

Pioneering positive impact

Alfa Laval's decarbonization toolbox

24 July 2024 (Wed.), 3.00pm - 4.00pm GMT+8

Rajesh Madhavan
Alfa Laval Singapore

Alfa Laval Together for sustainable shipping

– Video



Whether you sail ships or build them, we can help you meet the challenges of today and tomorrow.

From optimizing energy efficiency to navigating the fuel shift and environmental regulations, we offer innovative solutions for a wide range of applications and fuel types.

We accelerate decarbonization, digitalization and create synergies between your operations to save you time and resources. At sea or in port, on board or online – Alfa Laval is your trusted partner for a sustainable future.

- [Marine Division Brand Film 24_ENG SUB.mov \(alfalaval.com\)](#)

Webinar Agenda

1 **Waste heat recovery system**
Aalborg Micro boiler & economizer

2 **Power from waste heat**
E-PowerPack ORC

3 **Fresh water generation**
AQUA Blue E2

4 **Fluidic air lubrication**
OceanGlide

Presenter

– Credential's



- Rajesh Madhavan leads Sustainability solutions in Alfa Laval for Southeast Asia Market.
- He is strategically working with customers and industry stakeholders to meet decarbonization goals and assisting energy transition journey.
- He has 15 years of experience in the shipping industry with engineering background. Prior to this role in Alfa Laval, he led After sales & service department in Southeast Asia.
- His experience spans various maritime companies focusing on digitalization and worked with broad range of marine equipment's. He is actively involved in decarbonizations discussion in Southeast market.



From bow to stern

- 100 years in the marine industry





Lowering greenhouse gas emissions and energy efficiency at the center of attention.

As the regulations tighten and the demands increase, what is your strategy for meeting them?

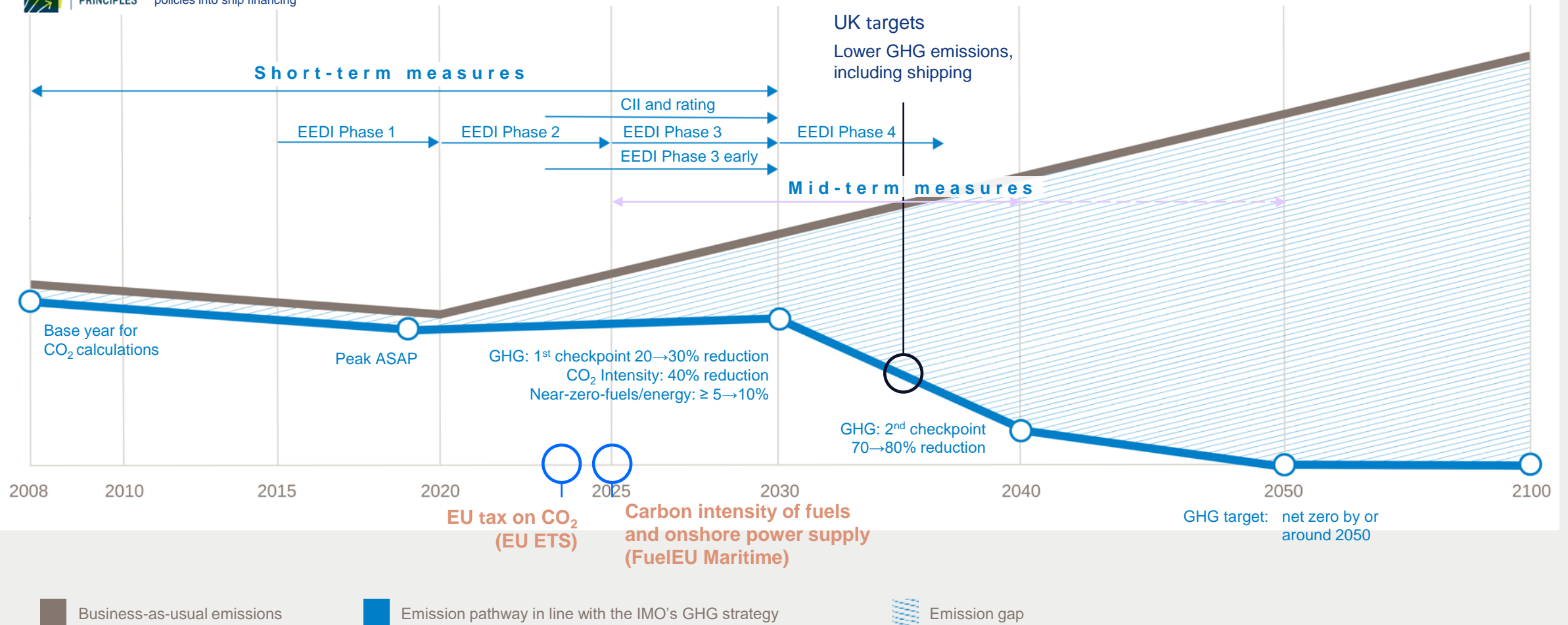
Regulatory developments

– Assessment of mandatory CO₂ reduction measures



POSEIDON PRINCIPLES

To integrate IMO climate change policies into ship financing



How Alfa Laval contribute on this journey?



Improve Energy efficiency:

I. Slow steaming

II. Operational efficiency

III. Waste heat management

IV. Propulsion efficiency

- Diverse range of energy-saving solutions supporting different energy saving paths
- Equipment improvements to reduce energy needs or boost its recovery
- Bringing efficiency into vessel operations to help save fuel & reduce emissions
- Process optimization, upgrades & retrofits

Maximizing energy efficiency of vessels

– Our portfolio supporting energy savings and efficient operations

Slow Steaming



Fresh water generation AQUA Blue E2

- Significant savings through efficient use of electrical power and waste heat

Operational efficiency



Heating and cooling Plate heat exchangers

- High heat transfer rate for maximum efficiency



Cargo Pumping Systems ★ Aframax & LR cargo pumping system (large tankers)

- Upto 80% fuel saving for every cargo discharge & up to 60 metric tons of fuel savings per voyage

Waste heat recovery & reuse



Waste heat recovery Aalborg Micro boiler & economizer

- Up to 45-50% heat recovery from exhaust gas
- Significant fuel savings, improves CII



Power from waste heat E-PowerPack

- Electricity from waste heat, up to 200 KW net power output. Significant fuel savings & improves CII, EEDI/EEXI

Propulsion efficiency



UPCOMING

Wind propulsion Oceanbird

- 7-10% emission reduction per wing
- Improves CII, EEDI/EEXI
- Expected retrofit in 2025



Fuel oil cleaning Flow Sync

- Synchronizing fuel flow to separators with actual engine output to save electric pumping



StormGeo Digital Solutions s-Routing & ★Planner

- Onboard route optimization tool with ENC
- Seakeeping tool for avoiding cargo loss

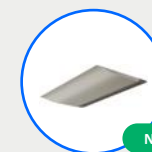


Tank management solutions ★

- Energy saving by reducing heated water requirement



Minimizing fuel consumption by using operational & technological advancements



NEW

Fluidic air lubrication OceanGlide

- Significant propulsion power savings, reduces CO₂ & improves CII, EEDI/EEXI

Waste Heat Recovery

Summary



A large portion of fuel energy is wasted through the exhaust gas.

Alfa Laval boiler technology recovers a proportion of this waste heat from exhaust gas – from both main and auxiliary engines.



Utilization of the heat in **exhaust gas from auxiliary engines** to generate steam during port operations, anchorage and for some vessels - also during voyage.

Significant reduction of the oil consumption for the oil-fired boiler(s) and thereby provide operational savings and not least improving the environmental profile of the ship and company.



