

Sustainable Data centers with efficient heat transfer

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Our presenter



Anna Blomborg, Industry Manager Data centers, has been working for Alfa Laval for more than 20 years. She holds a Master Degree in Mechanical Engineering and has many years of experience in business development of heat transfer solutions. For the last 8 years she had been responsible for Alfa Laval solutions for cooling and heat reuse to Data centers specifically.

Agenda



- 
- A photograph of a modern data center with glass-walled server racks. The racks are filled with server units and are arranged in a long corridor. The background shows lush green trees, suggesting a sustainable and natural environment.
- The sustainable Data center
 - Heat exchangers in the Data center
 - Sustainability improvements
 - Design for lifetime performance
 - Liquid cooling
 - Heat reuse

Alfa Laval at a glance (based on “Annual report 2021”)

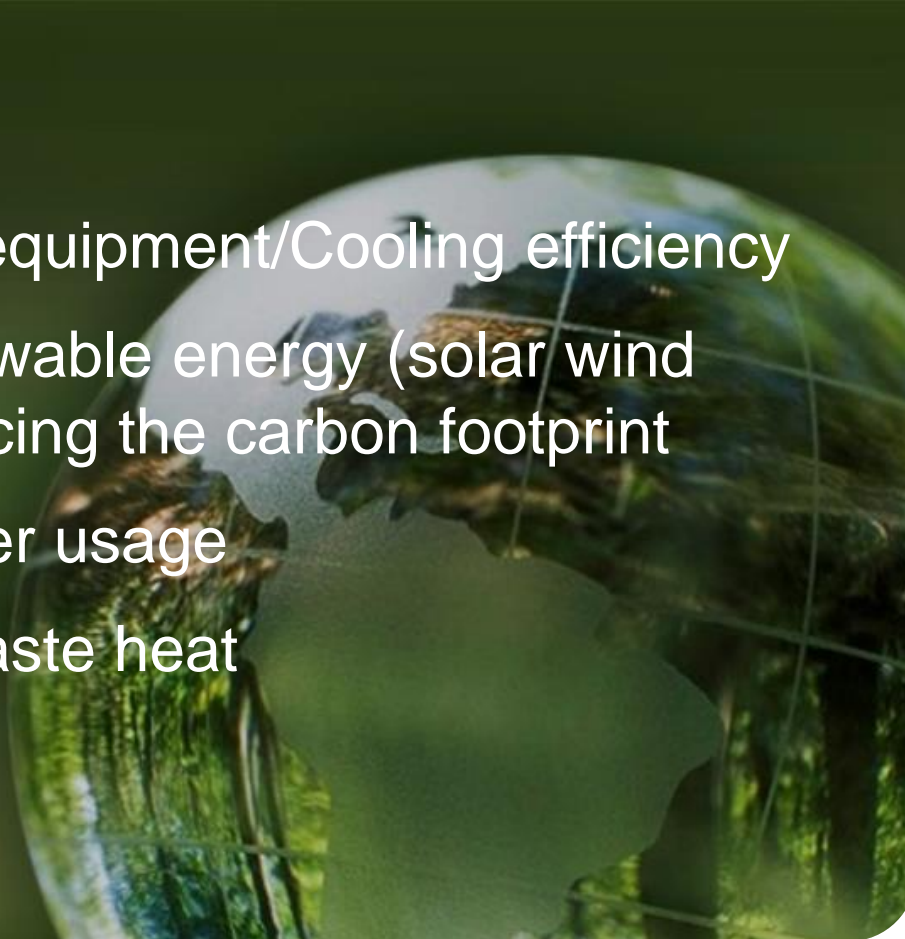


A sustainable data center

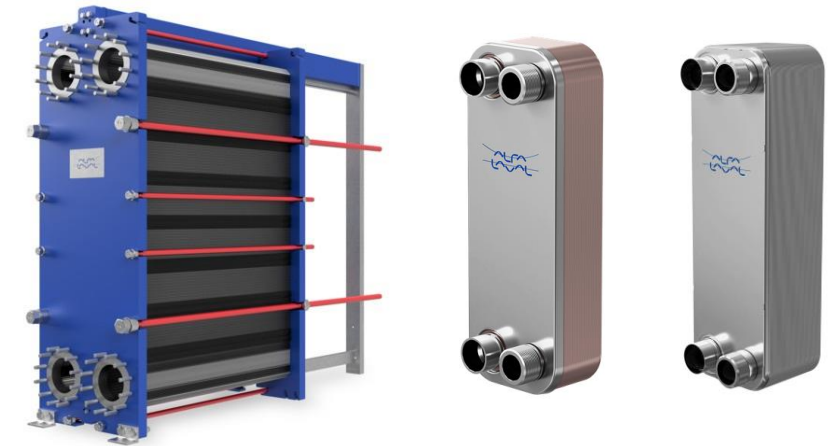
– Main focus areas



- Efficient IT equipment/Cooling efficiency
- Clean, renewable energy (solar wind hydro) reducing the carbon footprint
- Limited water usage
- Re-using waste heat



