

# Heat Transfer

Enabling the shift to liquid  
cooling and heat reuse

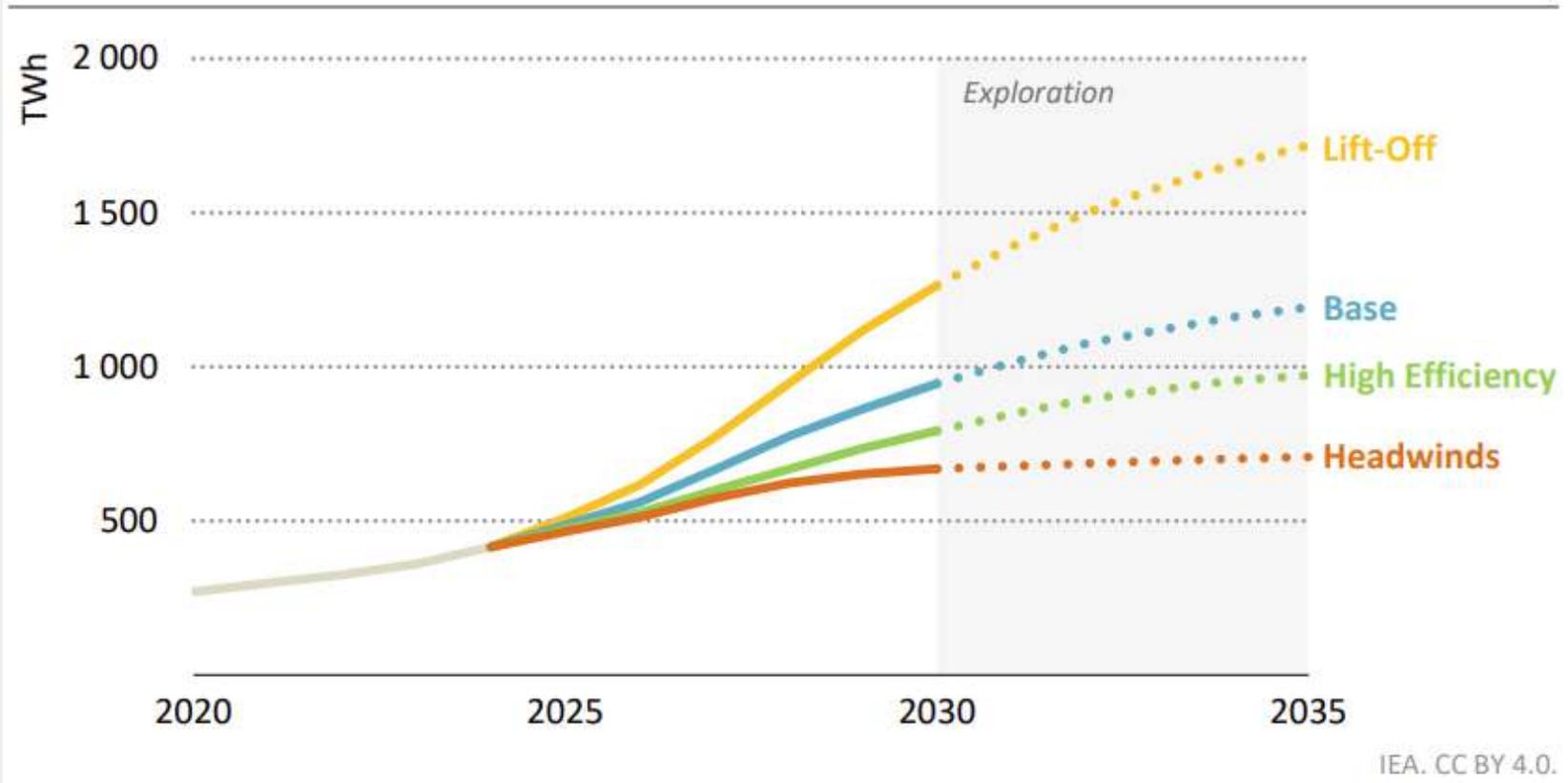
Gemma Reeves;  
Global Business Development Manager Data Centres



“Every Watt entering a data centre becomes heat and with rising power density, we must treat that heat as a resource.”