The Boiler (Economizer) models

– Different designs to suit your requirements



Smoke Tube



Aalborg XS-2V/7V
After main and auxiliary engines



Aalborg XS-TC7A
After auxiliary engines

Water Tube



Aalborg Micro
After auxiliary engines

Types of WHR system

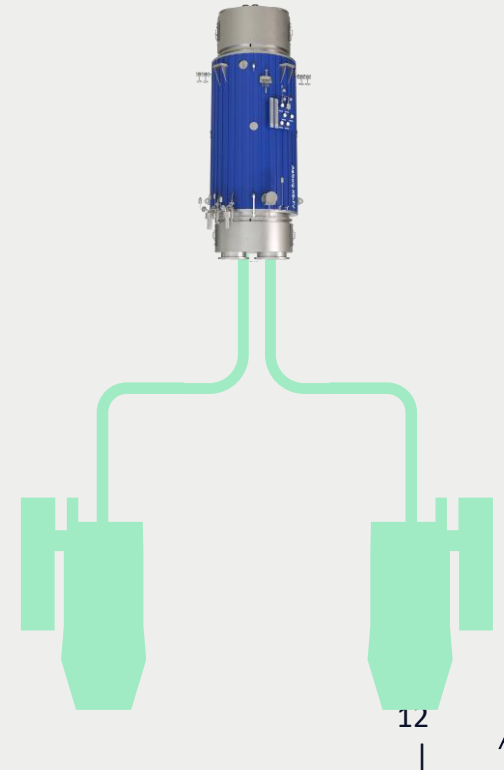
Micro Boiler :

- One to One with Aux engine, Compact, lightweight and small
- Standardized design, water tube boiler (Coiled fin tubes)
- Once installed, system start-up is smooth – just plug and play



XS 2V/ 7V : Dual Inlet Boiler

- Handle two engines in one boiler -> reduced CAPEX
- Smoke Tubes (Straight tubes), Easy to repair and retube
- Low system complexity – no need for separate control panel



Business Cases - WHR



Vessel Type	Capacity	Aux Engine	Fuel Savings	ROI
Container	10,600 TEU	01 x 4.500 MW , 1 x 3.000 MW	900 Tons	2 yrs
Container	3800 TEU	03 X 1.300 MW	200 Tons	2.5 yrs
Bulk Carrier	176000 DWT	03 x 0.800 MW	120 Tons	3-4 Yrs
Chemical Tanker	35,976 DWT	03 x 750 kW	150 Tons	3 Yrs

**Fuel savings
per day
From oil fired boiler
operation**

Alfa Laval E-PowerPack ORC

– Converting Excess Steam into Electrical power



Meet sustainability requirements by turning your vessel's waste heat into electrical power with proven Organic Rankine Cycle (ORC) technology.



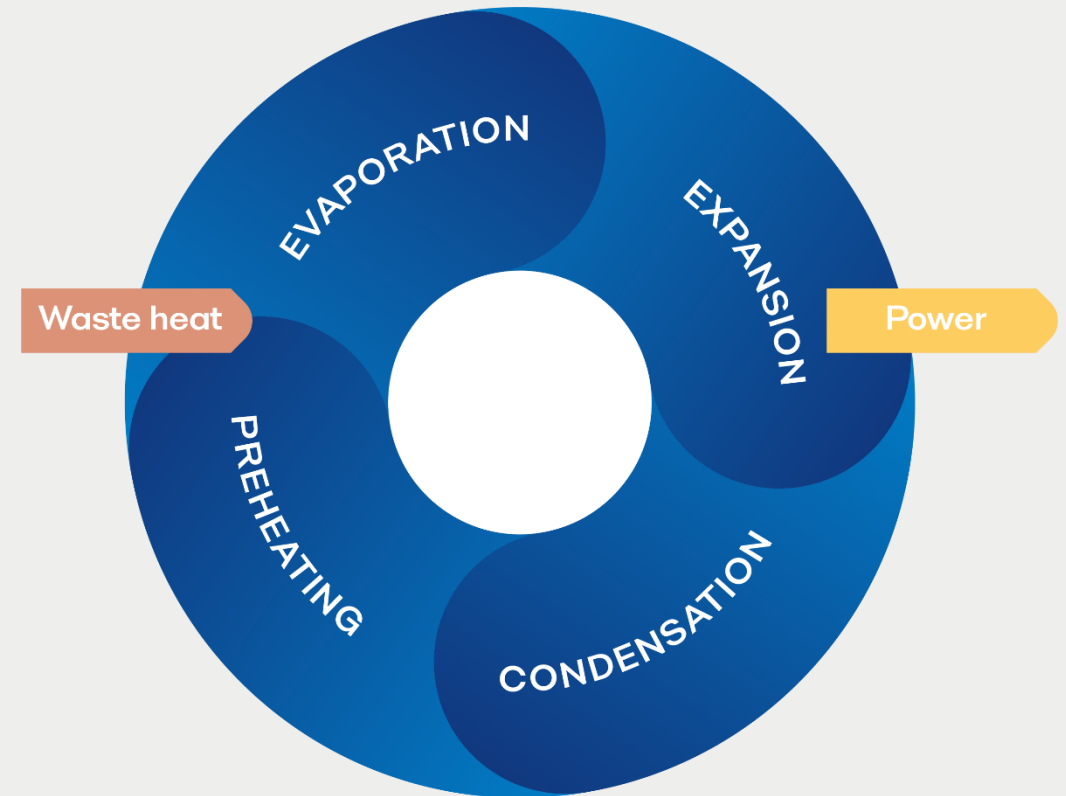
ORC technology makes it possible

– Proven and versatile power generation



Organic Rankine Cycle

- Similar to a traditional steam cycle but based on an organic fluid with a lower boiling point
- Enables production of electricity from relatively low-temperature heat sources
- Used for decades in land-based applications, e.g. geothermal power



Introducing the Alfa Laval E-PowerPack



From waste heat to free electricity

- Continuous power generation using a wide variety of heat sources
- Power straight into the vessel grid
- Up to 30% lower auxiliary engine load
- Every kW visible and recorded = tangible proof of efficiency

