



Increase the energy efficiency on your vessels with Alfa Laval's new plate heat exchangers

13 April 2023

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- 2 Sustainable product portfolio and partnerships
- 3 Cooling on-board and heat transfer theory
- 4 Common challenges and our solutions
- 5 Design parameters and specifications
- 6 Operations and maintenance

Today's focus for tomorrow's solutions

– Our approach

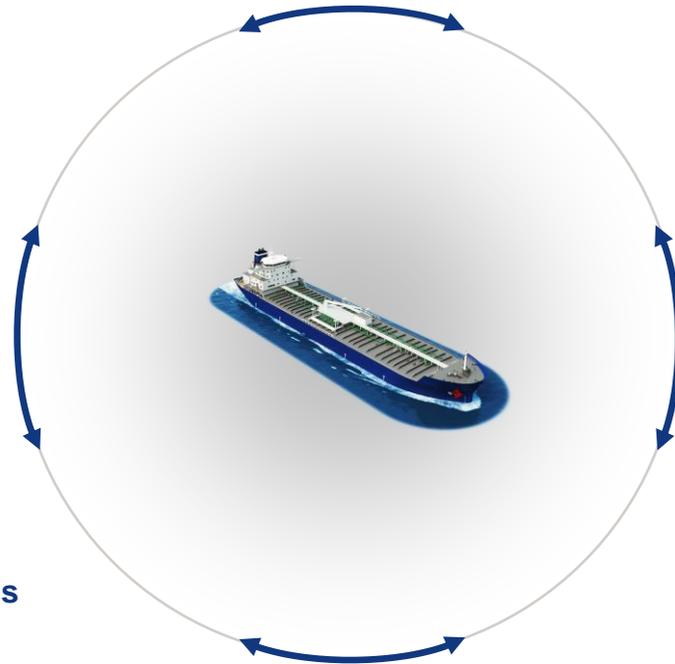


New Fuels

Methanol
Ammonia
Biofuel

New Technologies

Air Lubrication
Wind Propulsion
Carbon capture



New Regulations

CII/EEXI
EEDI Reductions
EU ETS

New Mindset

Clean environment
Decarbonization
Smart shipping

Our journey towards sustainability

– Advancing ahead for the better future



Focus on energy efficiency since 100 years



2004
Pure Thinking Environment-friendly solutions



2012
Alfa Laval acquires Aalborg Industries



2014
Alfa Laval acquires Framo



2014
The Alfa Laval Test & Training Centre



2015
Fuel supply Methanol



2021
E-PowerPack launched



2021
Methanol boiler



2021
Air Lubrication – buys MPS share



2021
Oceanbird – joint venture with Wallenius



2021
Alfa Laval acquires StormGeo



2021
Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping



2017
Focus on LNG



2022
Approval for testing Ammonia as fuel



2022
Methanol & ammonia fuel system – partnership with WinGD



2022
Tank cleaning – acquires ScanJet



2022
Sustainable bunker – acquires BunkerMetrics



2022
Partnership with SSAB – fossil free steel



2022
Carbon capture – “project ReMarCCable”



2023
High Speed Separators Biofuel



Building the green future

- Together with our customers



OPERATIONAL
EFFICIENCY
SUPPORT

1

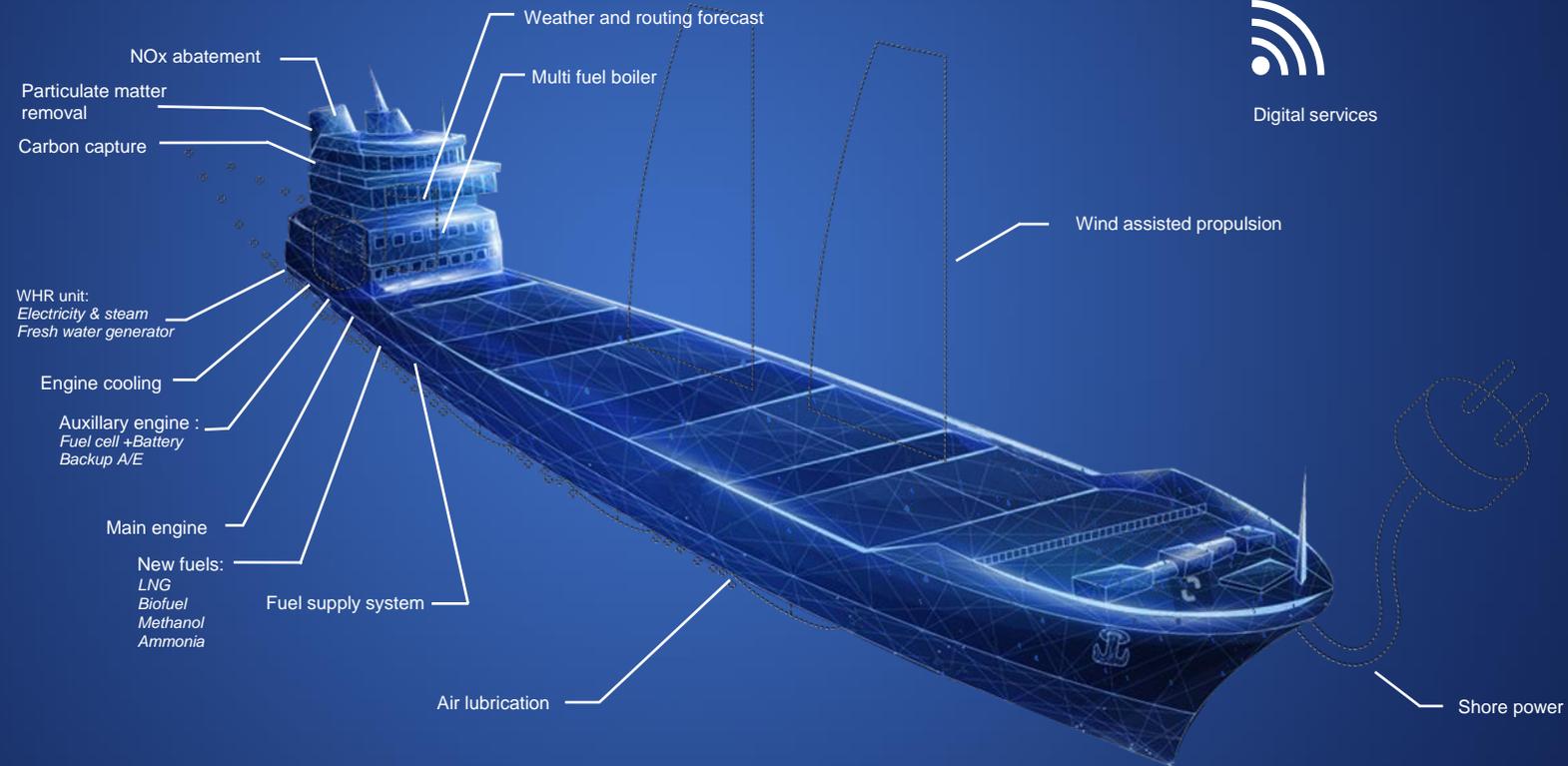
LOW & ZERO
CARBON FUEL
SUPPORT

2

GREEN
TECHNOLOGY
SUPPORT

3

Sustainable ship of the future



Digital services



Decarbonization



Energy saving



Compliance



Smart operations

From bow to stern

100 years in the marine industry



Power from waste energy

Power generation with fuel cells

Waste heat recovery

Exhaust gas recirculation water treatment

Exhaust gas cleaning

Crankcase gas cleaning

Oily waste treatment

Fuel conditioning

Filtration

Fuel treatment

Tank cleaning

Steam production

Thermal fluid heating systems

Heating and cooling

Fresh water generation

Ballast water treatment

Methane slip reduction

Inert gas system

Gas combustion

LNG as fuel

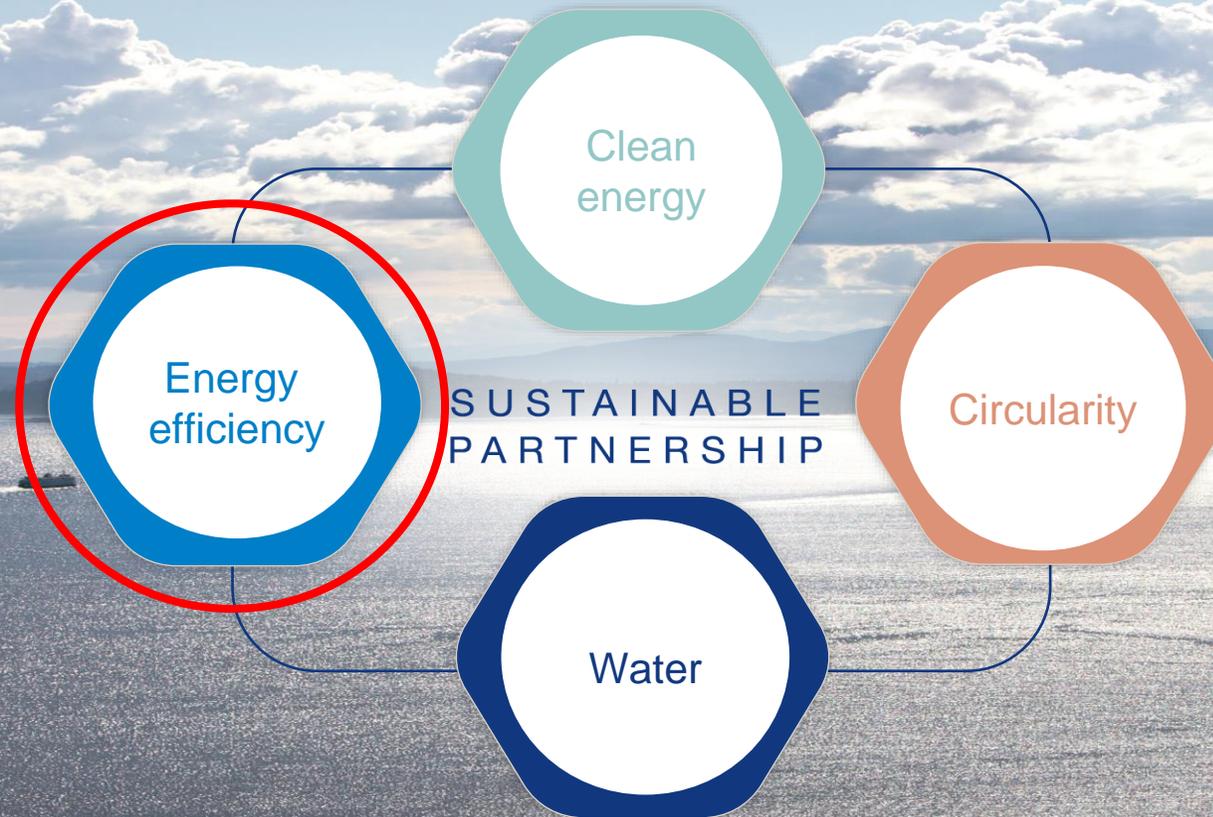
Methanol as fuel