# Power needs are climbing.....

**Figure 2.14** ▶ Global data centre electricity consumption by sensitivity case, 2020-2035



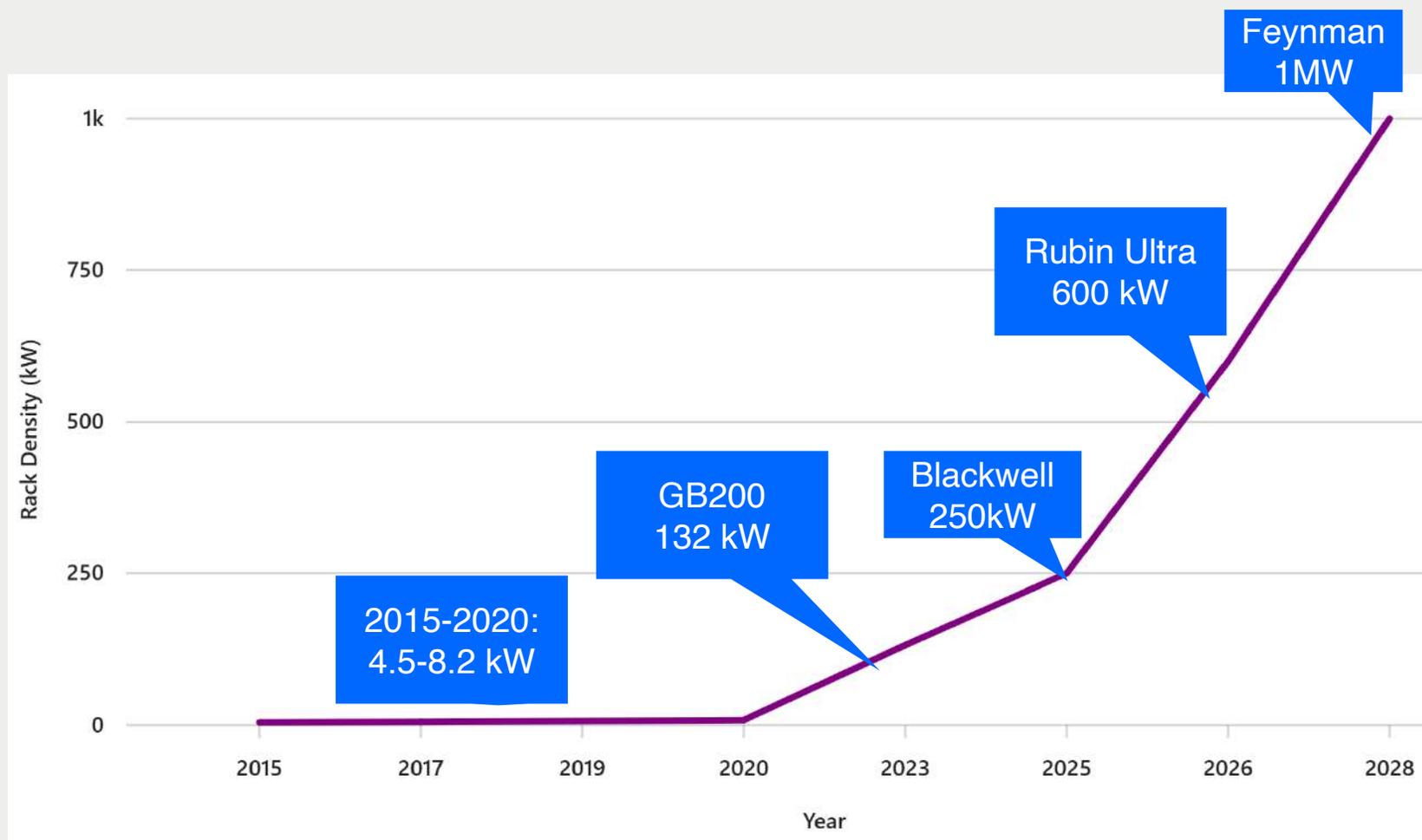
The outlook for data centre electricity demand is highly uncertain, driven by factors including efficiency improvements, AI uptake and potential energy sector bottlenecks

### Base case

- Total installed capacity reaches 225 GW in 2030.
- Including cooling efficiency improvements reaching 1000 TWh in 2030.
- DC's represent 3% of total global consumption.