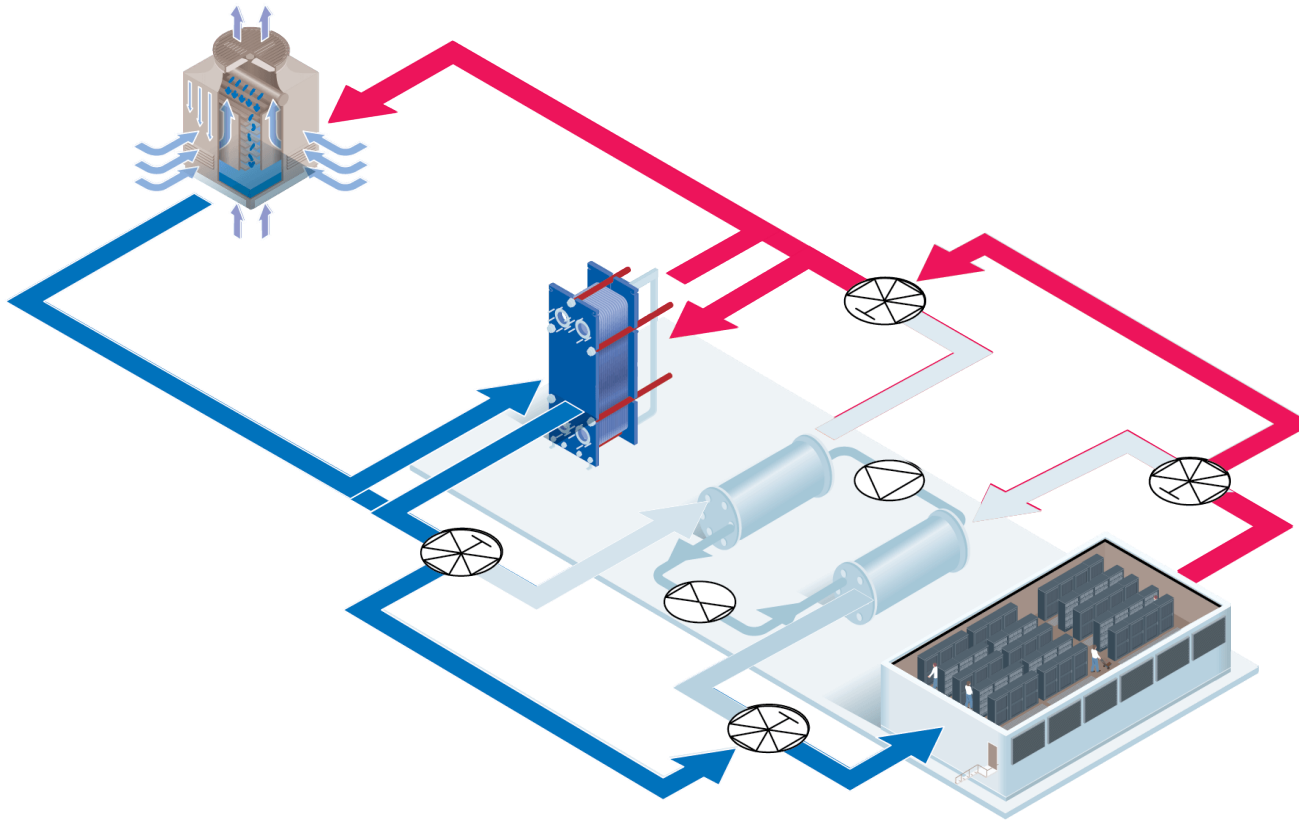
Heat exchangers in the Data center



- Free cooling with water
- Free cooling with air (dry/adiabatic)
- Liquid cooling
- Heat recovery
- Cooling tower interchanger

Cooling tower interchanger

Chiller protection & chiller by-pass for extended free cooling



The role of the heat exchanger

- Fouling protection
- Volume isolation
- Different pressure circuits
- **Chiller by-pass**

Cooling tower interchanger

Sustainability savings



Rolf Jönsson/15-Apr-21/12:02AM
Lund Sweden
Application: Chiller protection by-pass cooling tower




Chiller protection by-pass cooling tower

Cooling capacity	10000 kW
Chiller COP	5 COP
Chiller Capacity	2000 kW
Annual running time chiller	4380 Hours
Annual energy Cooling	8760000 kWh
Monthly energy Cooling	1440000 kWh
Annual IT Energy	13140000 kWh
Annual Total Energy usage	21900000 kWh

Assumption - number of month chiller by-pass
Saved chiller energy for period
Cost saving in electricity 0.1 Euro/kWh

	1 month
	1440000 kWh
	144 kEuro

PUE without chiller by-pass	1,67	
PUE with chiller by-pass	1,56	
Reduction of PUE	6,6 %	

CO2 Saving (229g/kWh)	330 Ton CO2	
Reduction of CUE	6,6 %	

1 mm coating of CaCO3 can cause >20% reduced heat transfer efficiency for the chiller condenser.

Every 1°C higher condensing temperature is 1.5% higher running costs.

WUE	1,8	
Reduction of water usage with 20%	1,44	
Saved volume of water	0,36 L/kWh	
Saved volume of water per year	4730400 L	
Saved volume of water per year	4730,4 m3	
Olympic pool 50x25x2	2500 m3	
Saving in no of Olympic pools	1,9	
5 min shower = 50 l How many showers?	94608 5 min showers	

PUE



-7%

Improved PUE