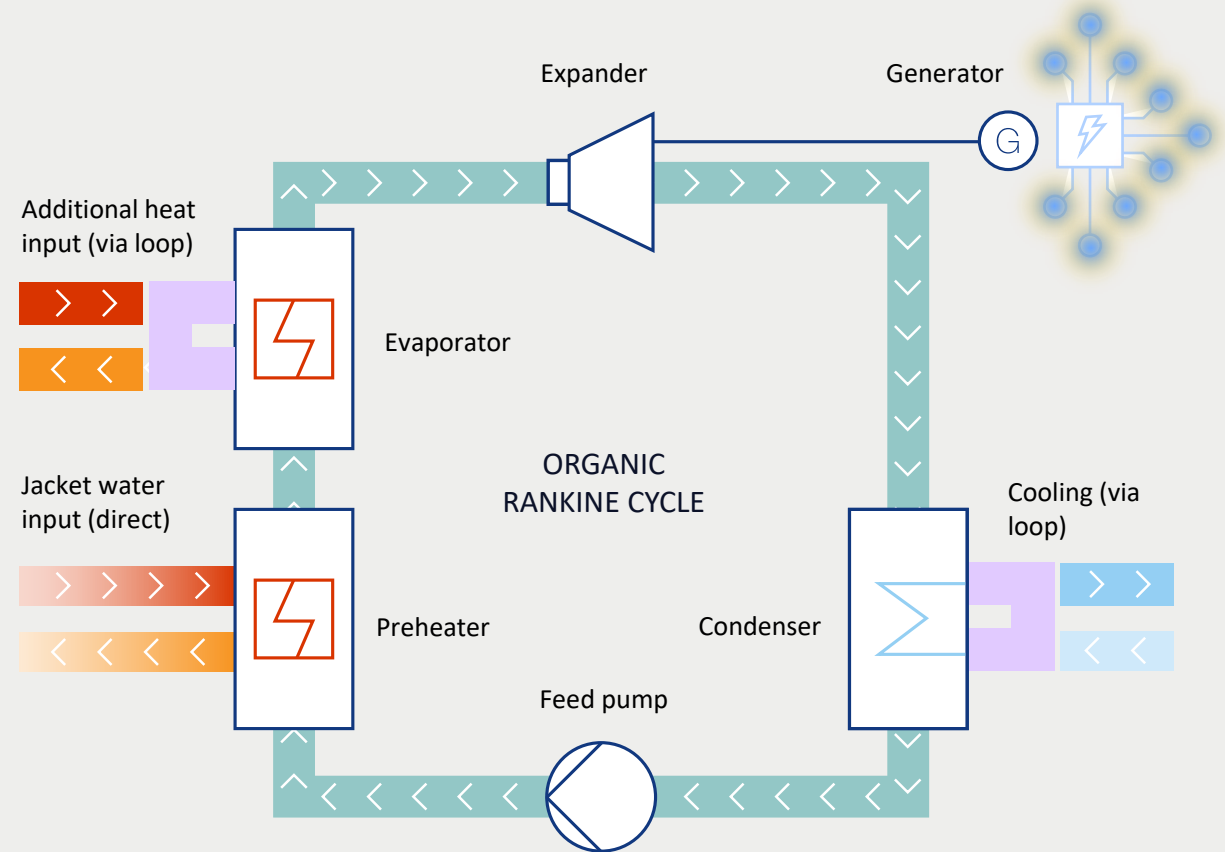


In principle – the ORC process



– A closed, continuous system

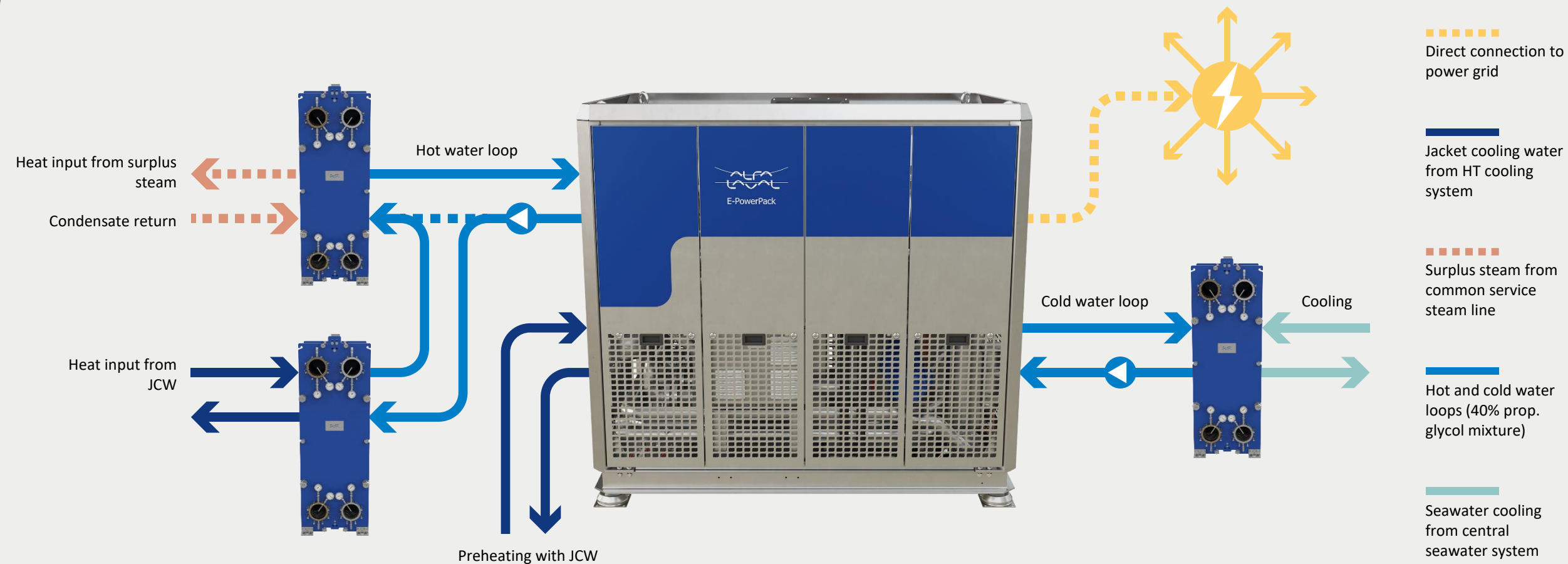
- Heat enters in two stages:
 - Preheater – direct input of jacket water
 - Evaporator – additional heat via hot water loop
- Heat turns the organic fluid into vapour
- Vapour enters the expander, turning rotary screws that drive the generator
- Expanded vapour enters the condenser and is reliquefied via indirect cooling
- A feed pump repressurizes the fluid and the cycle begins again



E-PowerPack Connections



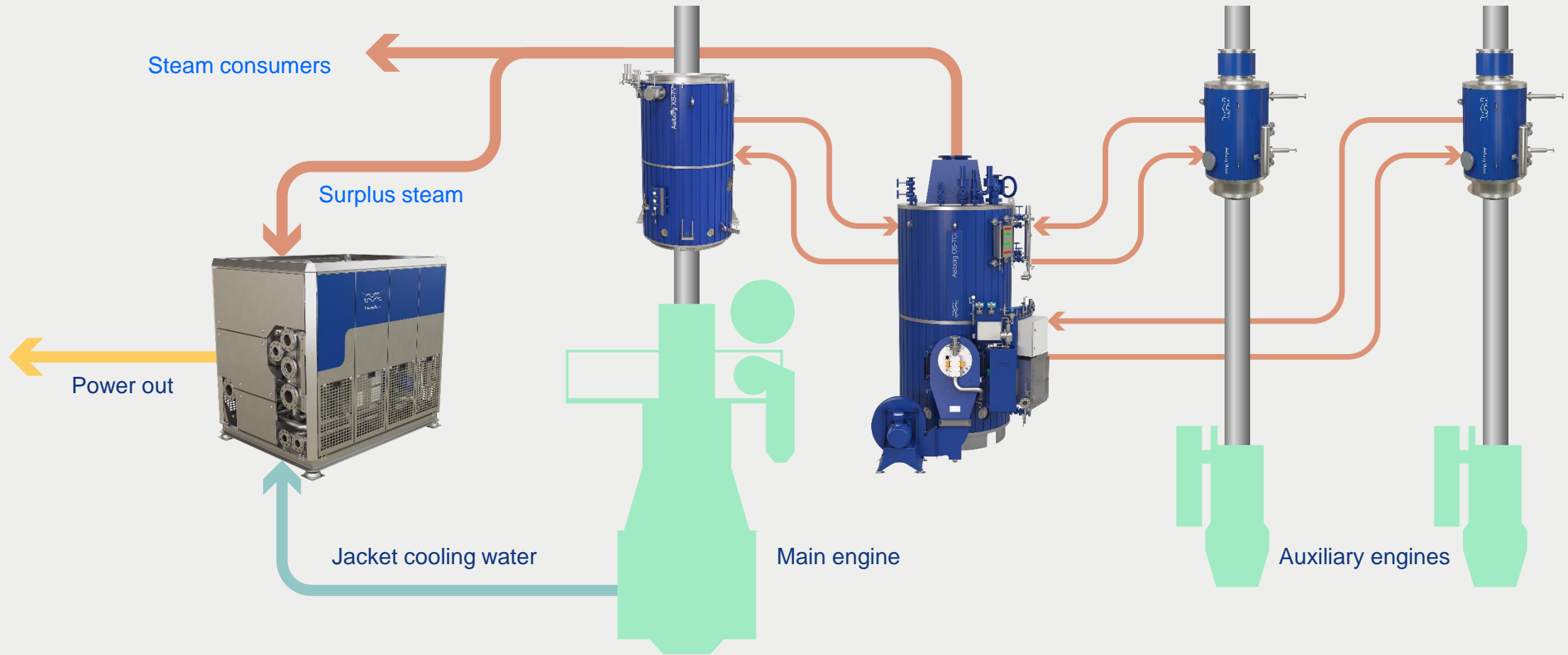
– Simplified system layout



Integration with the steam system



- No dumping of valuable thermal energy (Waste Heat)