Sold and serviced by Framo AS only

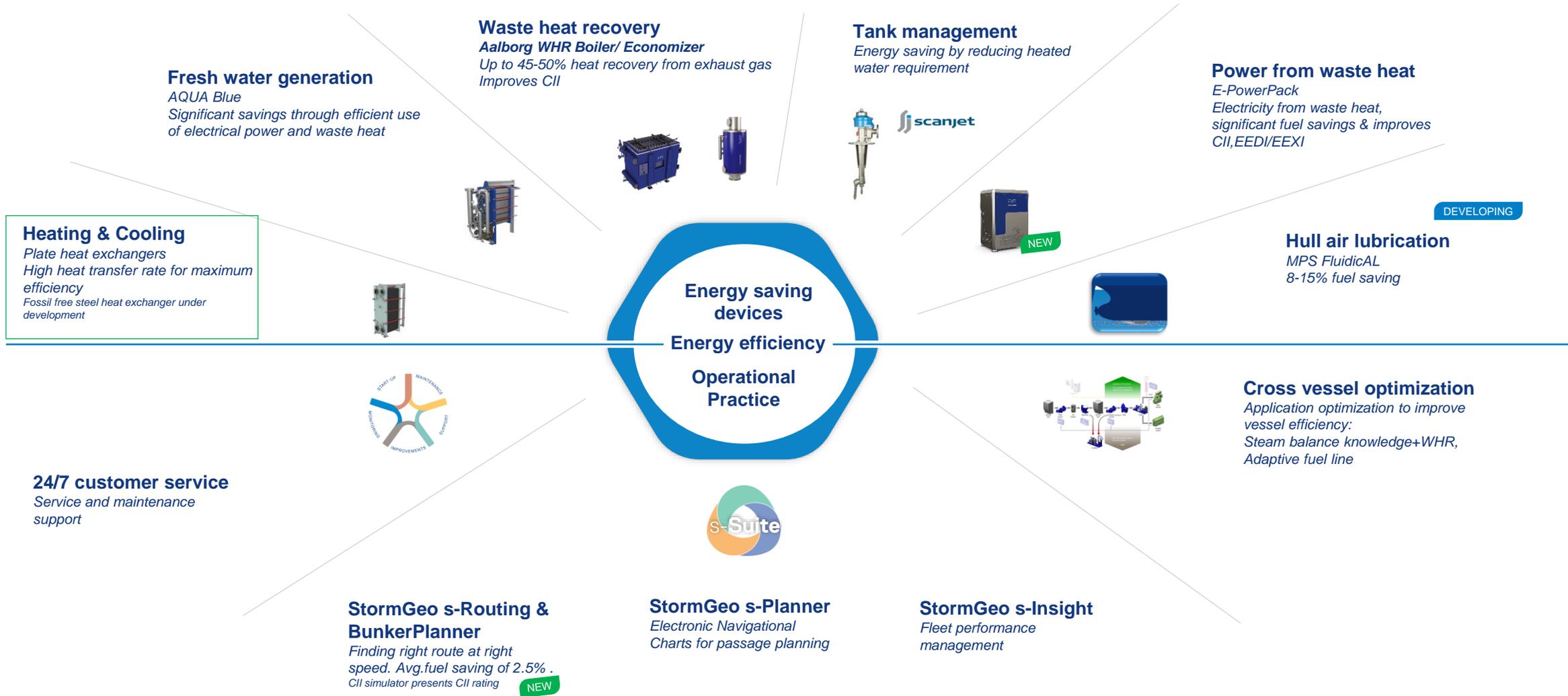
Together for sustainable shipping

– Our sustainable solutions



Energy efficiency

– A step towards fuel reduction and efficient operations



Our speaker



Joseph A. Olsson is the Senior Regional Business Manager of Marine Heat Transfer in East Asia , responsible for Marine gasketed plate heat exchanger business in East Asia. He works closely with sales teams and customers, as well as with factories and our R&D teams to ensure the best offering.

Joseph is based in Shanghai, China, and he has been with Alfa Laval since 2017. He has a first-class Bachelor and Master degree in Mechanical Engineering from LTH in addition to a Bachelor Degree in Business Administration from Lund School of Economics and Management

Having a balance of both technical and business knowhow and with more than a decade of experience in the industry, he is actively developing solutions to further improve vessel efficiency in a cost-efficient way.

Heat Exchangers on-board

- The right heat exchanger selection for energy efficiency



Joseph A. Olsson
Senior Regional Business Manager

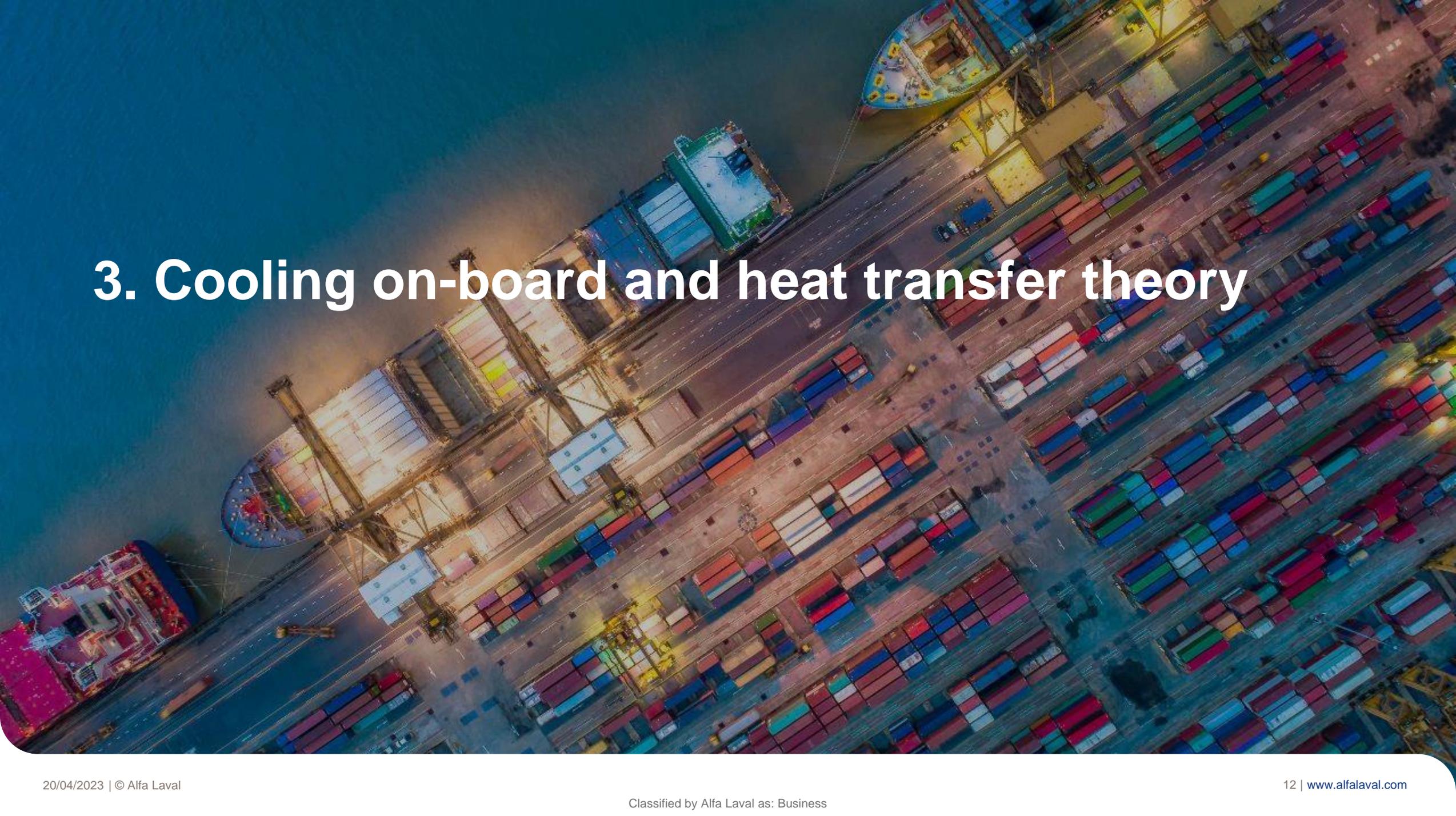
Energy Efficiency & Heat Transfer in Decarbonization