Reduced electricity usage
Lower cost

CUE



-7%

Improved CUE
Reduced carbon footprint

WUE



-20%

Improved WUE
Less water consumption
Lower cost



The key to sustainable data center cooling:

Alfa Laval plate heat exchanger technology >



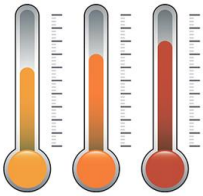
Design considerations

– Good to know before finalizing your specifications



Data center cooling is not HVAC cooling. Demand more!

Bigger is not better!



- **Temperatures:**
 - Consider seasonal variations and evaluate need for temperature approach
 - 0.5 degrees difference can double or half your footprint!
 - **Flow rates** – plate heat exchangers work best with similar flow rates on each side



Turbulence is key!

- **Fouling** – do NOT apply Shell & Tube fouling factors
- **Pressure drop** – the lower available dP, the larger the heat exchanger



Specify AHRI certified units for guaranteed performance

AHRI performance certification



– The only way to be sure that you get what you specify!

- AHRI is a global certification programme for Liquid-to-liquid plate heat exchangers
- Guarantees thermal performance
- Gives you the opportunity to compare quotes based on real performance



How does it work?

- AHRI randomly tests a number of PHE models from each supplier every year
- Lab tests verify that the software ratings are within the certification programme's tolerances
- Failure to comply lead to rerates and exclusion



How to get AHRI certified heat exchangers



– Add this to your specifications

*One sentence is enough:
"Heat exchangers shall be
performance certified in the AHRI
Liquid to Liquid Heat Exchangers
Certification Program".*



Free of charge!