# The AI Compute Revolution

Based on key GPU architecture milestones

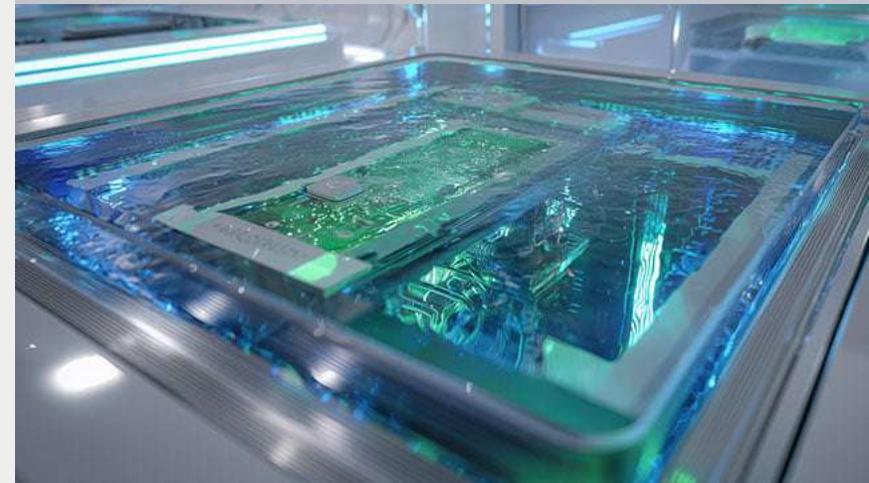
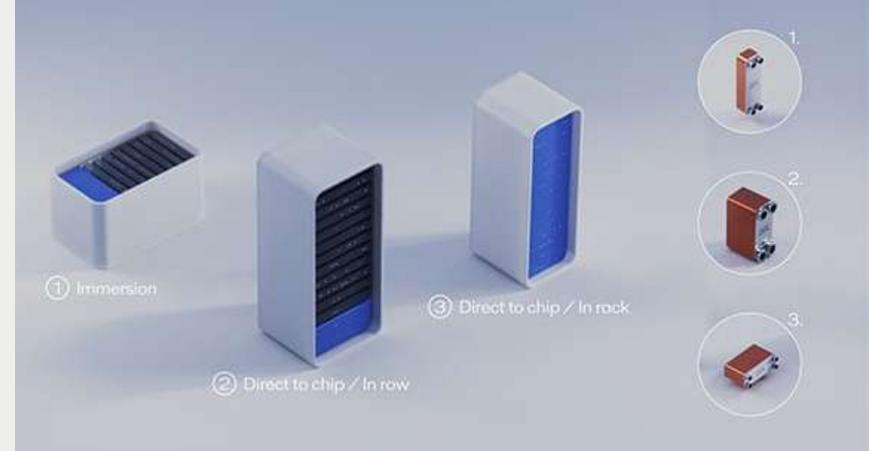


- Rubin Ultra has a heat flux which means power per unit of  $10^6\text{W}/\text{m}^2$ .
- Extreme heat flux levels, potentially exceed those found at the edge of a nuclear blast!
- Posing significant challenges for cooling and thermal management.