- Why it is important



- Energy efficiency - 40% in the race to zero
- Inefficient heat exchanger - 2.5% of CO₂ emissions
- Independent of fuel selection
- Solutions readily available





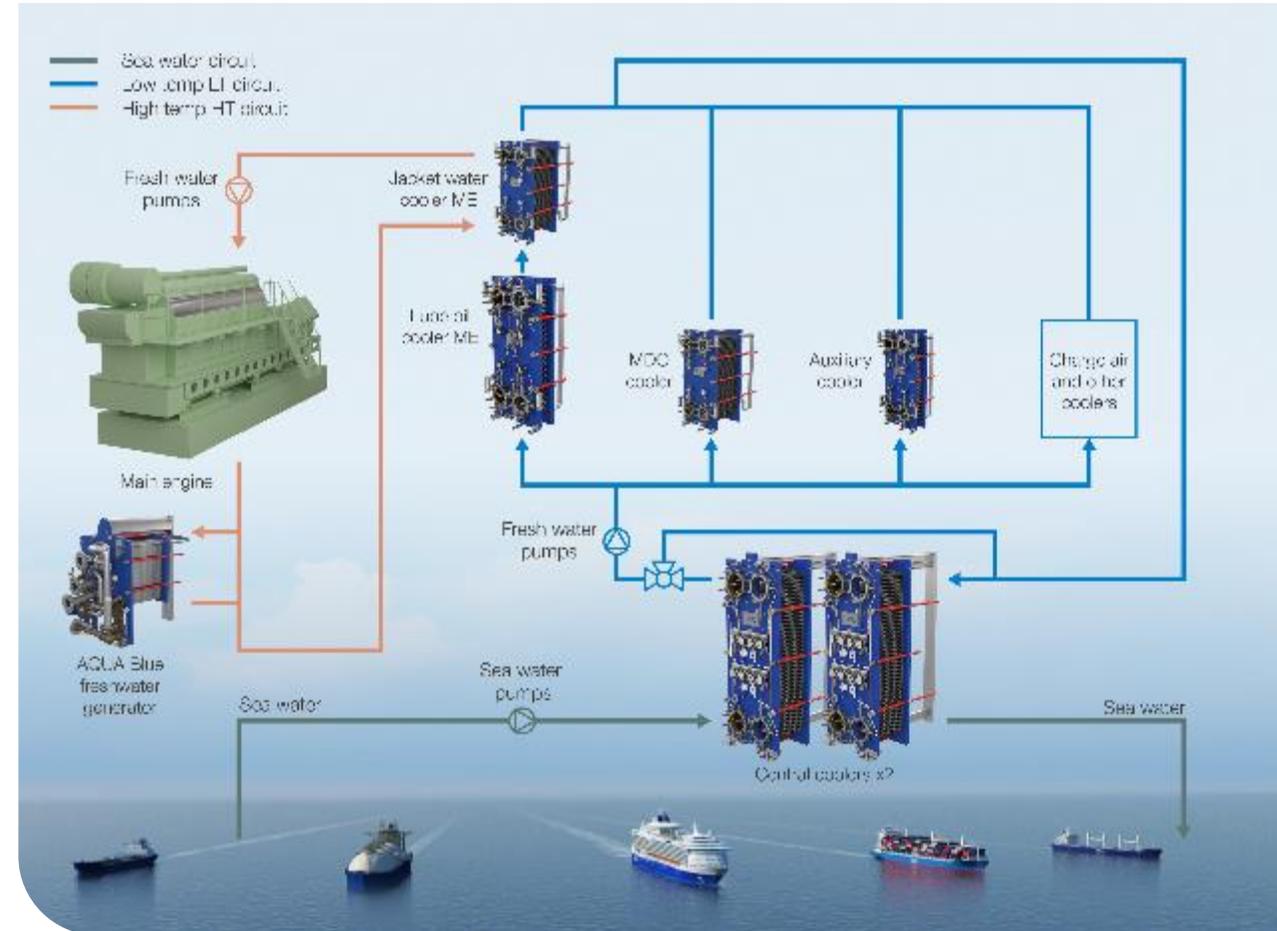
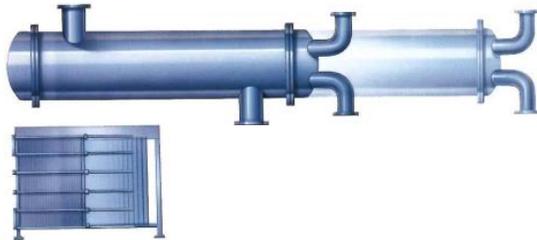
3. Cooling on-board and heat transfer theory