Performance throughout the life-cycle

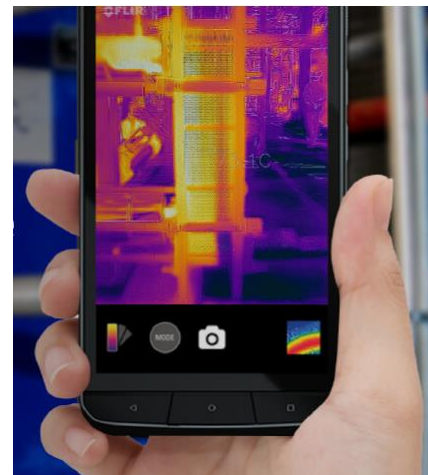
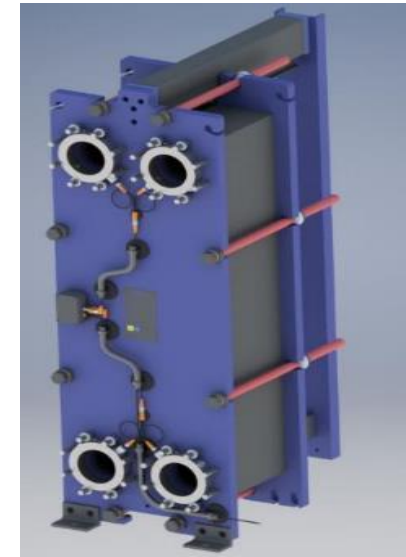


The Basics:

- There is no such thing as clean water!
- Keep flow rates at design conditions
- Do not open the heat exchanger for inspection unless necessary

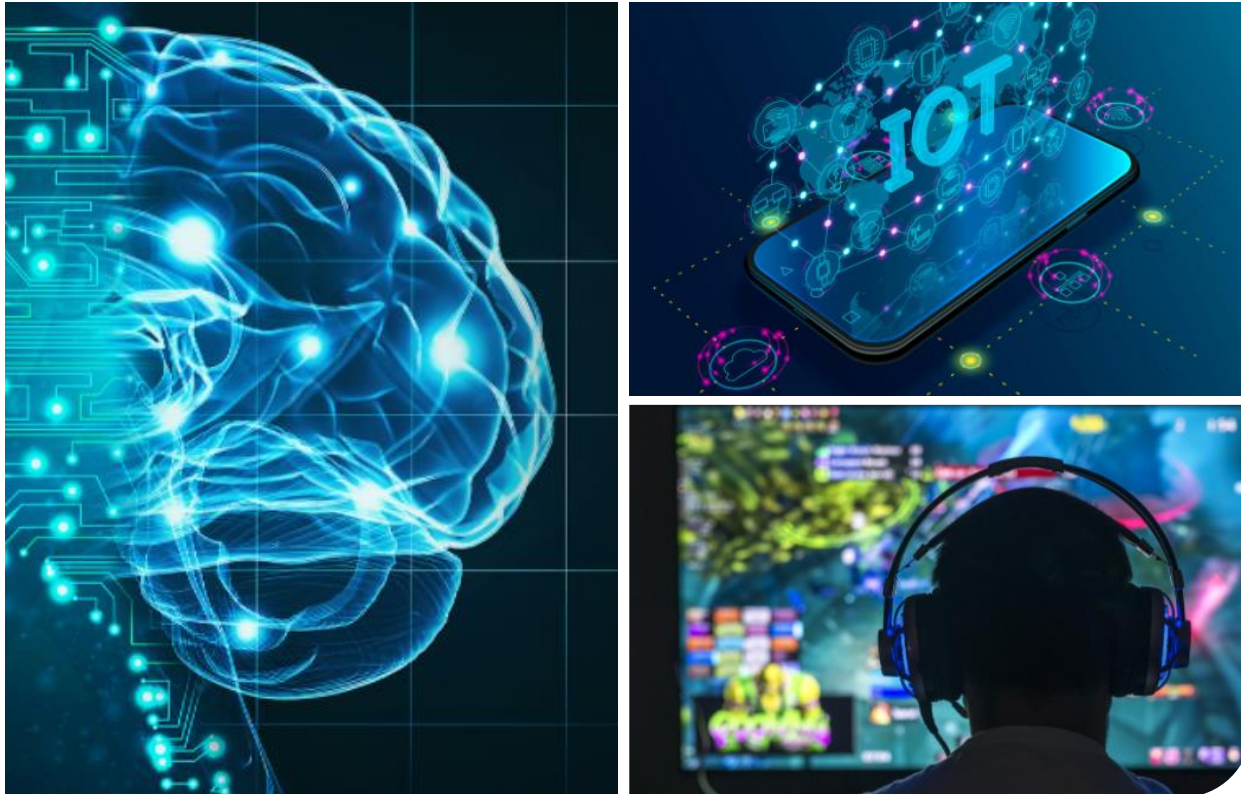
Solutions:

1. Preventive maintenance
 - Backflushing and/or Cleaning-in-place
 - Use filters
2. Monitoring the performance
 - Visual condition assessment
 - Connectivity
3. **Utilize our experts and service centers**



Liquid cooling

– The future of data center cooling or?



Driven by high demand applications:

5G, AI, IoT, Internet of Vehicles, Augmented/Virtual reality, e-sports, cryptocurrency mining, online gaming/gambling etc.

For these applications it will not be enough to use air to cool the servers

We are keeping a close watch on the development of liquid cooling and are ready for any choice of technology

Heat exchangers in Liquid cooling systems



– Small and compact, for single phase or two-phase

Direct-to-chip



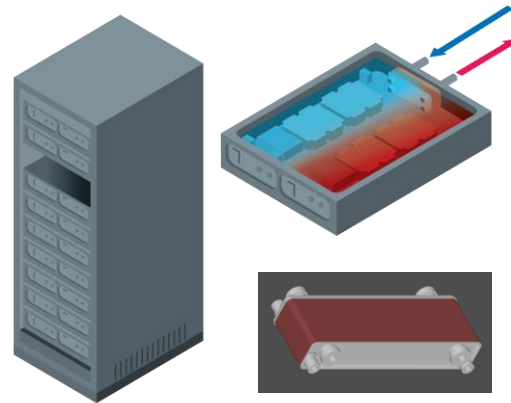
The cold plate is attached to the CPUs/GPUs, the fluid (1 or 2phase) removes the heat.

Power Density
30KW

Applications

Telecom, edge, retrofit for higher density

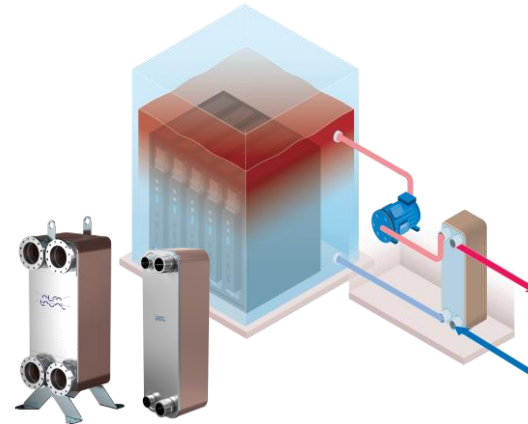
Immersion Chassis



The servers are fully or partially immersed in a dielectric liquid coolant covering the board and the components.

Power Density
50KW

1-phase immersion (tank)



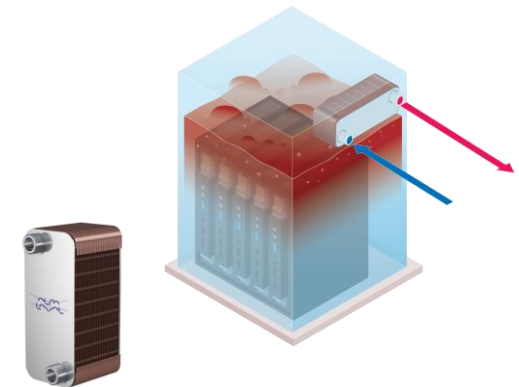
The servers are fully immersed in a dielectric liquid coolant.

