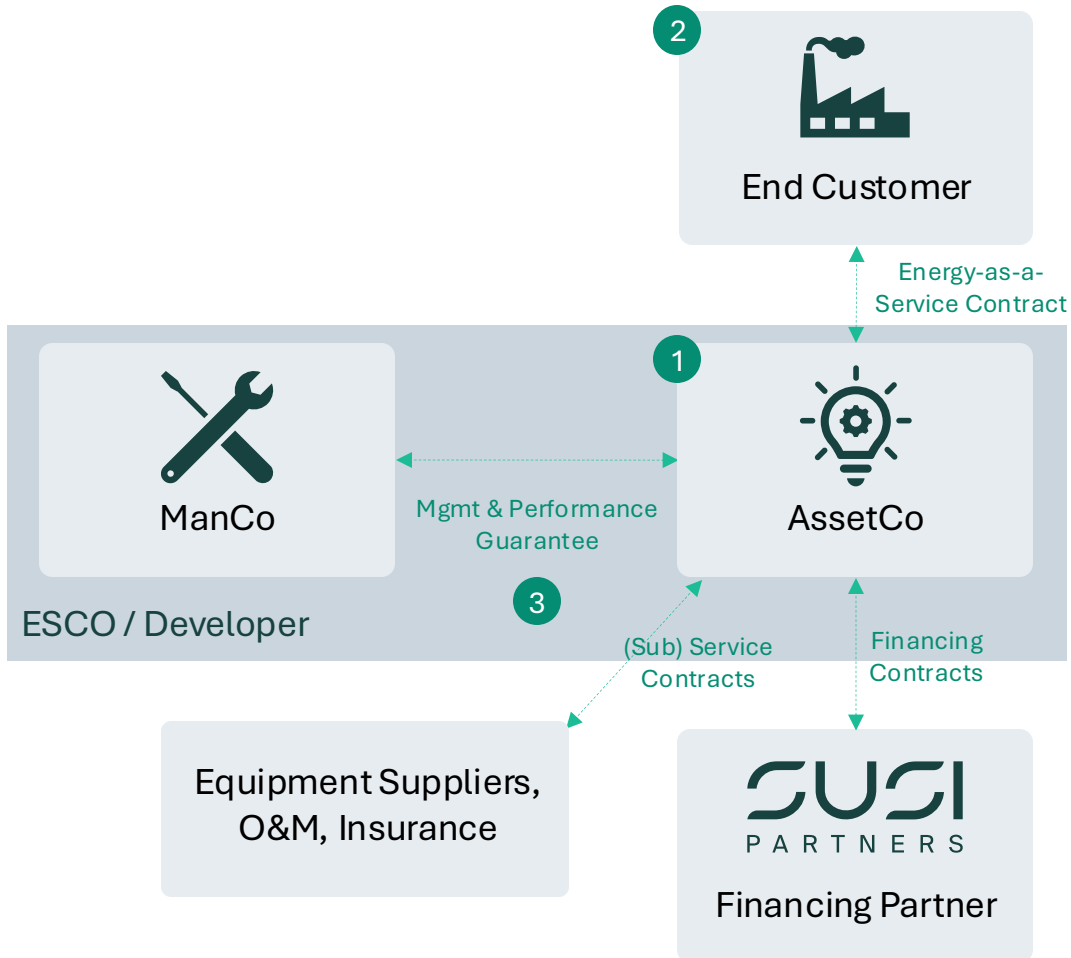
Mt of CO₂e Avoided

- 100% investment in businesses providing climate solutions
- Equity investments since 2010
- Credit investments since 2014
- Asia investments since 2021

*All data per year-end 2023 | ** in 2023



Source: SUSI Partners - for illustrative purposes only



1 Intrinsic Asset Value

- Proven technology
- Essential service
- Predictable, standardized and independent cash flows
- Structurally ringfenced asset value
- Moveable/residual value/enforceability

2 Credit Worthiness Service Offtaker

- Creditworthy rating offtaker / end-customers
- Credit history / track record

3 Other Stakeholder Default Risks

- Redundancy of service providers
- Replacement of ESCO (step-in rights)
- Back-to-back warranties with quality suppliers

Source: SUSI Partners - for illustrative purposes only

AIRTHIUM – a **scalable** heat pump that adapts to **any load**

Unparalleled

GWP-free, nontoxic, non-flammable working fluid: helium

Up to 86% of Carnot's efficiency

Patent-pending fast, near-isothermal compression technology

Safe, reliable and cost-effective design

No sliding seals, 10x cheaper heat exchangers

Hotter, Simpler

Heat supply Up to **550°C**

Heat lift Up to **300°C** per stage

Capacity **100 kW_{th} – 10 MW_{th}**

Versatile, Scalable

Very efficient even at high lift or part load

T _{source, in}	T _{source, out}	T _{sink, in}	T _{sink, out}	COP _{heatin}
85°C	65°C	206°C	212°C	2.2
16°C	12°C	206°C	212°C	1.8
135°C	115°C	154°C	160°C	3.4
165°C	145°C	250°C	300°C	2.4

Same hardware for most source/sink temperatures

Only the heat carrying fluid changes

→ **low cost, scalable**

Batch process compatible

Heats/cools products all the way to/from ambient