In practice – a compact module



– One size fits all

E-PowerPack (200 kW)

- Less than half the size of comparable ORC systems
- Standardized design simplifies engineering needs
- Modules can be connected to form larger systems

Example:

Ship (bulker/ tanker etc) with 15 MW 2-stroke engine, running at 70% of MCR -> operational load $15 \times 0.7 = 10$ MW.

Heat in JCW (for 2-stroke) approx. 12% of operational load = 0.12×10 MW = 1200 kW

- ➔ Sufficient to run E-PowerPack even without any excess steam (> 1000 kW)
- ➔ Electrical output E-PowerPack at this design point (for SW 20 deg C) 55 kW
- ➔ Electrical output will increase if excess steam is available from M/E EGB or Aux.Engine Micro boiler



Footprint: 4 m²
Weight: 4600 kg (incl. refrigerant)
275 kg + 19.5 kg POE

Business Cases - E-power Pack ORC



Project Specification:

10K TEU Container , Single Fuel

Main engine type: 7G80ME-C10.5-HPSCR, SMCR: 32,300 kW

Steam Output from M/E JCW @60% Load: 2500 kW

Steam output from 2 Micro Boilers: 1500kW

Heat for FWG: 500, Steam consumers : 2000kW

Case description:	FWG: Two stage type Steam heat: 1 x ME EGB + 2 x GE EGE @ 50% load Steam heating balance.: As informed by shipyard		
Annual sea going			275 days
Specific fuel oil consumption in fuel mode			0.220 kg/kWh
Specific fuel oil consumption in gas mode			- kJ/kWh
Conventional fuel price			650 EUR/t-fuel
Gas fuel price			- EUR/t-gas
Carbon tax			150 EUR/t-CO2
Carbon factor (CF) per ton conventional fuel			3.114 t-CO2/t-fuel
Carbon factor (CF) per ton gas fuel			- t-CO2/t-gas
Percentage of fuel consumption subject to tax under EU ETS			50 %
Nominal generator efficiency			96 %
Operational profile distributed by main engine load			
90% of SMCR			5 %
80% of SMCR			10 %
70% of SMCR			20 %
60% of SMCR			35 %
50% of SMCR			15 %
40% of SMCR			10 %
30% of SMCR			5 %
Sum			100 %
Operation profile distributed between			
	ISO	Tropical	Winter
(Seawater Temperature)	30 %	60 %	10 %

E-PowerPack electrical power and fuel savings	Fuel mode
Annual power savings	1,006 MWh
Annual fuel savings in aux. engines	221 t-fuel/year
Annual CO2 savings in aux. engines	689 t-CO2/year
Fuel savings on fired boiler during port stay	Fuel mode
Annual days in port	90 days
Steam output from aux. engine exhaust gas economizers (total)	kg/h
Annual steam output from aux. engine exhaust gas economizers (total)	- kg/year
Evaporation ratio	13 -
Annual fuel savings in aux. boiler during port stay	- t-fuel/year
Annual CO2 savings in aux. boiler during port stay	- t-CO2/year
Total savings per year	Fuel mode
Fuel savings	221 t-fuel/year
CO2 savings	689 t-CO2/year
Economical savings	195,477 EUR
Estimated payback period	Fuel mode
CAPEX	350,000 EUR
Installation cost (estimate)	100,000 EUR
Total cost (CAPEX)	450,000 EUR
Total savings per year	195,477 EUR
Payback period	2.3 year(s)

Alfa Laval Freshwater Generator

The Big Splash, with a small footprint

– AQUA Blue E2



Fresh Water Generator range

– AQUA Blue Family



The AQUA Blue FWG Family:



Mini: 0.5–18 m³/day
Based on SW 32°C.



E1-C-type: 2–60 m³/day



E1-S-type: 7–60 m³/day



AQUA Blue E2
20 – 80 m³/day

Value Proposition Aqua FWG E2

– Electric power and thermal heat



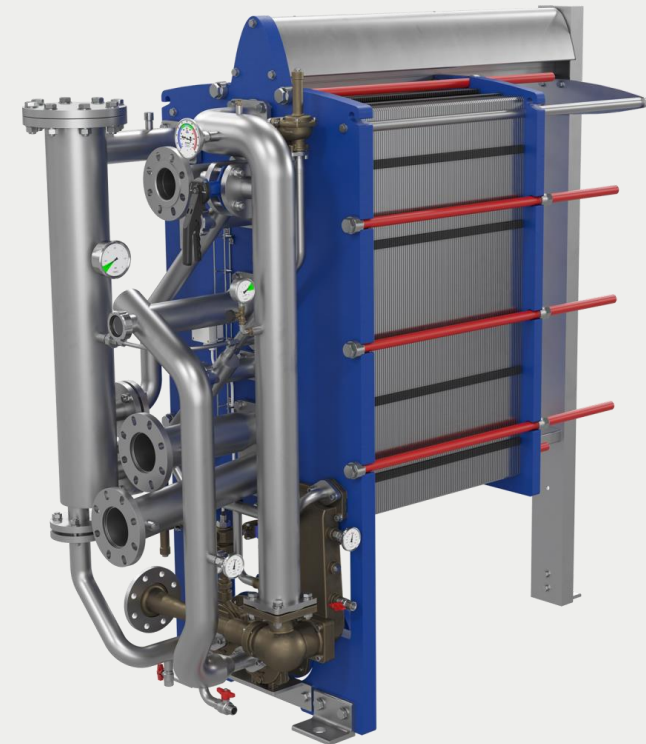
The most energy-efficient solution – for Slow Steaming

- **Aqua FWG E2 almost 50% less thermal heat & jacket water flow** compared with single stage Freshwater Generator
- **Lower electric Power Consumption** per ton of water compared with:
 - Single stage: same
 - Old two stage: approx. less 50%

Require half the seawater flow when compared to a conventional type FWG(JWP), which means our model requires smaller pumps and motor.



E1



E2

AQUA Blue FWG 2-Stage



– How it works

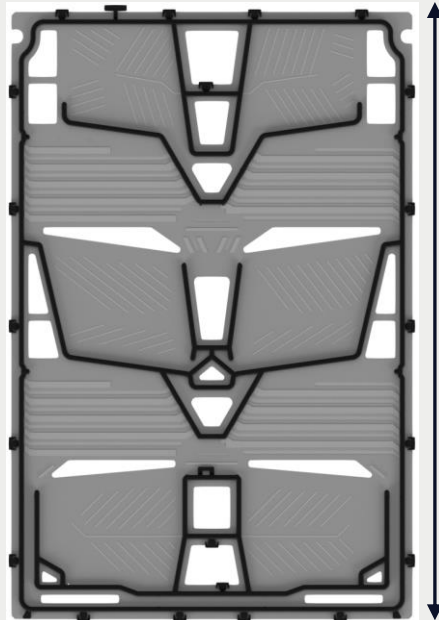
3 in 1 plate technology in two stages

With the AQUA plate technology there is only one single plate pack with all 3 processes: evaporation, separation and condensation.