Power Density
60KW

Applications

Blockchain, edge

2-phase immersion (tank)



The servers are fully immersed in an evaporating fluid, that removes the heat.

Power Density
120kW

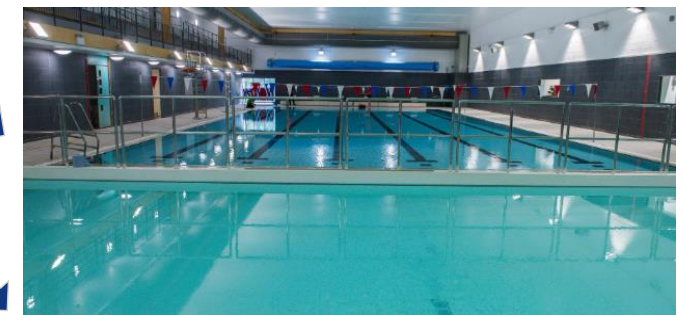
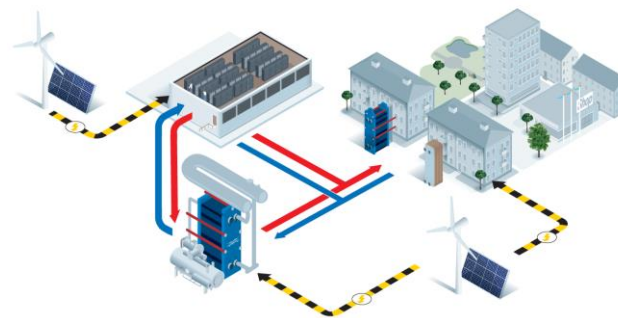
Applications

AI, IoT, HPC

Heat reuse

- **98%** of the energy used in data centers **converts to heat** energy
- Recover heat with as high temperature as possible – liquid cooling provides **high grade heat**
- Low temperature waste heat can also be recovered – **heat pumps**
- Waste heat can be used in **many different applications** – not only for district heating!

Temperature
Capacity
Location
Legislation/Tax



Alfa Laval Carbon Neutral 2030 statement



Alfa Laval is committed to the Paris Agreement!

With the wide product portfolio for energy efficiency and dedicated work to reduce our carbon footprint, we aim at being carbon neutral by 2030.

This means that:

- In line with the GHG protocol our targets are:
 - Net-zero emissions from Scope 1 & 2 by 2030
 - Reduce our Scope 3 emissions by 50% (baseline 2020) by 2030 in line with the Paris Agreement
- We expect our actions to reach the targets, and that this, together with our energy-efficiency offerings, will bring us to carbon neutrality by 2030
- The roadmap is dependent on the projected development in energy mix change



Efficient heat recovery means savings from all sides

– Alfa Laval, Lund, Sweden



Since 2013, an Alfa Laval factory in Lund, Sweden has had an ammonia heat pump installed, equipped with our own efficient plate heat exchangers. Low temperature waste heat from the component production process is the source of energy. The system covers nearly the entire heating and hot water requirements for the factory and Alfa Laval's corporate headquarters.



3,700 MWh
Energy savings



140 tonnes
Emission savings



Cost savings

Concept Zero – carbon neutral heat exchanger by year 2030

The worlds' first heat exchanger made using fossil-free steel and recycled materials



Concept Zero is our vision and target to produce the world's first carbon neutral heat exchanger by 2030. It will be made using fossil-free steel from our partnership with SSAB and with recycled material in the gaskets. The heat exchanger will also be easy to recycle.

Concept Zero means a CO₂ reduction of over 40%, which is a huge step on our journey towards a fully carbon neutral heat exchanger.

