How will a new building look like in 2035 The Future – Technology

1st CSN Greece Crewing Conference – Athens, September 28th, 2023

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Wärtsilä Greece S.A.

This is Wärtsilä

- Wärtsilä is a global leader in innovative technologies and lifecycle solutions for the marine and energy markets.
- We emphasise innovation to help our customers continuously improve environmental and economic performance.
- Our passionate team of 17,500 professionals in more than 240 locations in 79 countries shape the decarbonisation transformation of our industries.

Global leader

in decarbonising marine and energy

Founded in

1834

Net sales, MEUR

5,842

Our personnel

17,581

Nationalities

127

Country presence

79

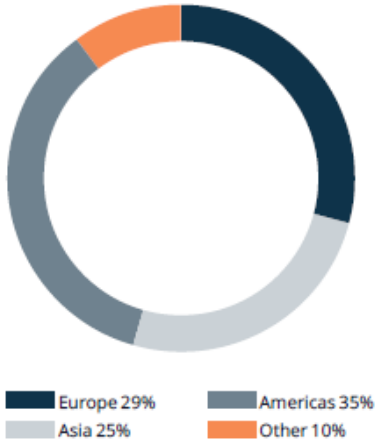
Locations worldwide

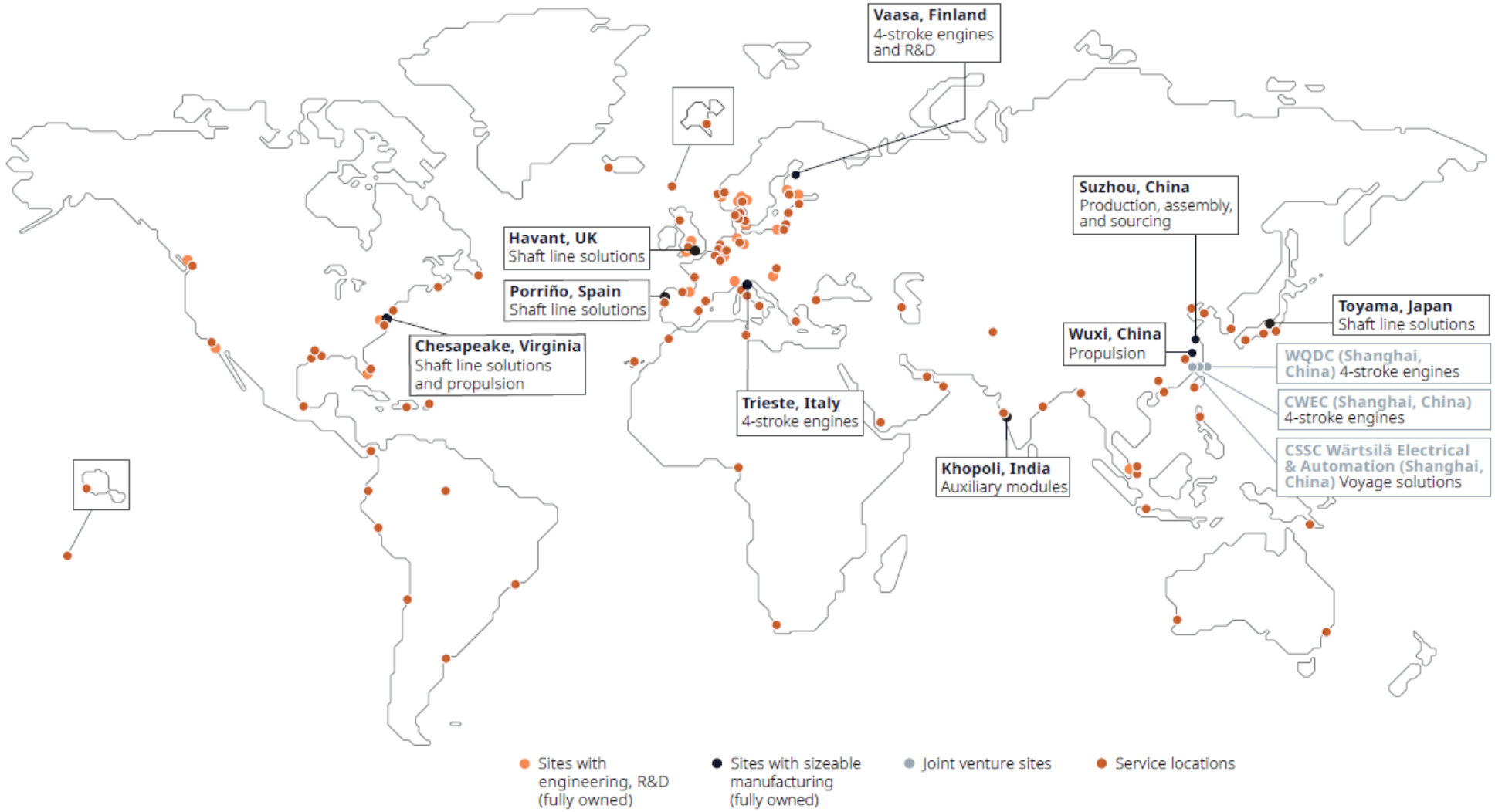
242

Figures from 2022

Wärtsilä's position as a global company is reflected in the geographical breakdown of our net sales