Condenser

Evaporator 2

Evaporator 1



1140 mm



2685 mm

2010 mm

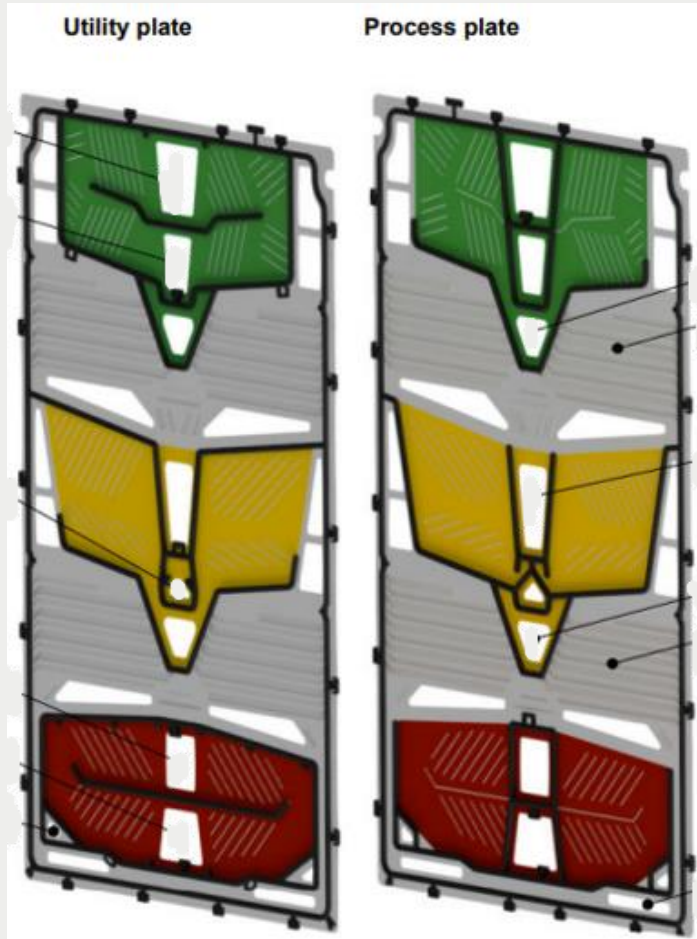


AQUA Blue 2-Stage

– How it works



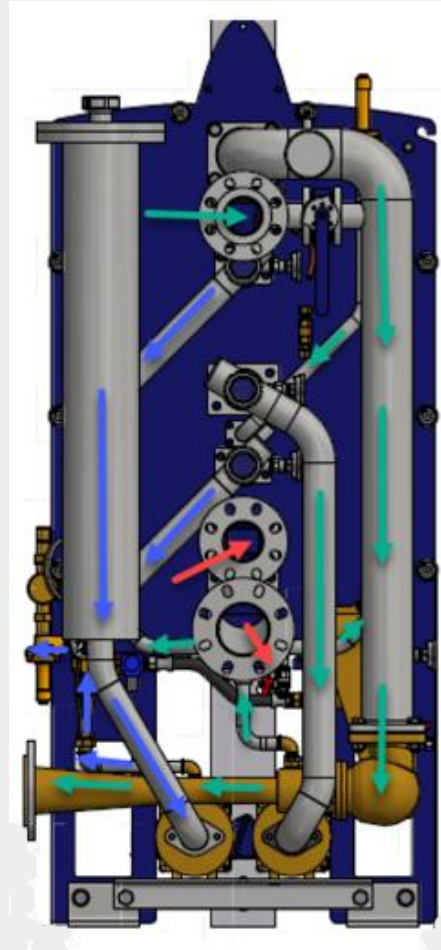
3 in 1 plate technology in two stages



Condenser

Evaporator 2

Evaporator 1



• Heat consumption comparison:

- AQUA E1 Blue 1-stage 36 ton/day: 1060 kW
- AQUA E2 Blue 2-stage 36 ton/day: 600 kW

• Compatible with slow steaming (Hotwater loop) : Same FWG production output

• Flow from the outside:

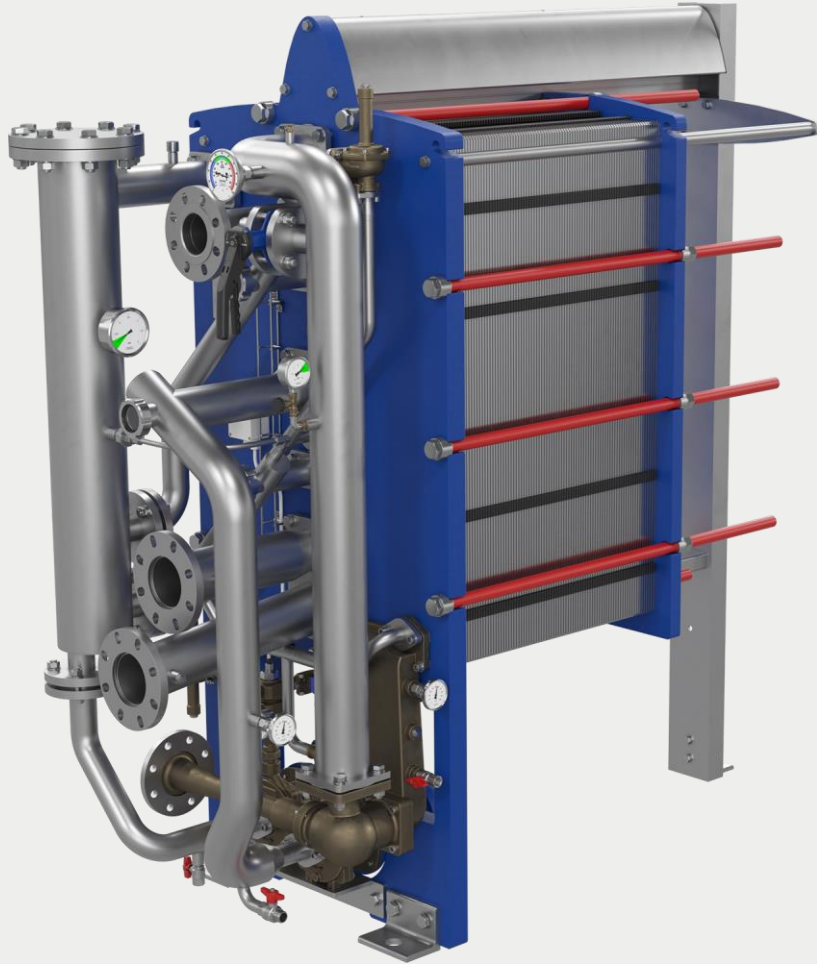
- **Green:** Sea water, feedwater and brine
- **Red:** Hot water
- **Blue:** Fresh water

• 3 pumps:

- 1 x Ejector pump (Sea water pump)
- 1 x Freshwater pump
- 1 x Feedwater pump

AQUA Blue E2 C-type - Features

– Perfect solution for slow steaming and ORC



- Capacity 20 – 80m³/24hrs
- High Energy Efficiency
 - Less Thermal heat, can be utilized for ORC (E-power pack)
 - Less Electric power consumption
- 3 in 1 plate technology – in two stages
- Non-glued gaskets , Less OPEX
- Lower seawater flow
- Smaller components and pipe dimensions
- High quality of water (less than 2 PPM)
- Small footprint
- Lower weight (to other two stage)
- Ease of operation & maintenance
- Reliable & proven operation

Energy efficiency with Alfa Laval OceanGlide Air Lubrication System

Alfa Laval Air Lubrication System OceanGlide is a unique combination of proven technologies: **air lubrication and fluidics.**

It ensures real, substantial improvement in vessel energy efficiency – resulting in lower emissions.