**90% of new AI will be liquid native by 2026**

# The Shift to Liquid Cooling

- Liquid transfers heat around 3,000 times more efficiently than air
- Effective performance
  - More power per rack
  - Less energy consumption from mechanical cooling
  - Maintain safe temperatures
  - Up to 48% lower energy use and operating costs
  - Extend equipment lifespan
- Liquid Cooling methods:
  - Direct-to-chip
  - Immersion cooling



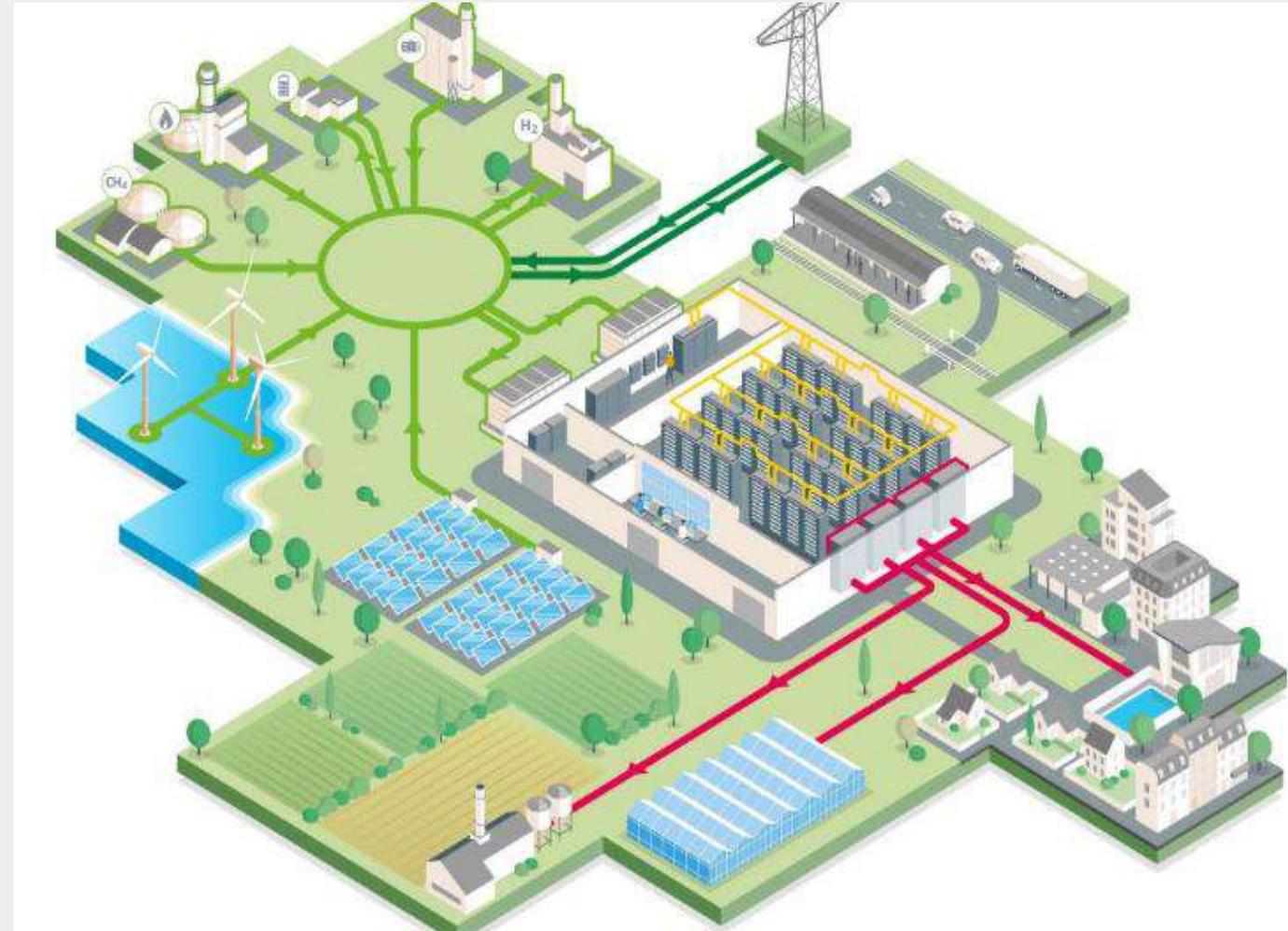
# Heat Reuse from Data Centers

“A data centre is a heat source, whether we use it or throw it away.”