Net sales, geographical





Marine will move with unprecedented speed towards decarbonization

Policies and regulations

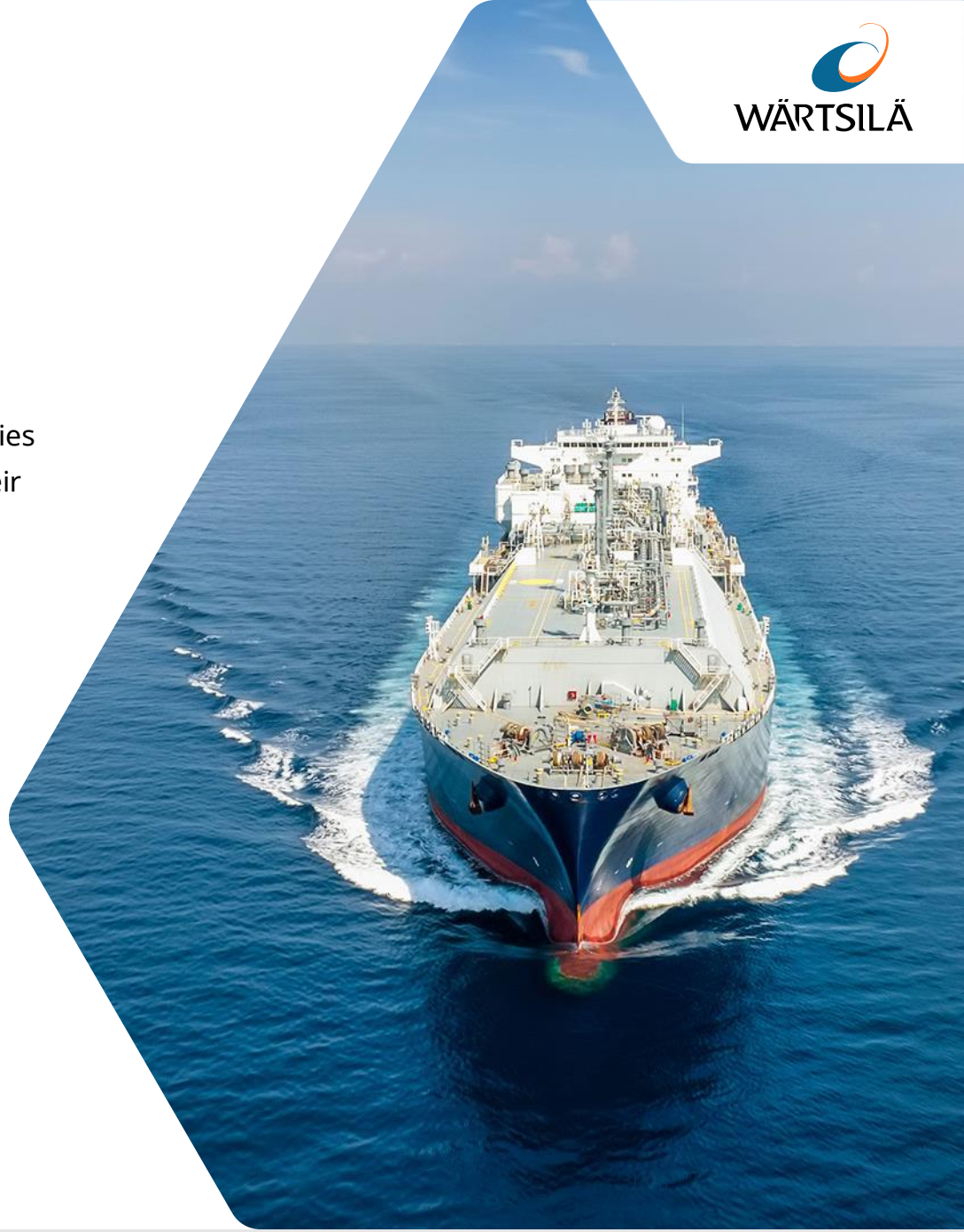
- IMO target: -50% GHG emissions from shipping by 2050
- Access to capital: EU taxonomy, Poseidon principles and ESG
- Cost of carbon: carbon certificates e.g., EU Fit for 55, IMO carbon levy, and local green policies
- Demand for green sea transport, driven by companies' environmental commitments to their customers and investors' push for sustainability targets

Technology

- Focus on carbon neutral and zero carbon fuels. However, carbon fuels will likely be used for many years
- Next steps in abatement technologies, e.g., maritime carbon capture
- Increase in battery systems, hybrid solutions, and energy saving technologies
- Focus on fuel flexibility and upgradeability to increase overall efficiency

Connectivity and data

- Vessels as data pools - system complexity increasing
- Optimisation solutions based on a holistic view of the entire transport system
- Performance-based agreements with a focus on uptime, reliability, and fuel efficiency
- Cyber security growing in importance
- Various degrees of autonomous operations