What is Air Lubrication system?

Reducing friction between hull and water

What does air lubrication promise

Reduced propulsion power



Reduced fuel consumption



Reduced CO2 and other emissions



Reduced marine noise

Why Alfa Laval OceanGlide?

A smooth path to real energy savings

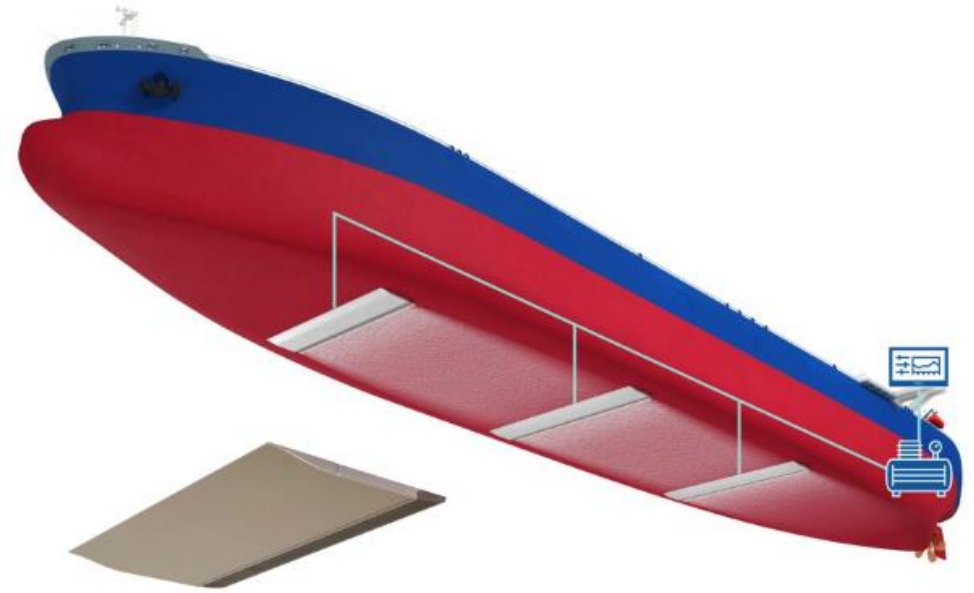


Alfa Laval by your side

Alfa Laval air distribution bands

Intelligent integration of air lubrication with fluidics

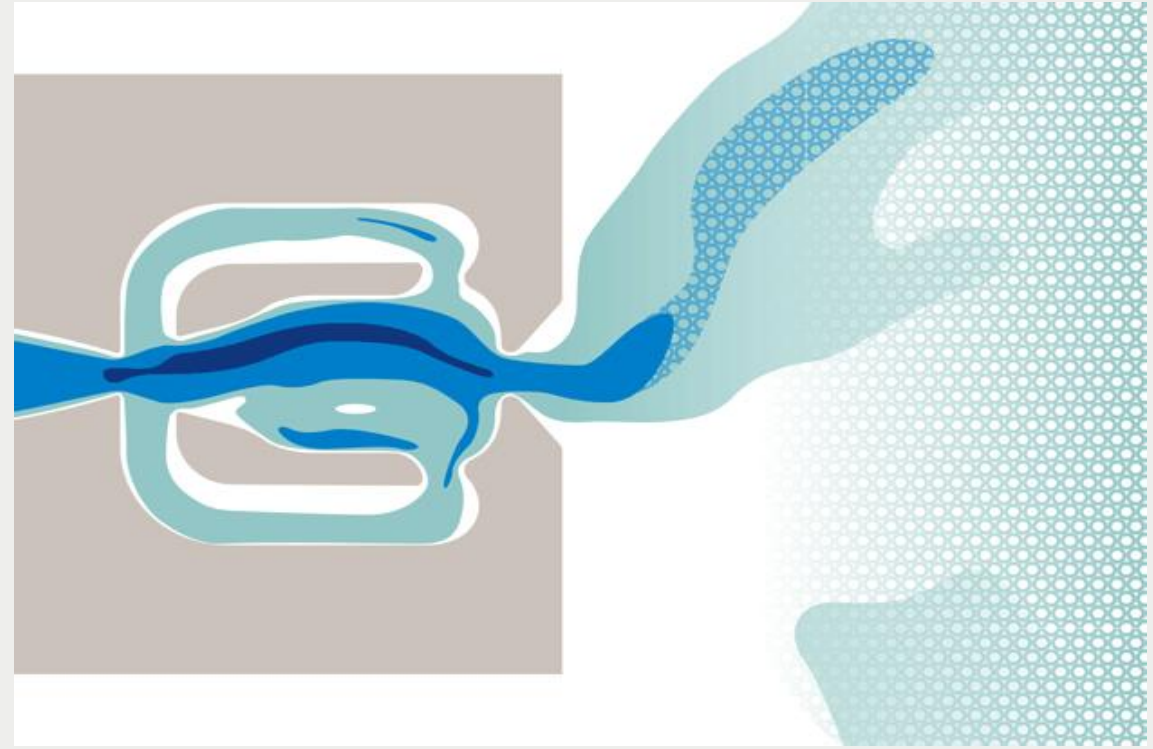
- Even and dynamic air layer, produced with few compressors
- Effective coverage of the entire flat bottom area helps in reducing drag
- Individually controllable sections for air layer optimization
- No large sea chests or required compressor placement



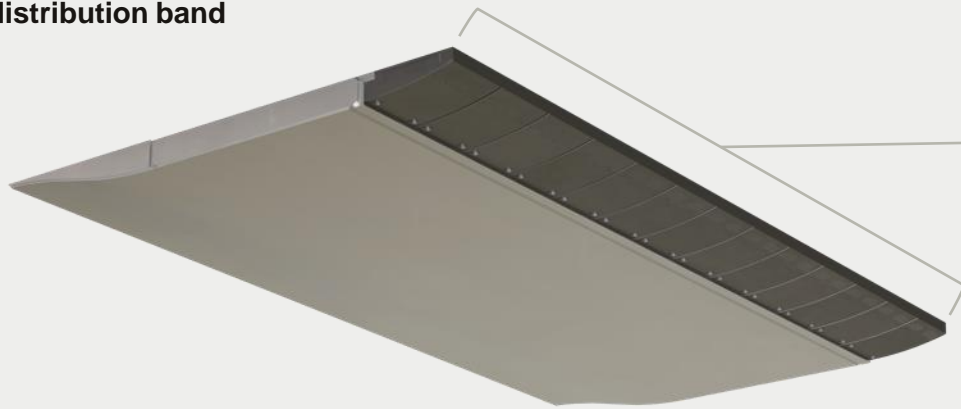
How is Alfa Laval OceanGlide different?

The control of fluid pressure and flow by means of precisely shaped channels, without any moving parts

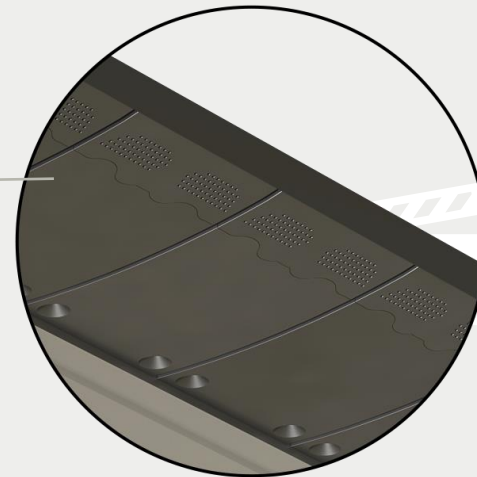
- Installed across the hull, creating sections
- Hydrodynamic wing-shaped profile
- Fluidic oscillators have no moving parts



Air distribution band



Fluidic oscillators



How Fluidic works?