- Almost **100%** of the energy used in data centers converts to heat energy
- Waste heat potential:
  - 20-30°C: Air systems
  - 45-55°C : DtC or Immersion
  - ~80°C from HPC
- Recovering heat from liquid is easier than air.
- Excess heat can be used in many different applications

## DC Benefits:

- Energy efficiency
- Cost savings
- Environmental impact
- Regulatory compliance & Enhanced reputation



# Heat reuse-COP

Why is heat capture and re-use so important?

The COP of a heat pump is directly affected by the amount of temperature increase the heat pump must achieve

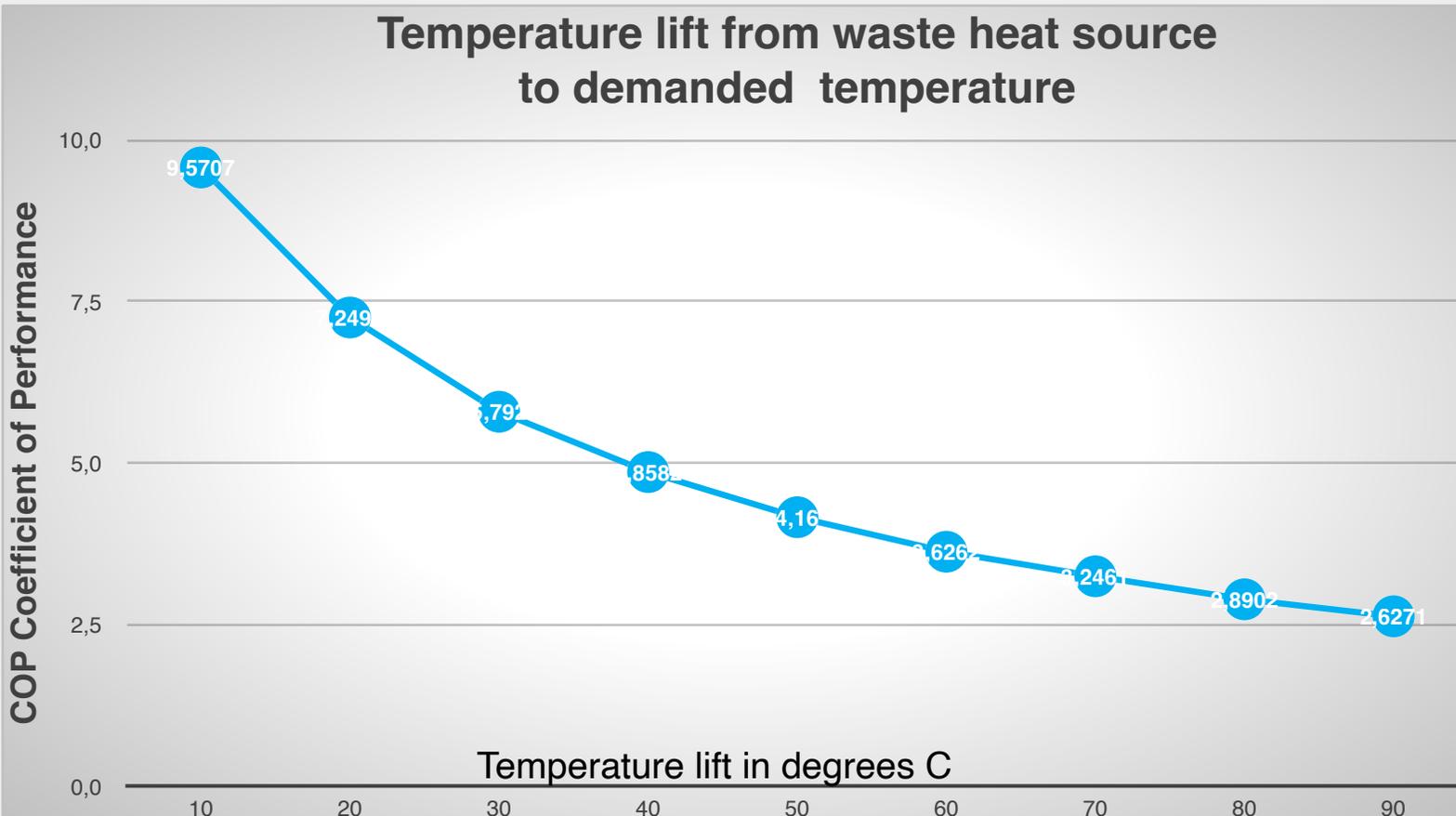
The greater the increase in temperature, the lower the COP of the heat pump