SSAB



Energy savings



Resource savings



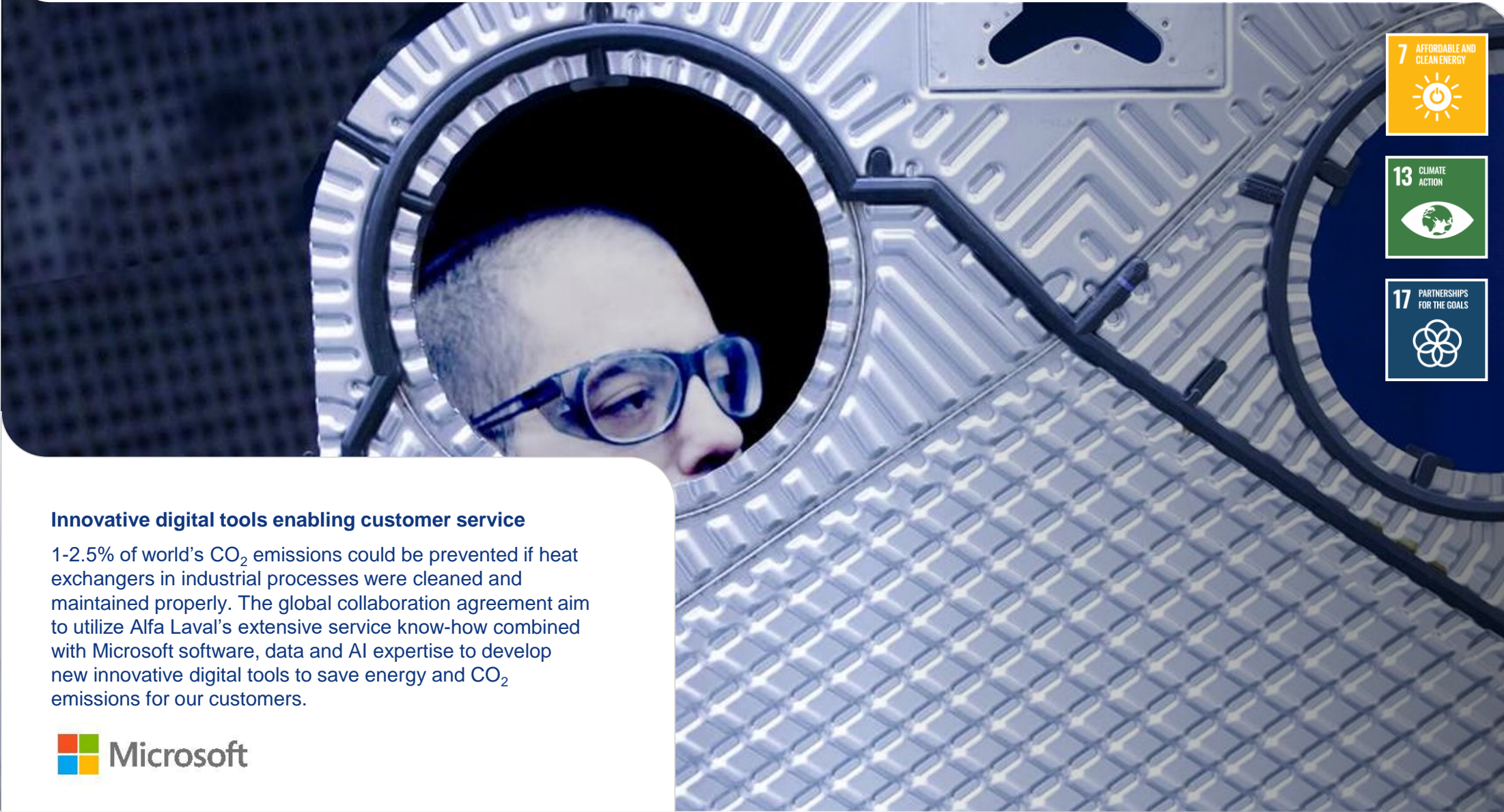
Emission savings

[READ MORE >](#)

Digital solutions contribute to save 2.5% of the world's emissions



Global partnership agreement with Microsoft to develop digital solutions



Energy savings



Scalability



Reduce cost

Innovative digital tools enabling customer service

1-2.5% of world's CO₂ emissions could be prevented if heat exchangers in industrial processes were cleaned and maintained properly. The global collaboration agreement aim to utilize Alfa Laval's extensive service know-how combined with Microsoft software, data and AI expertise to develop new innovative digital tools to save energy and CO₂ emissions for our customers.