Fluidics is the control of fluid pressure and flow by means of precisely shaped channels, without any moving parts:

- Unlike other air lubrication systems, OceanGlide doesn't just inject air under the vessel.
- Using fluidics, it creates an actual air layer – with much higher efficiency. That air layer covers the vessel's entire flat bottom.
- And because of how it's produced, it can be fully controlled and optimized.

Why add fluidics?

- Higher efficiency in creating the air layer
- Complete coverage of the flat bottom
- Full control over the air layer

The proven results:

- 50–75% reduction in specific drag
- Significant propulsion power savings



Wide application

With fluidics making the most of air lubrication's potential, OceanGlide significantly reduces propulsion power, fuel costs and emissions.

Consistent results – whatever the vessel

- Nearly any vessel size
 - From 3,350 to 214,000 DWT
- Nearly any vessel draft
 - From 3 to 18 m
- Nearly any speed
 - From 5 to 21 kn



Tharsis Sea-River Shipping

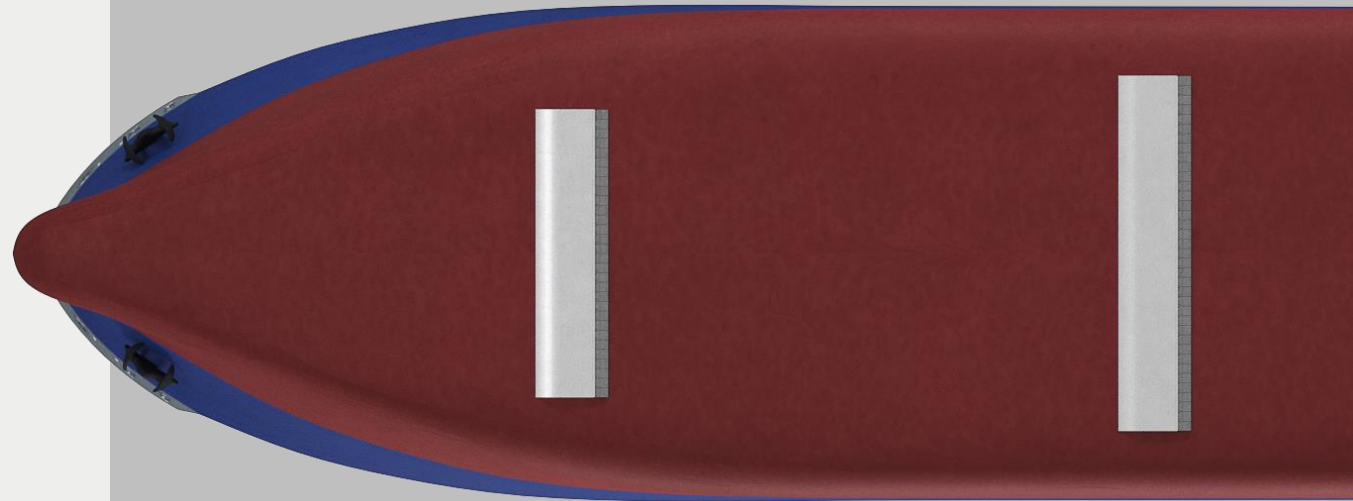
Owner	Tharsis Sea-River Shipping
Vessel type	Coaster general cargo (3,350 DWT)
Installation	October 2020
Savings	7–9% net fuel savings through reduced propulsion power
Retrofitting 2 nd vessel with OceanGlide ALS	



An advantage now and always

Easy to install means future-proof as well

- Bolt-on air distribution bands reduce maintenance complexity in dry dock
- Oscillators can be replaced by divers if needed between dry dockings
- Exchangeable oscillators allow easy upgrading as technology develops
- Air layer control can be upgraded through software updates



Compressor flexibility

Few compressors, placed where convenient

- Oil-free screw compressors
- Typically just 1–3 needed
- Installed anywhere on board



Low-profile air distribution bands

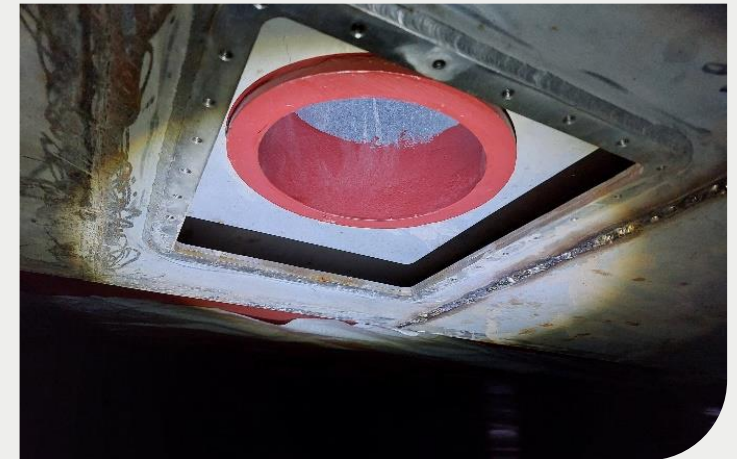
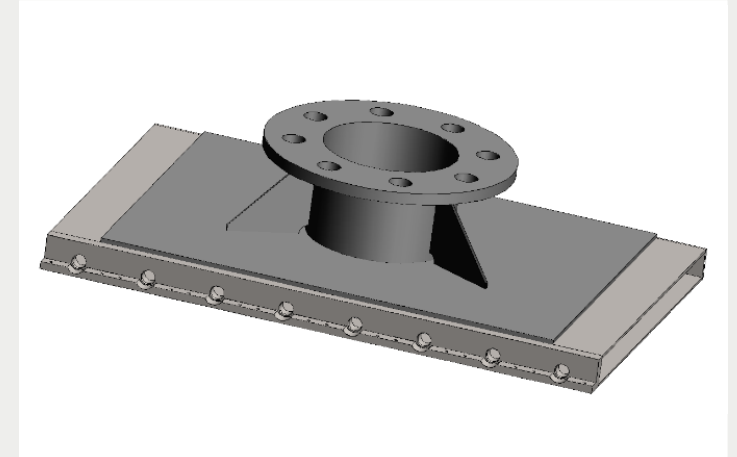
Mounted on the hull by any shipyard