Upgradable solutions for the maritime decarbonisation

Technology


Multi-fuel engines


Hybrid systems


Propulsion systems


Electrification solutions


Catalyst systems


Voyage and fleet optimisation


Fuel gas supply systems


Port optimisation and simulators

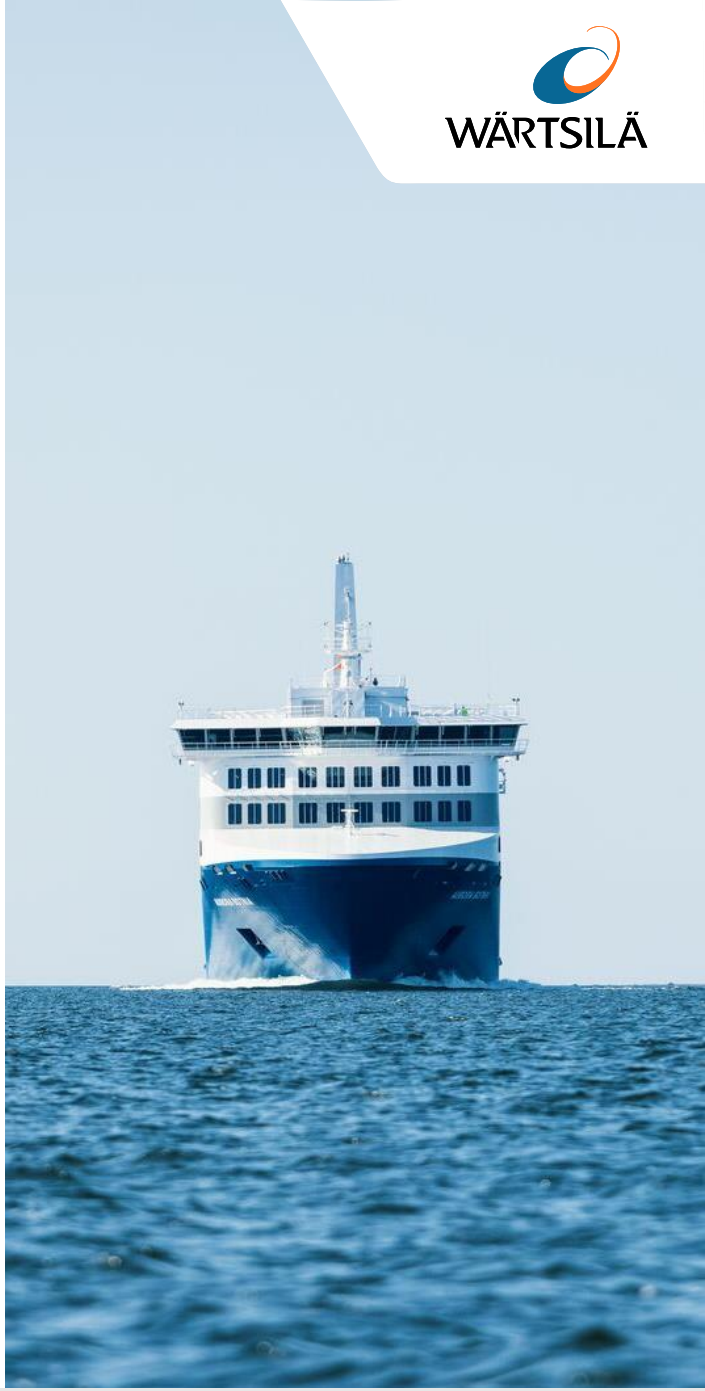
Services


Spare parts


Maintenance services


Performance based agreements


Upgrades & retrofits



How a NB in 2035 will look like ?