[READ MORE >](#)

Exchange programme to increase energy efficiency and save resources



A circular partnership between Stena Recycling and Alfa Laval



Energy savings



Resource savings



Emissions savings

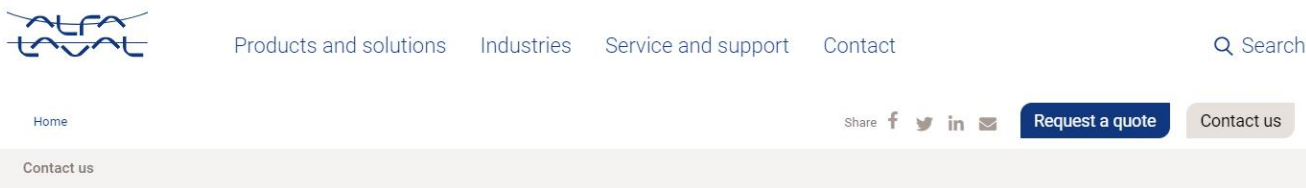
A exchange programme for heat exchangers that allows the owner to upgrade to a new plate heat exchanger and get a refund for the old equipment.

It enables us to recover as much as 100% of the valuable metals and install improved energy efficiency with reduced carbon footprint.



[READ MORE >](#)

Want to know more?



Data center cooling

Energy efficient cooling is critical to building more sustainable data center operations. Alfa Laval has been a trusted partner to the IT industry for decades, working with customers to design reliable, environmentally friendly data center cooling systems. With 80+ years' experience in thermal technology, we offer expertise to enable new opportunities for free cooling and energy savings in server rooms of all sizes, all around the globe.

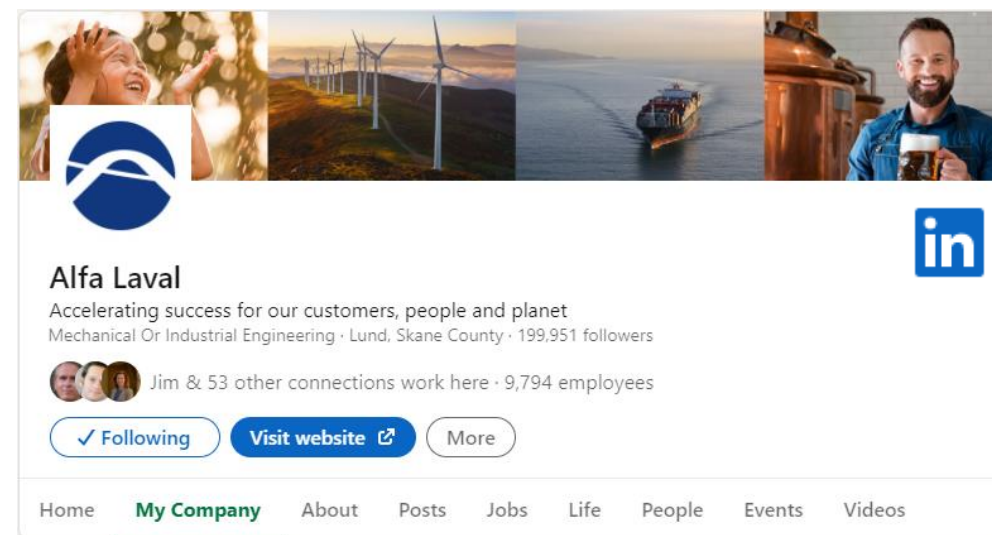


Efficient and reliable technology: that is what we do

Unique expertise to ensure dependable sustainability over time

- Visit our industry pages
www.alfalaval.com/datacenter

- Connect with us on LinkedIn



Thank you for listening!



Questions?