Minimal hull penetrations

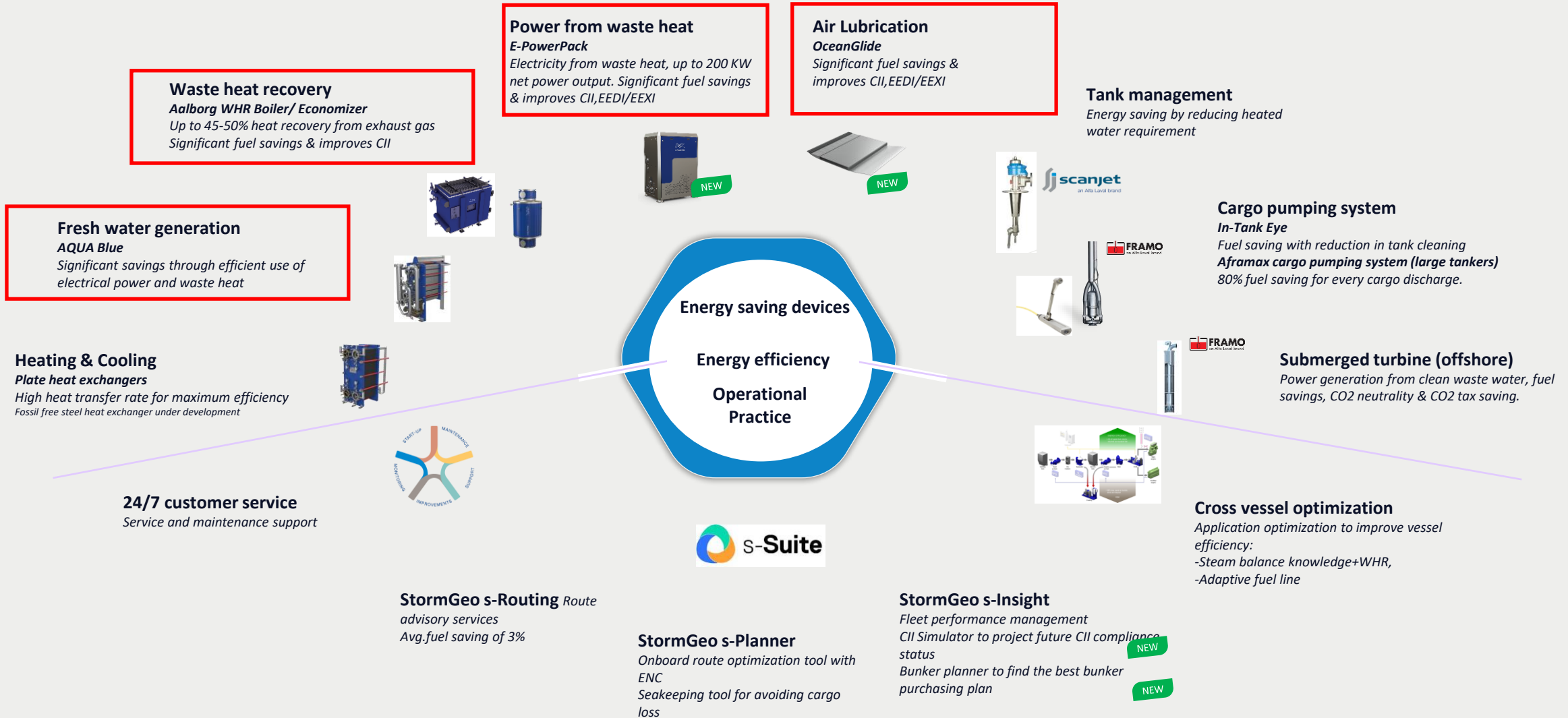
No impact on structural integrity

- Typically one penetration per band
- From the ballast tank to the band
- Secured by a class-approved non-return safety valve
- Accessible via inspection hatch



Summary

To improve energy efficiency and minimize environmental impact - Alfa Laval is your trusted partner for a sustainable future.



We support you – at land, at sea and remotely



Our 24/7 Service & Support function provides worldwide, round-the-clock support and fast assistance

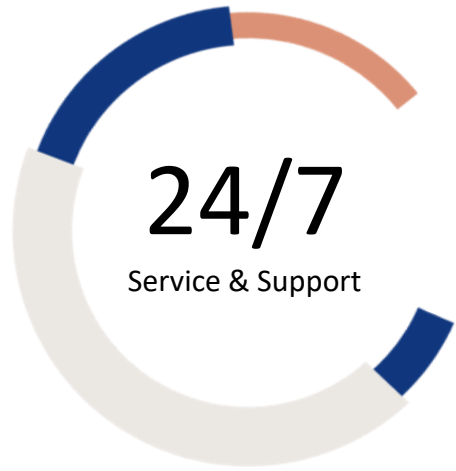


We have a complete in-house service and support organization







Our experts can supervise installation and commissioning – anywhere in the world

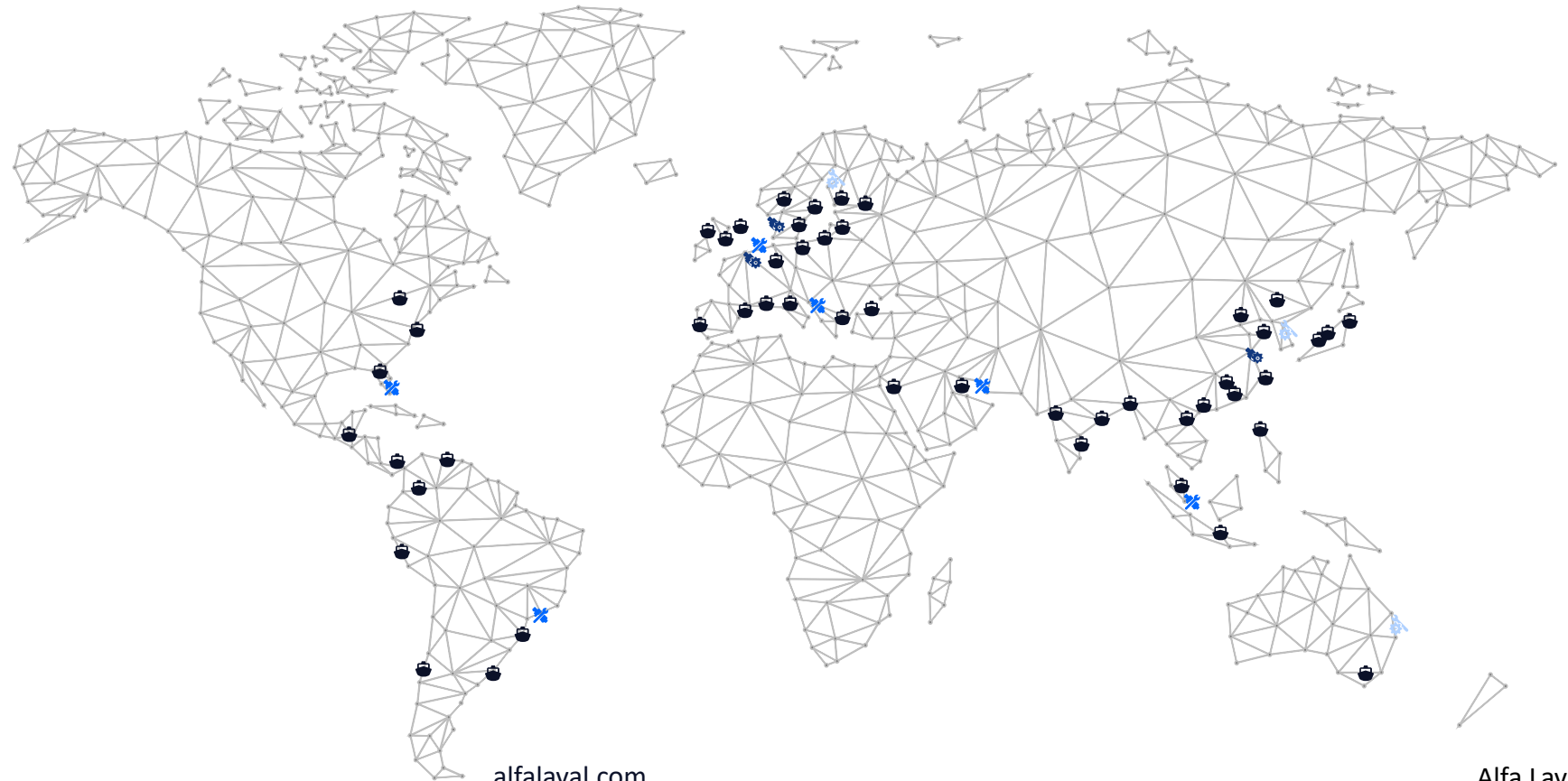
You can find us in all major ports



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-  General marine service centre
-  Service station
-  Repair unit
-  Service station and repair unit



alfalaval.com

Alfa Laval

Together for sustainable
shipping

Thank You