2S Engine Efficiency Optimization

Carbon Capture

Future Fuels

Shaft Generators

4S Engines for LNG & Future Fuels

4S Engine Performance Optimization

Wind Assistance

Hull Air Lubrication

EnergoFlow

Optimised Propeller

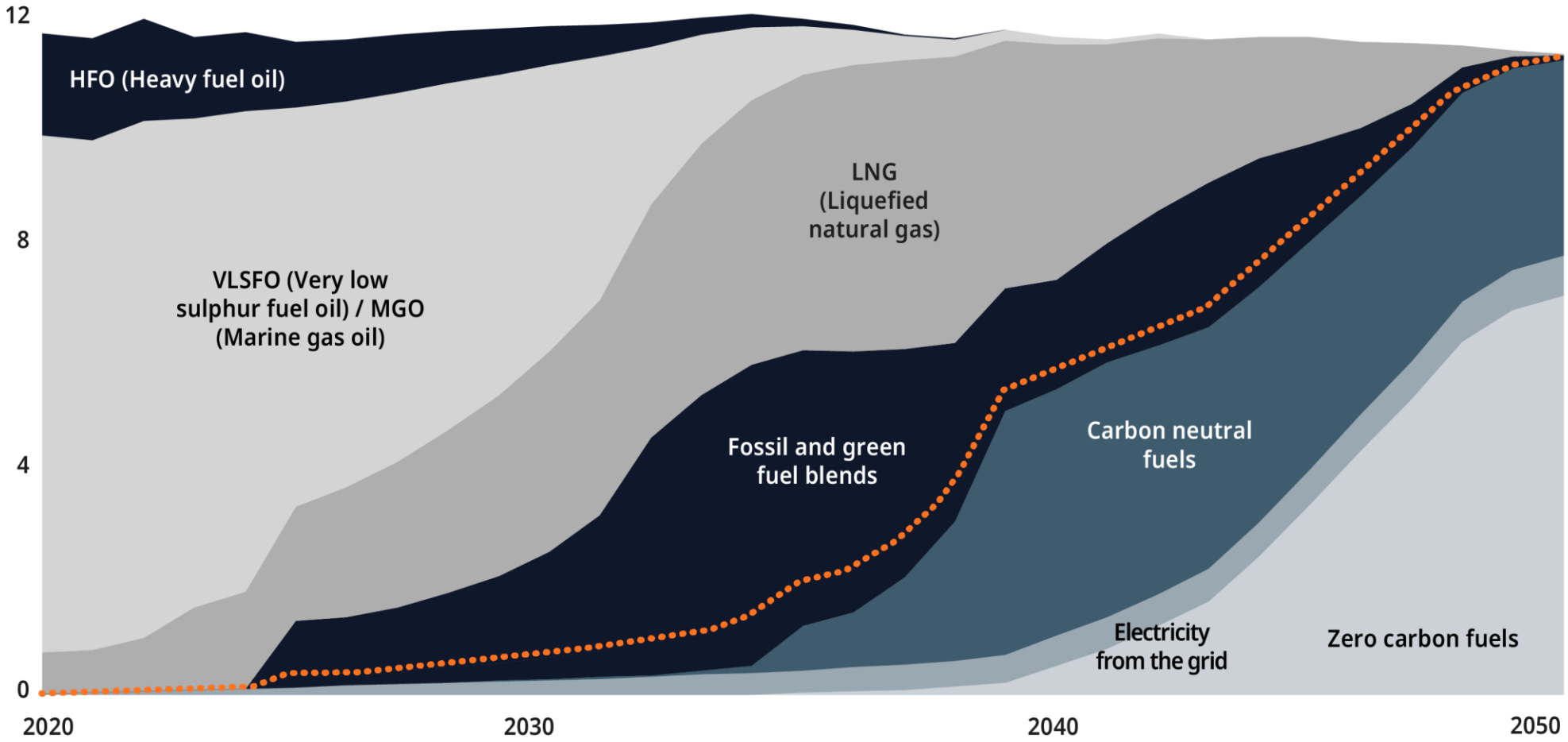
Shore Power

EnergoProFin

Hybrid & PV

Moving from a single-fuel industry to a multi-fuel one

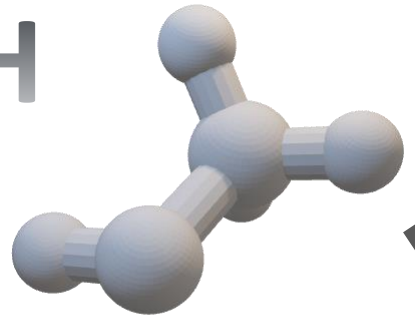
Distribution of fuel types for Decarbonisation 2050 (1.5c scenario), EJ



Source: DNV Maritime Forecast 2050 model, Wärtsilä internal estimates

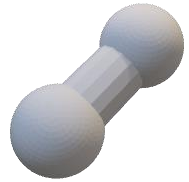
Future Fuels for the marine engines

CH3OH
Methanol



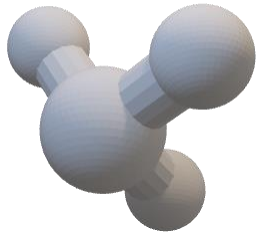
- Easy implementation? Y/N
- Liquid fuel at ambient temperature
- Toxic fuels
- W-t-W profile – availability of biomethanol

H2
Hydrogen

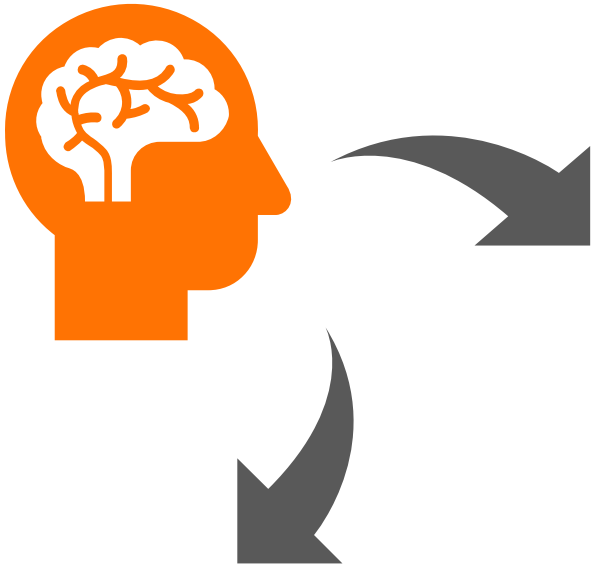


- Energy density per m³
- Competition landscape / price?
- Cryogenic storage (-253˚C)
- Safety risk - explosivity

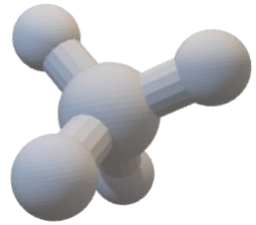
NH3
Ammonia



- Highly toxic substance / safety risks
- Energy density per m³
- Technological maturity
- Availability of green ammonia