Typical Engine Room Cooling

– What it is

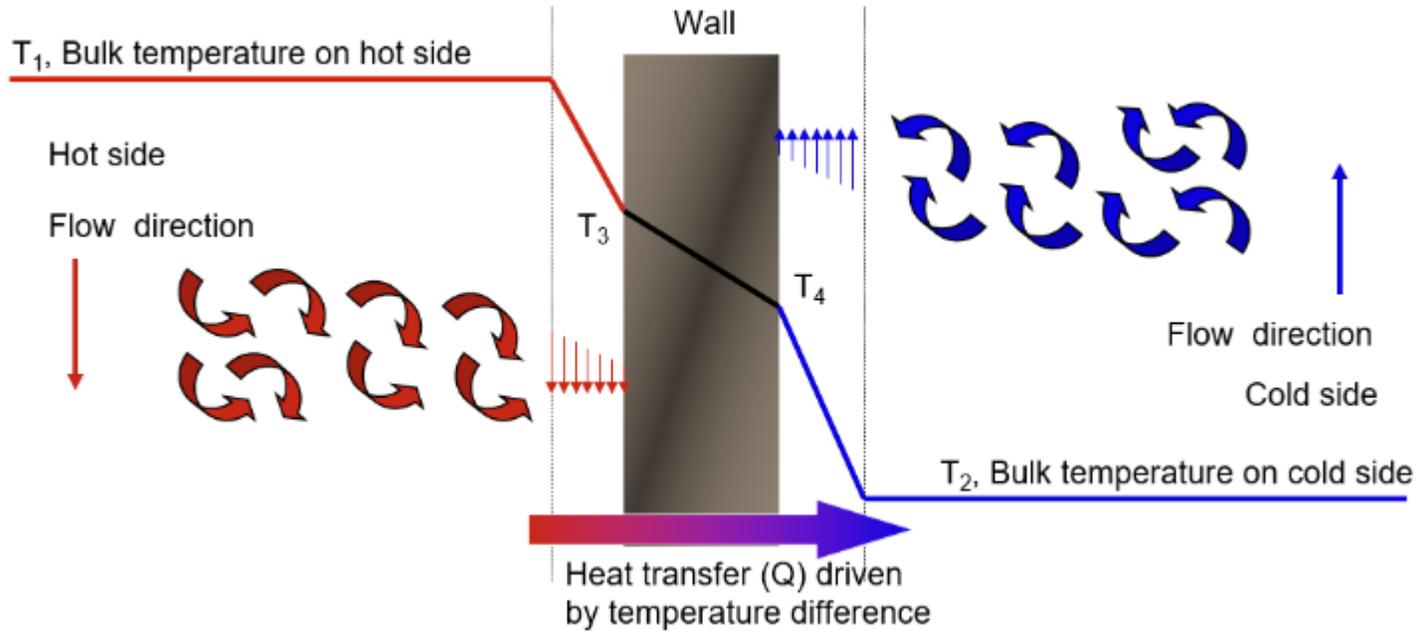


- Fresh water loop for duties on-board
 - Separate sea water and engine/oil
 - Less maintenance needed for FW loop
 - Cheaper piping on FW loop
- Direct sea water cooled still common for mid-small vessels
- Shell & Tubes have largely been replaced
 - Heat transfer efficiency
 - Footprint
 - Maintenance



Heat Transfer in a GPHE

- What it is



$$\text{Heat Transfer } Q \text{ (kW)} = k * A * LMTD$$

$$\frac{1}{k} = \frac{1}{\alpha_1} + \frac{1}{\alpha_2} + \left(\frac{\delta}{\lambda} \right)_w$$

heat transfer coefficient $W/m^2 \cdot C$

Don't forget the cost:

$$\text{Pumping Power (kW)} = \text{Volume flow} * \text{Pressure drop (kPa)}$$



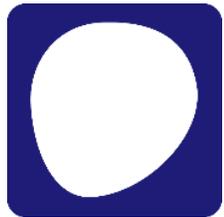
4. Common challenges and our solutions

OmegaPort™

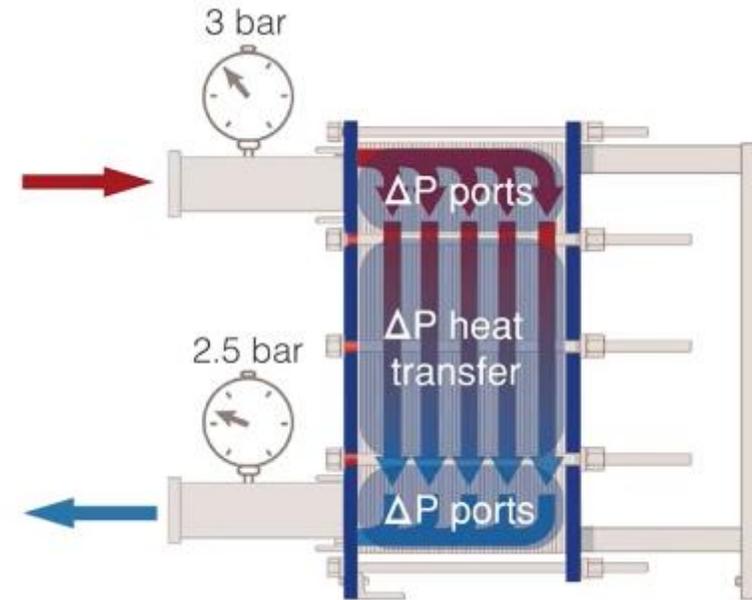
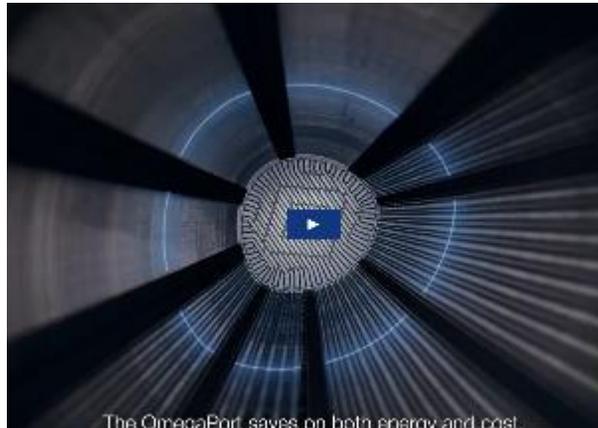
– Noncircular port holes



- Enhances media flow and thermal efficiency
 - Pressure drop better utilized for heat transfer
 - Avoids shortcuts in plate pack



OmegaPort™
Noncircular port holes



“The price paid for heat transfer is pressure drop”