Air source or ambient temperature water source heat pumps results in lower heat pump COP's

**Higher waste heat temperature -> higher COP -> lower electricity use**

**Heat Source-to-Heat demand:  
1K lift reduction = 2% efficiency increase**

Temperature lift from waste heat source to demanded temperature



# Why Efficient Heat Transfer Matters

- Efficient heat transfer is the foundation of:
  - Liquid cooling loops
  - Reducing reliance on mechanical cooling systems
  - Improving PUE by lowering energy consumption
  - Unlocking Heat recovery
  - Supports stable cooling operation
- Without high-performance heat exchangers → no efficient heat reuse
- End-to-end liquid-cooling expertise; direct-to-chip, immersion, and facility water systems
- Scalable, ultra-efficient solutions for high-density, sustainable data centres.



# Energy efficiency potential in data centers

Data centers account for as much as 20% of the world's energy use, and 7% of the world's CO<sub>2</sub> emissions.

More than 35% of a data center's energy consumption comes from cooling the servers.

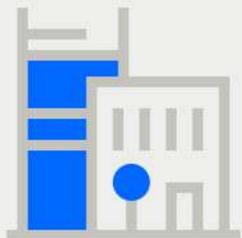


## Alfa Laval's contribution

### Yearly new installations

Every year, new Alfa Laval plate heat exchangers enable free cooling, reducing CO<sub>2</sub> emissions by 33,000 tonnes by saving 144 GWh of energy. That is enough energy to heat:

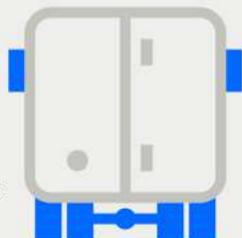
**10,000**  
American homes



### Total installed base

Annually, Alfa Laval heat exchangers provide a total of 530 GWh of energy savings through free cooling in data centers, reducing CO<sub>2</sub> emissions by 120,000 tonnes. to the amount of CO<sub>2</sub> emitted annually from:

**1,400**  
Heavy trucks



### Service potential

If all plate heat exchangers in the data center industry were serviced to optimize heat transfer efficiency, energy consumption could be reduced by 300 GWh per year, saving 86,000 tonnes of CO<sub>2</sub> – the same as the emissions from:

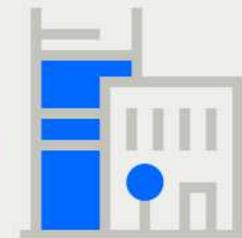
**280**  
Flights between  
London – Shanghai



### Imagine if...

...by 2030, all data centers utilized the waste heat from the servers. That would reduce CO<sub>2</sub> emissions by 680 million tonnes every year, while saving a combined 3,000 TWh. The energy recovered is enough to heat:

**300 million**  
European homes



# High-Performance Heat Exchangers in Data Centres

Conduction performance = system efficiency



## Plate heat exchanger facility positions

- As an interchanger with an open or closed cooling tower
- For sea water/lake/river/borehole cooling (incl. filters and pumps)
- For heat reuse connection and in heat pumps

## Plate heat exchanger white space positions

- In CDUs/CCDUs

# Service, Maintenance & Lifecycle Performance

“Efficient cooling and heat reuse rely on ongoing heat transfer performance and that requires proper service.”



Energy savings  
**50 GW**



Emissions reduction  
**25 MT**

**Did you know** that up to 2.5% of the world's CO<sub>2</sub> emissions could be prevented if heat exchangers performed optimally and were serviced regularly?

Annually **serviced heat exchangers** by Alfa Laval, reduce capacity needs by 50 GW. That is equal to production by 10,000 wind turbines in the same timeframe.