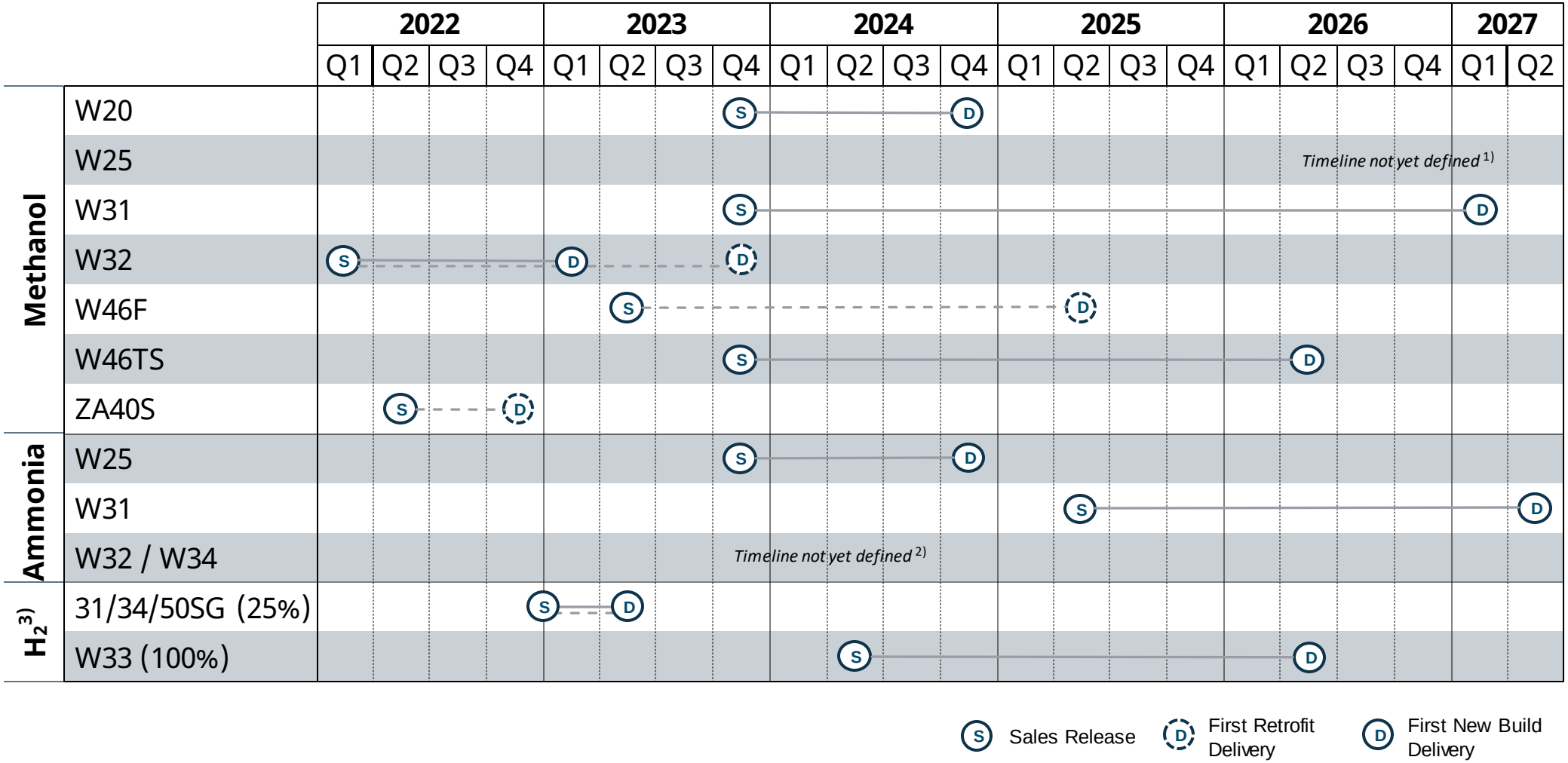


CH4
Methane



- Fossil fuel
- Availability of biomethane
- Methane slip
- Cryogenic storage (-162˚C)
- Proven technology

Future Fuels Roadmap – 4str Engines



1) *The W25 Methanol timeline is not yet defined. Tentative plans indicate a sales release may occur not earlier than 2027*
2) *Retrofit package is under planning. Sales release and first delivery dates are dependent on results from on-going technology tests. Tentative plans indicate a sales release not earlier than 2024.*
3) *Hydrogen applied to Power Plant only for the time being.*

Future Fuels Roadmap – 2str Engines

Full-scale LNG testing
Q4, 2022

Start MeOH testing
Q3, 2023

LNG tech. demonstrator project with MSC
H1, 2024

Start NH3 testing
Q2, 2024

MeOH pilot project
H2, 2024

MSC tech. demonstrator converted to NH_3
H1, 2025

The right solution for each vessel

Engine optimisation
& fuel flexibility

Electrification

Energy saving
devices

Lifecycle
solutions

Technology-driven shipping – Blessing or curse for the seafarers?

Challenge

- Traditional ways of working on a vessel has been overtaken by technology
- Seafarers need training to handle the new systems and education for the new processes
- Luck of skilled crew in the future

Solution

- Systems are designed carefully to facilitate interaction with seafarers
- State-of-the-art training with simulators prepares ships' crews to handle systems safely and correctly
- Technologies deployed are designed to support crew in making shipping even safer

Benefits

- Real time data facilitate monitoring of vessel's condition hence improving operational performance
- Proactivity and early fault finding reduces crew's interference
- Officers avoid bureaucracy and have more time to focus on their navigational duties
- Crew shortages will be tackled with the help of technology
- Valuable assistance to the crew from shoreside operators

The crew onboard ships will retain a crucial role regardless of shore control and autonomy level.

Expertise Centers – the Experts and Integrator

OPTIMIZED MAINTENANCE

Expertise Centres
ALERTS PERFORMANCE DEVIATIONS
and provides
REMOTE SUPPORT SERVICES