CurveFlow™

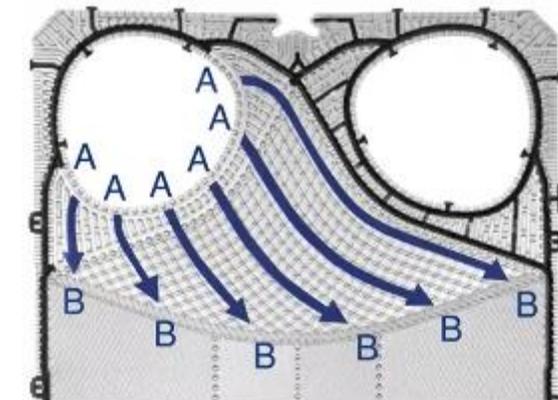
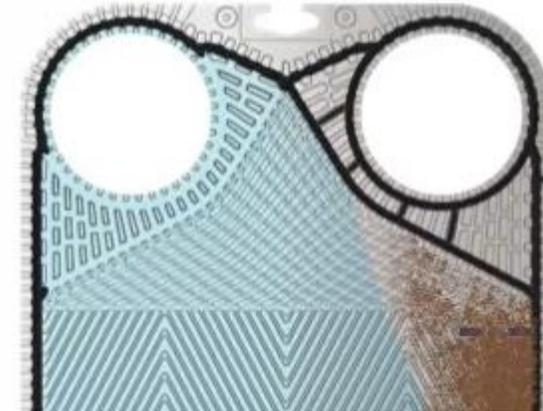
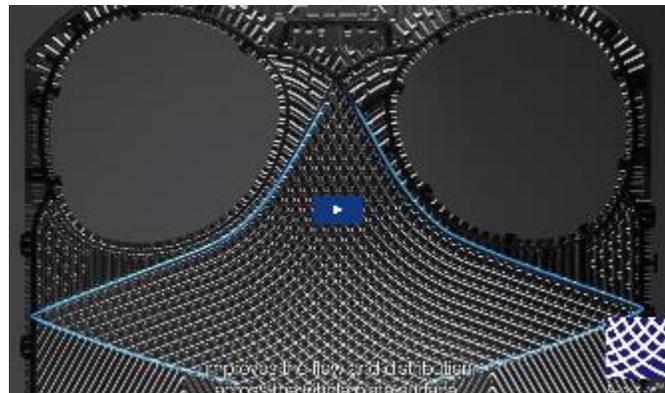
– Distribution area



- Improves media flow and minimizes the risk of fouling
 - Fully utilizes available surface area
 - Provides perfect distribution inside channel, unit stays clean longer



CurveFlow™
Distribution area

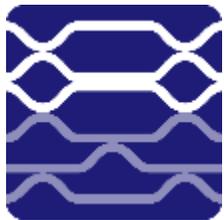


FlexFlow™

– Plate design



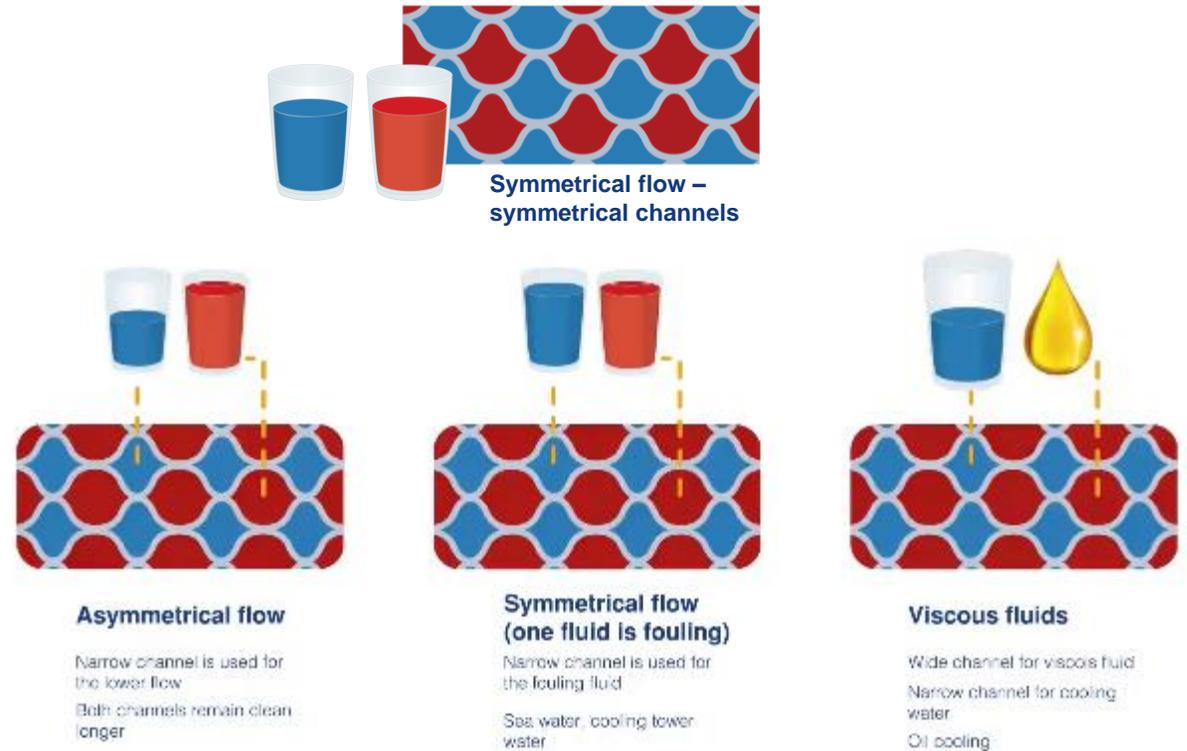
- Up to 30% higher efficiency and optimizes pressure drop utilization
 - Perfect for applications with unequal flows
 - Stay clean longer, reducing operations cost



FlexFlow™
Plate design

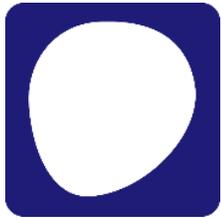


It improves thermal efficiency and optimizes pressure drop utilization.