50 GW is about 25 million tonne **CO<sub>2</sub> reduction**, or the carbon emitted by London every year.

# Certified Performance

Protect capacity and energy budgets

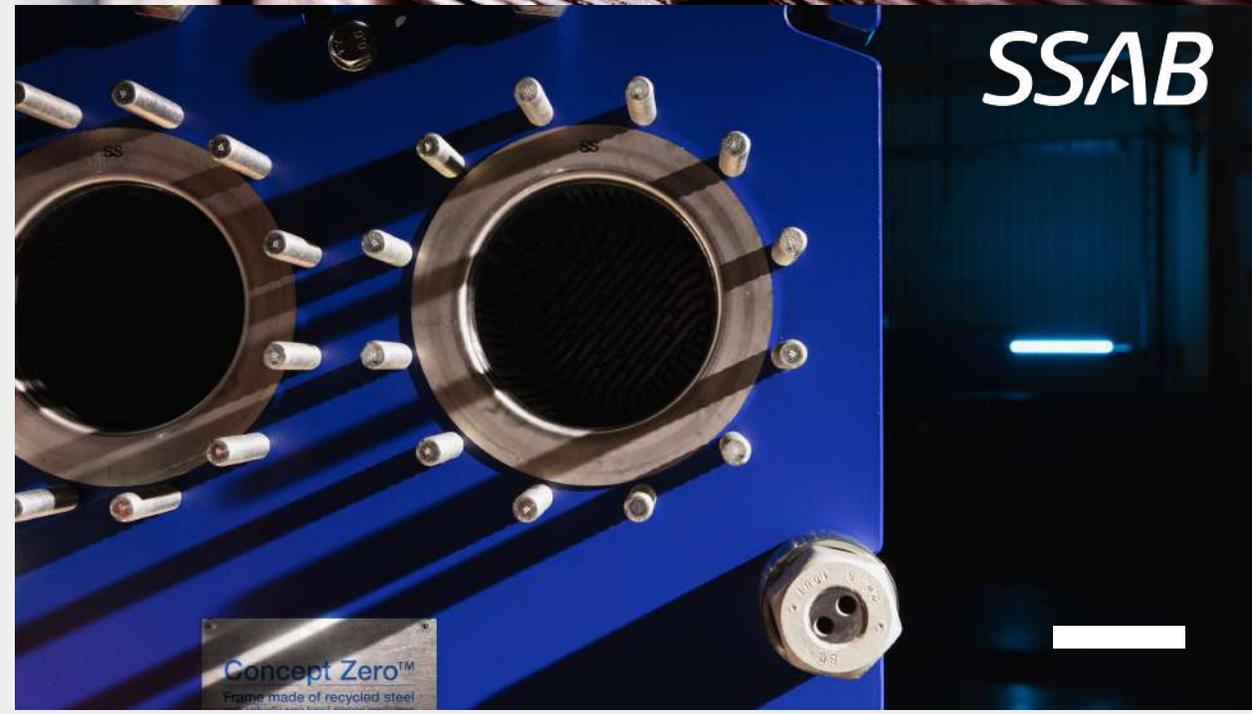
- AHRI is a global certification programme
- Guarantees thermal performance and reduces operational risk
- Easy to compare quotes based on real performance
- No additional cost
- Underperforming exchangers = major hidden cost
- Easy to specify:  
Heat exchangers shall be performance certified in the AHRI Liquid to Liquid Heat Exchangers Certification Program”.