Expertise Centres
PLANS & SOURCES
maintenance works

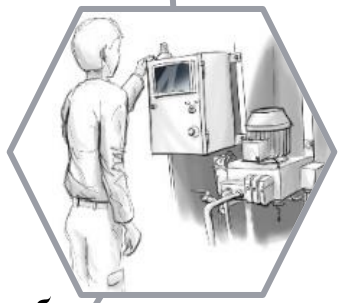
PREDICTIVE & PROACTIVE

EFFICIENT WORK EXCECUTION

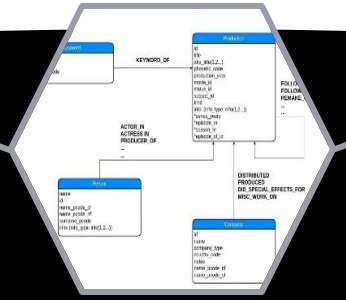
EXPERTISE CENTRE

GUARANTEED ASSET PERFORMANCE

Expertise Centres
OPERATIONS SURVAILANCE



Expertise Centres
MONITORS
work progress



MARINE

OFFSHORE

POWER PLANTS

INDUSTRIAL

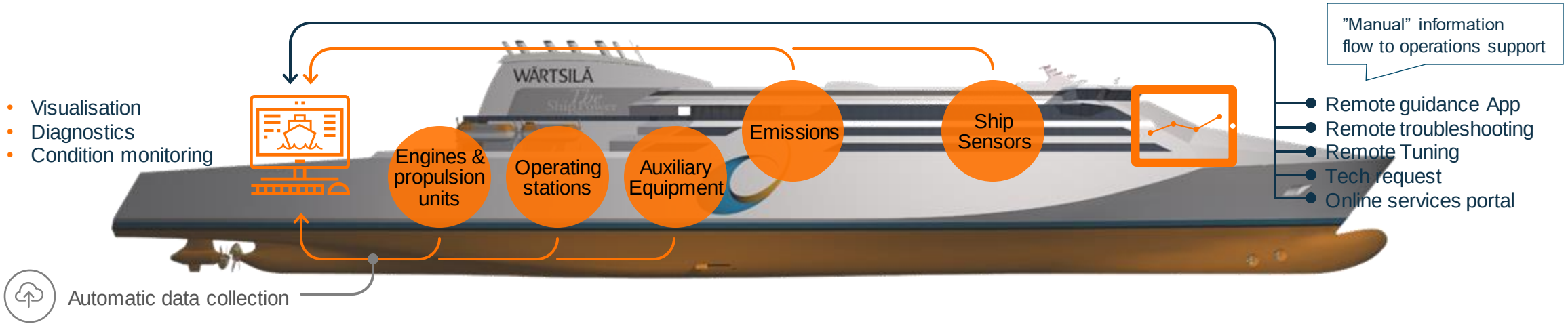
MAINTAIN installation-level
ASSET REGISTRY & FLEET VIEW
with customers.

Operations Management Services description

- Remote operational support – Remote guidance
- Remote operational support – Remote troubleshooting
- Remote operational support – Remote tuning

What Expertise Centers Do

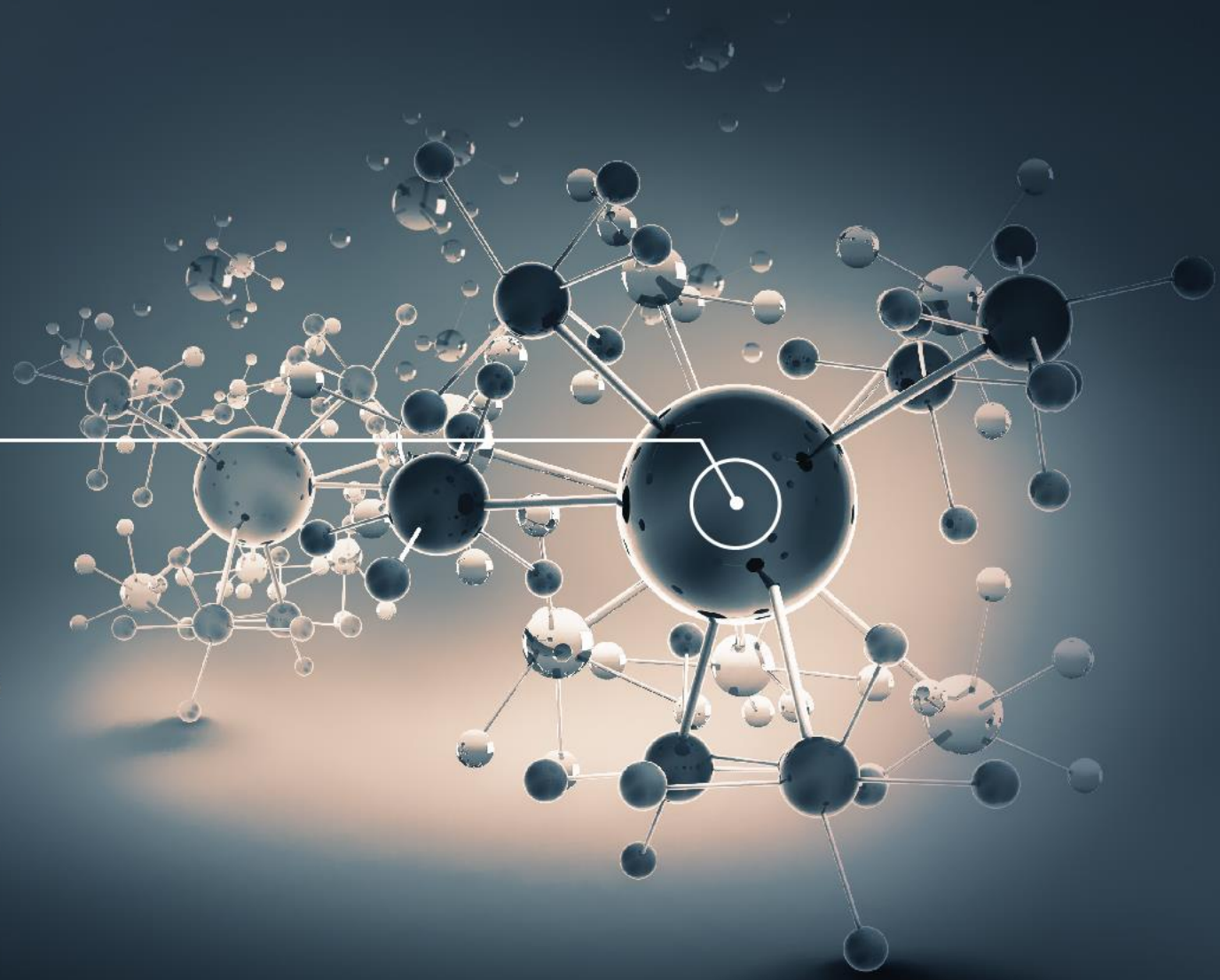
PERFORMANCE MONITORING	REMOTE OPERATIONAL SUPPORT	PERFORMANCE IMPROVEMENT PLANNING	MAINTENANCE MANAGEMENT AND DYNAMIC MAINTENANCE PLANNING™
• Expert service that provides actionable advices to maintain engine health in optimum level • Detect abnormalities before leading to unplanned events • The service is based on long term experience of operating / monitoring Wärtsilä equipment's and is provided by Wärtsilä experts	• Dedicated experts´ advice and guidance on operational and technical issues. • Diagnostics of operating conditions to determine best possible actions.	• Performance improvement proposals based on continuous monitoring and guidance • Advice to improve equipment performance • Technical upgrades for improved availability and efficiency	• Matching preventive and predictive maintenance to your operations • Ensuring availability of spare parts and service engineers