New level of energy efficiency

– Benefits



OmegaPort™

Noncircular port holes

- ✓ Avoids shortcuts in plate pack
- ✓ Pressure drop better utilized for heat transfer



CurveFlow™

Distribution area

- ✓ Fully utilizes available surface area
- ✓ Provides perfect distribution inside channel, unit stays clean longer



FlexFlow™

Plate design

- ✓ Perfect for applications with unequal flows
- ✓ Both channels stay clean longer

**Performance
is better than
surface area!**

5. Design parameters and specifications

- How to optimize OPEX and CAPEX



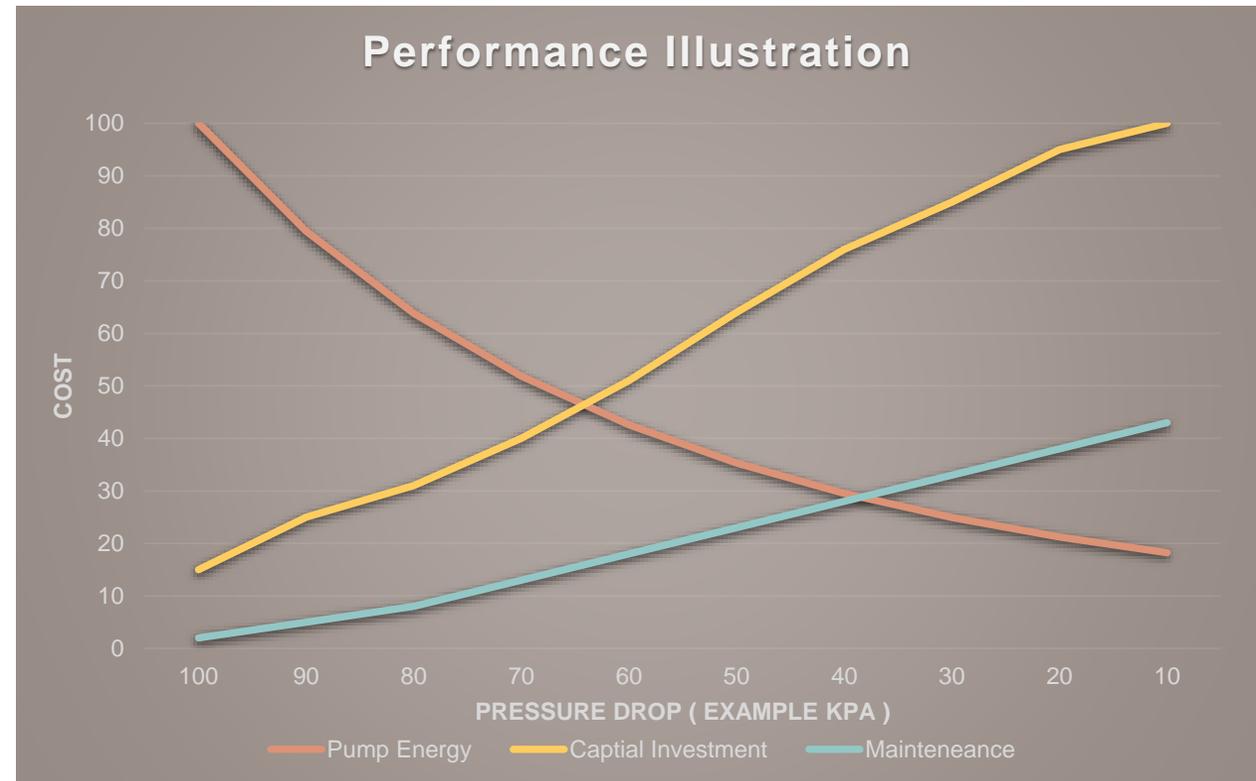
Consider while specifying GPHE

– How to optimize CAPEX + OPEX



Common limiting factors

- Heat Transfer Duty
- Pressure drop
- Port velocity / Volume flow
- Maldistribution
- Expired k-value restrictions
 - New Alfa Laval Marine T-range makes them obsolete
- Safety Margin
 - Should be 5-10%
 - Shell & Tube needed higher
 - Past performance issues should be more accurately addressed



Marine Classification & Dual-use

– Marine specific topics



- GPHE with less than 20 m² Titanium
 - Dual-Use restrictions
 - End User Certificate (EUC) required
 - Not always challenge-free
- Pressure vessel approvals and classification
 - Rules are class society dependent
 - Class I to III gives big cost impact
 - Avoid over specifying design temp and pressure

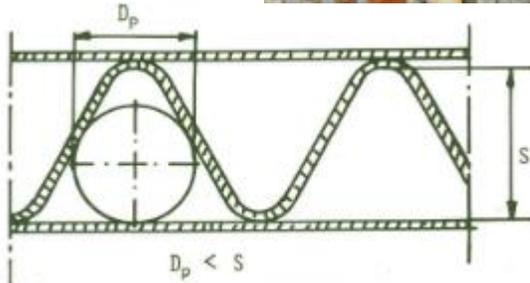
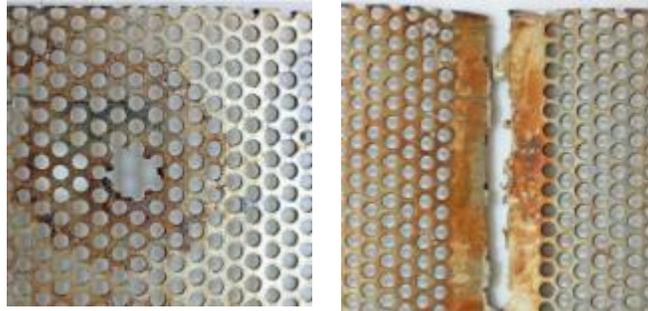