# Advancing Carbon Neutrality

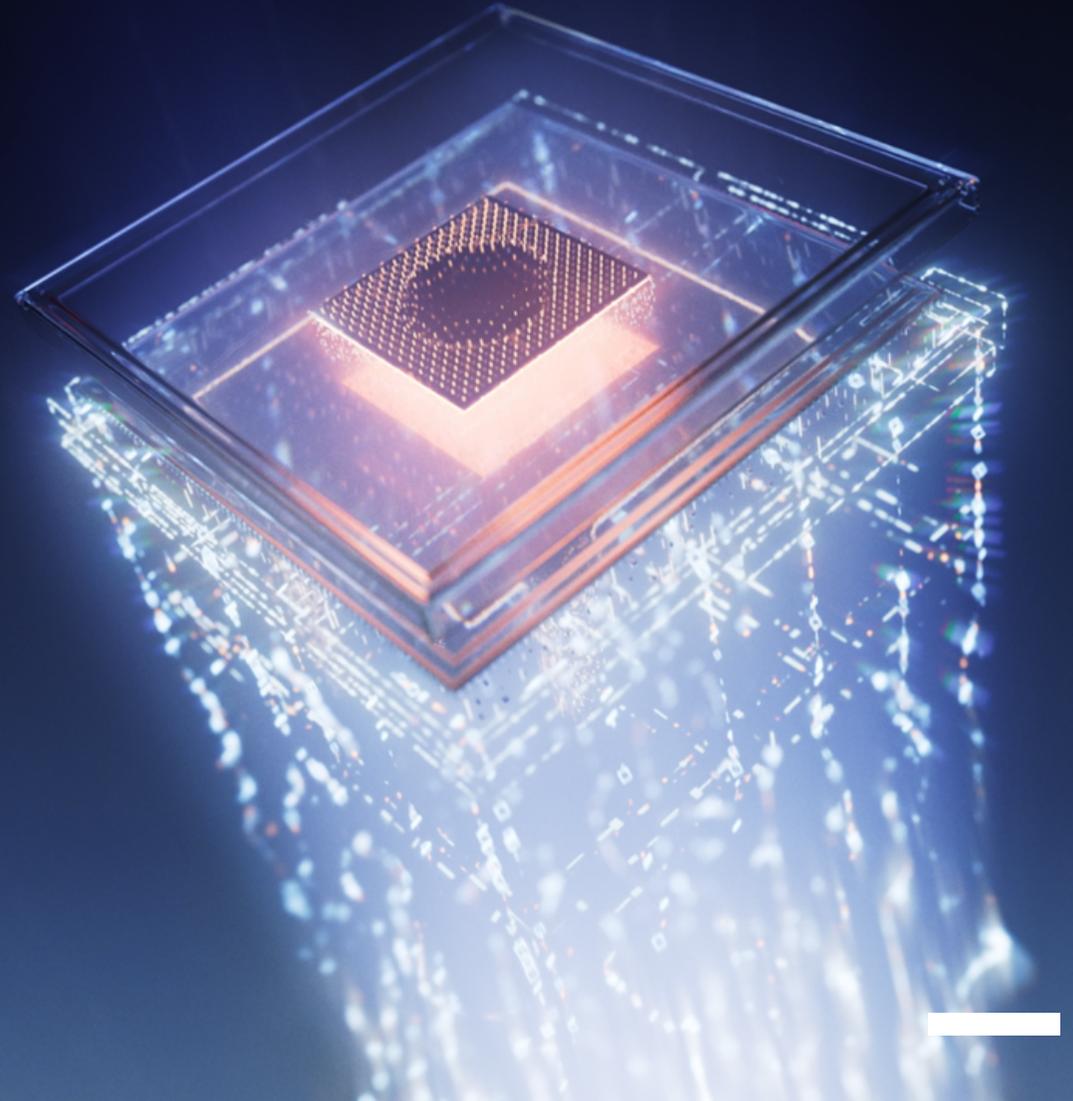
## Concept Zero & Low-Carbon Copper

- Partnership with Boliden to produce heat exchangers with a reduced carbon footprint.
- Key step in Alfa Laval's journey toward net-zero by 2030.
  
- The world's first heat exchanger made using fossil-free steel via partnership with SSAB.
- Gaskets made from recycled materials
- Designed for easy end of life recycling.
- Delivers over 40% CO<sub>2</sub> reduction.
- Major milestone toward a fully carbon-neutral heat exchanger.



# Summary

- Power density is skyrocketing → liquid cooling is becoming the new standard.
- Liquid cooling produces valuable heat → heat reuse is essential.
- Efficient heat transfer enables both, and together with a strong sustainability focus, Alfa Laval leads in performance and lifecycle reliability.



“If we want sustainable data centres, we must stop wasting the heat they generate and put it to work”