SMART TECHNOLOGY WÄRTSILÄ

Augmenting existing propositions
with newly acquired technologies

Developing new business models and solutions

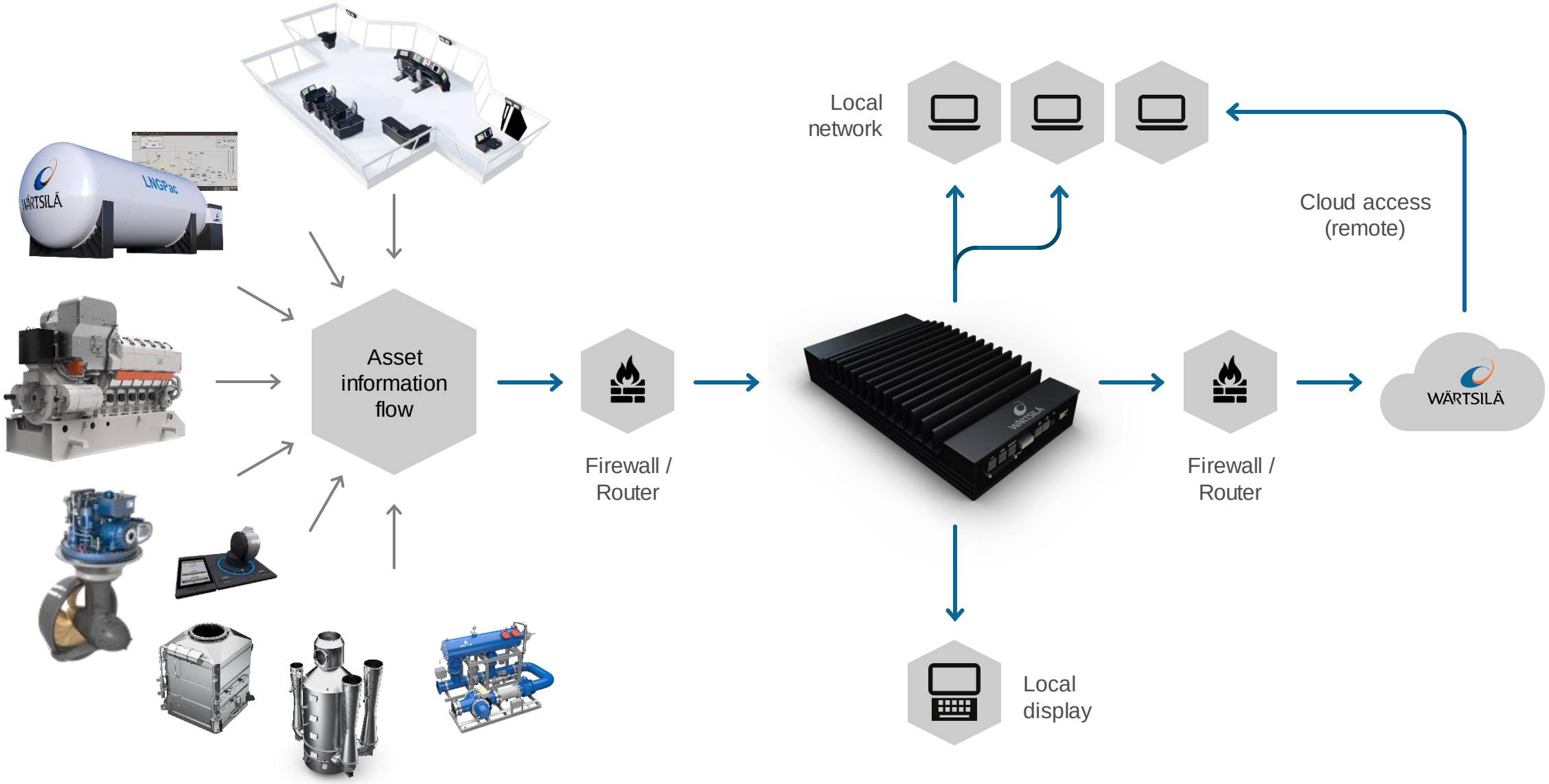


POWERED BY THE

WÄRTSILÄ DATA BRIDGE ECOSYSTEM

Integrating the best of modern data technologies from strategic acquisitions, and developing additional capabilities like the Wärtsilä Data Collection Unit (WDCU), and Streaming Cloud Platform, to support Wärtsilä's products and processes and provide for engagement with industry data ecosystems.