Marine Extras – Portfilter & Instrument kits

– Choosing sea water resistant materials for lowest total cost

Port filters for sea water

- Recommend SMO254
- Mesh size smaller than depth of free channel



Instrument kits for sea water

- CuNi/Brass for flanges
- Duplex for all SW wetted parts



Case stories

– How it may look in a specific project



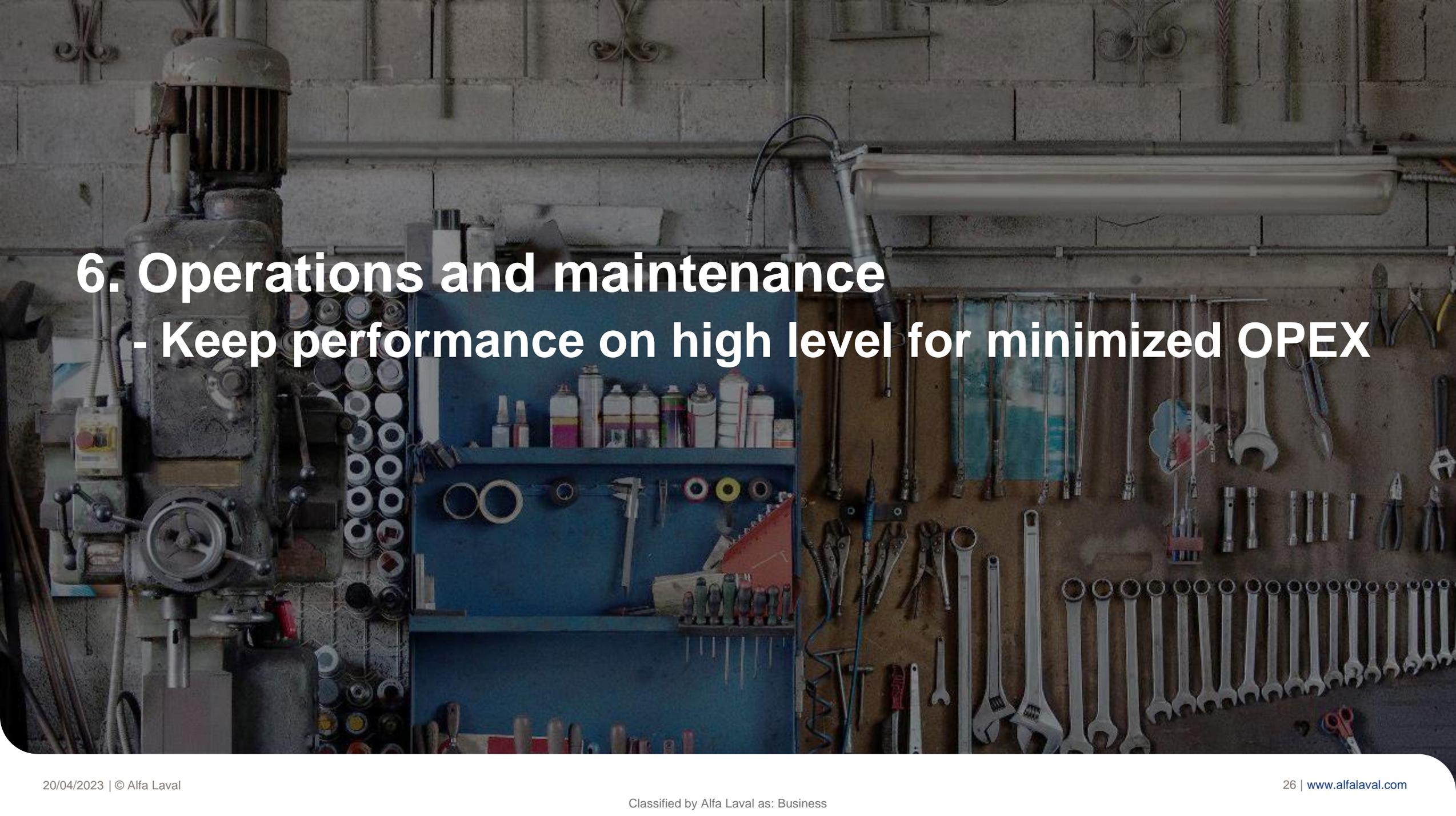
LNG Carrier project in Korea (last year)

- Yard applied max k-value restrictions
- Initial shipset price - USD 430,000
- After showing new T-range the restrictions was dropped for Alfa Laval
- New shipset price – USD 390,000
- Initial CO2 saving per ship – 26,400 Kg
- Further benefits for owner (USD + CO2)



Bulker project in Japan (last month)

- Central cooler spec:
 - FW flow 1,000 m³/h
 - SW flow 1,430 m³/h
- FlexFlow™ suitable and applied
- But still excessive SW flow
- Could quote same price with new spec
 - FW flow 1,000 m³/h
 - SW flow 1,100 m³/h
- Possibility for yard to reduce pump size
- Reduced OPEX for owner



6. Operations and maintenance

- Keep performance on high level for minimized OPEX

Day to day operations



– <https://www.alfalaval.com/service-and-support/ten-top-tips/>

- Monitor temperature and pressure drops to catch and act on fouling early on
- Cleaning methods
 - Remove & clean port filter, then backflush
 - Cleaning In Place (CIP)
 - Mechanical cleaning (on-site)
 - Reconditioning (service center)
- [Condition based maintenance with Alfa Laval](#)
- Genuine spare parts for life-time and performance



Dry-docking turnkey solution

- Reconditioning of GPHEs



All-inclusive offering

- Disassembly of plates ✓
- Transport of plates from ship to closest Alfa Laval Service Center ✓
- Pre-cleaning inspection ✓
- Removal of gaskets ✓
- Hydro-jet cleaning ✓
- Chemical cleaning ✓
- Visual inspection ✓
- Crack detection (fluorescent penetrant inspection) ✓
- Replacements of defective plates, if any ✓
- Reassembly with new Alfa Laval gaskets ✓
- Oven curing using heat and chemical resistant glue (glued-type PHE only) ✓
- Service report with process and equipment recommendation ✓
- Transport of plates from service center back to the ship ✓
- Reassembly of plates ✓

Replacements or conversion projects

– End of lifecycle



- End of lifecycle or want to boost performance?
- T – range's superior efficiency makes it the go-to solution
 - The most compact solution on the market
 - CC measurements same as M - range
- Re-made to Matter – Recycling Discount Program



Summary



1. An efficient heat exchanger will be more compact, utilize pressure drop smarter, and stay cleaner for longer – minimizing total cost of ownership
2. New T-range is a big leap for the industry in terms of efficiency
3. Involve your local Alfa Laval representative early on – CAPEX + OPEX
4. Regular performance checks and maintenance to save pumping energy

מחנה
המנוחה