Wärtsilä Data Bridge – Onsite Data Collection



Data Bridge – Using the data

Data Sources

Data Bridge

Solution examples:

Wärtsilä Trending Tool

Wärtsilä Asset Diagnostic Service

Wärtsilä Expert Insight

Wärtsilä SFOC

Current and future solutions

- Chief engineer Engine expert
- Fleet operations controller
- Maintenance engineer
- Business analyst Data scientist
- Other customer or internal users

Fully digitalized ship

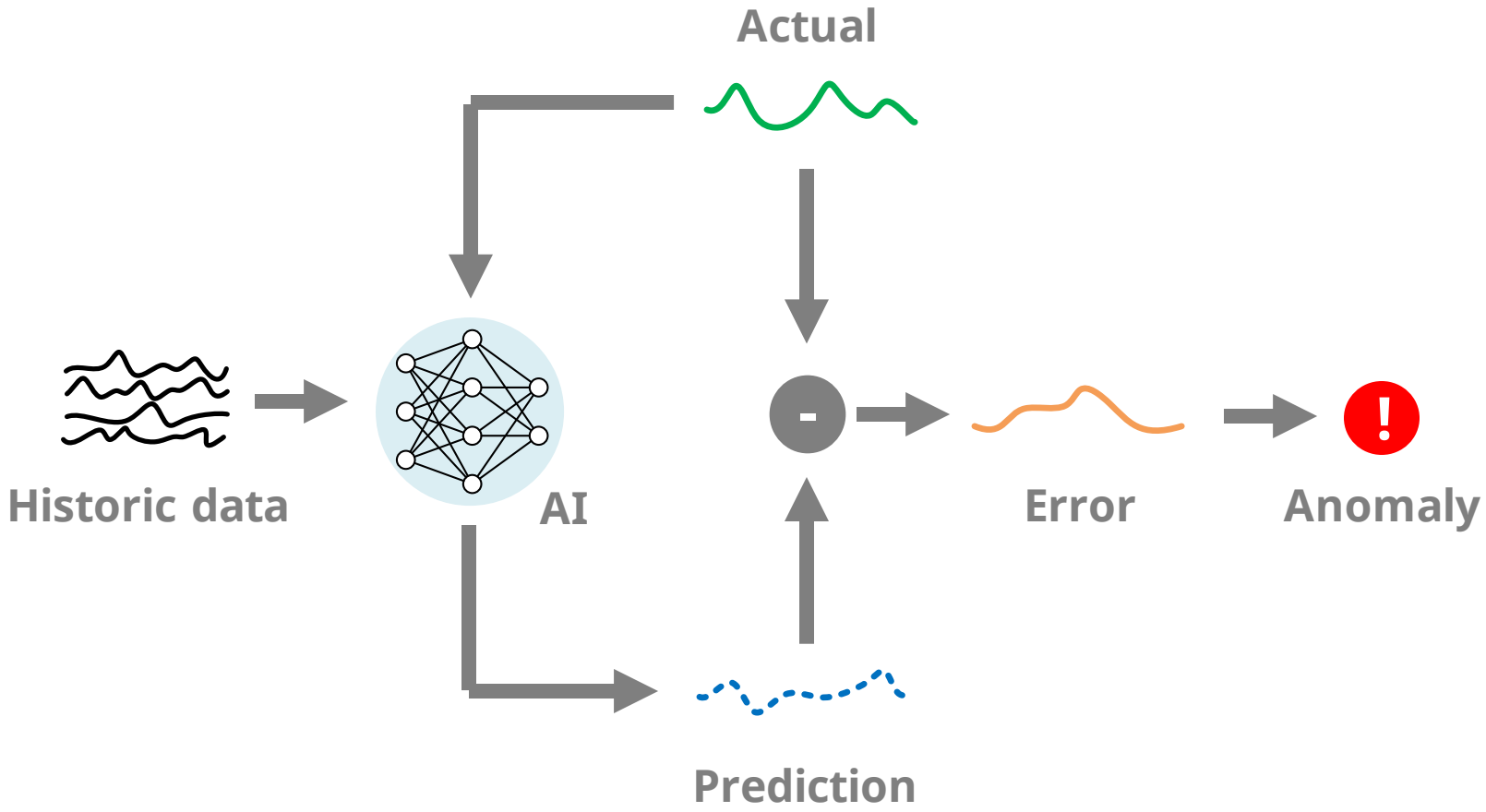
- Deadweight: 179,120 DWT
- Distance travelled 2021: 72,688 nm
- Fuel consumption 2021: 10,868 ton (HFO)
- Attained CII 2021: 2.599
- CII Rating 2021: **C**

WÄRTSILÄ EXPERT INSIGHT

Expertise and AI to enhance reliability efficiency and safety of assets

EARLY DETECTION THROUGH PREDICTION

- Simple alarms and trend analysis are only a rough approximation based on one or a few parameters
- Our AI does not rely on rules or thresholds but rather predicts the signal itself, based on all parameters
- Machine learning algorithms learn to predict based on historic data. Differences between actual and expected data generates an anomaly



FROM REACTIVE TO PROACTIVE

AI processes data continuously in real-time

Expert is automatically alerted to anomalies and supports the customer proactively

From “Houston we have a problem” to “This is Houston, listen carefully…”

WÄRTSILÄ