Future-Proofed Dredger Design Considerations

Opening Viable Pathways to Decarbonisation

WEDA Dredging Conference, San Francisco CA26-28 October 2022

Mark Keneford, Maneging Director & General Manager Marine Sales Canada
Stephen Taylor, Marine Sales
Ryan McKinnon, Marine Sales

Delivering customer value through leading R&D and partnerships

- We believe that the shift to new technologies will be gradual, and there will be a need for a broad array of solutions to decarbonise marine and energy.
- Our focus will remain in developing our core technologies and through partnering we can ensure a broad solution offering for our customers.
- Wärtsilä will continue to invest a stable ~3% of net sales in R&D.

175 MEUR

In 2021, R&D investments amounted to 175 MEUR, representing 3.7% of net sales.

2,800

Patents and applications.
Current patent portfolio in 2022: approx. 2,500 patents and 300 patent applications in 50 countries.

What is Decarbonisation?

Decarbonisation is about **reducing Carbon emissions resulting from human activity** such as burning oil, gas or coal, with eventual goal of eliminating them.

Carbon emissions are the **most important source of Green House Gas (GHG) emissions** in the atmosphere which contribute to global warming and climate change.

CO_2 is the largest of GHG's

Decarbonisation tends to refer to the **overall process of reducing 'carbon intensity'** by lowering the amount of greenhouse gas emissions. There are several ways of achieving this by increasing energy efficiency, replacing fossil fuels with low carbon alternatives or carbon emission abatement.

EMISSION IMPACT

CO_2 accelerates the warming of our planet,

CH_4 also accelerates the warming of our planet, and is 28 times as potent as CO_2 in doing so but it is much less present in terms of absolute volume.

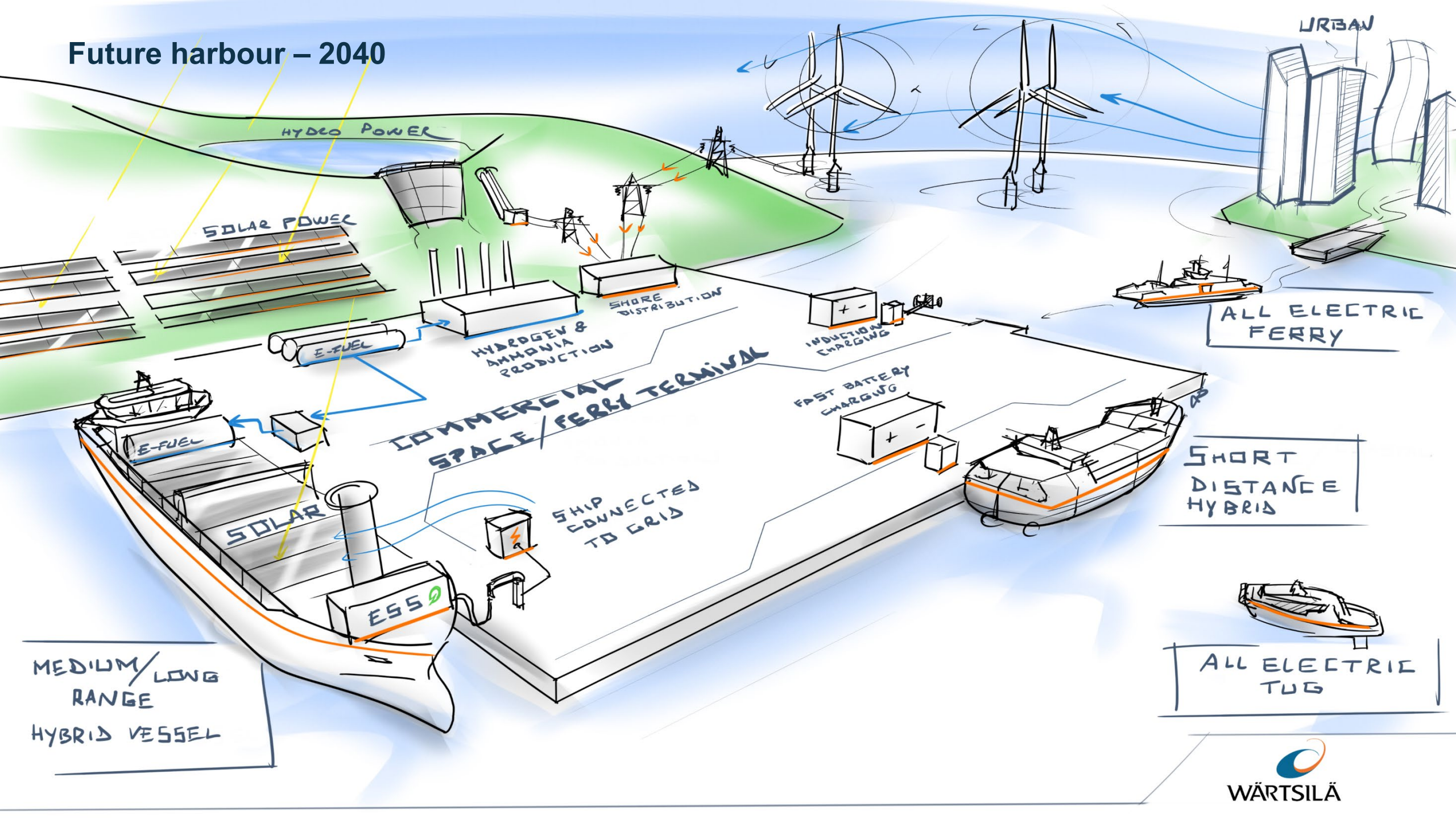
Nitrogen oxides or NO_x is a known source of smog formation especially in urban highly polluted areas (with related health effects), and causing acidification and eutrophication in nature.

SO_x emissions contribute to acid rains and promote the formation of small secondary particulates.

Particulate emissions impact the local air quality and effects human health as small particles penetrate to respiratory system causing lung diseases and further penetration to blood circulation.

Dredgers and the Community

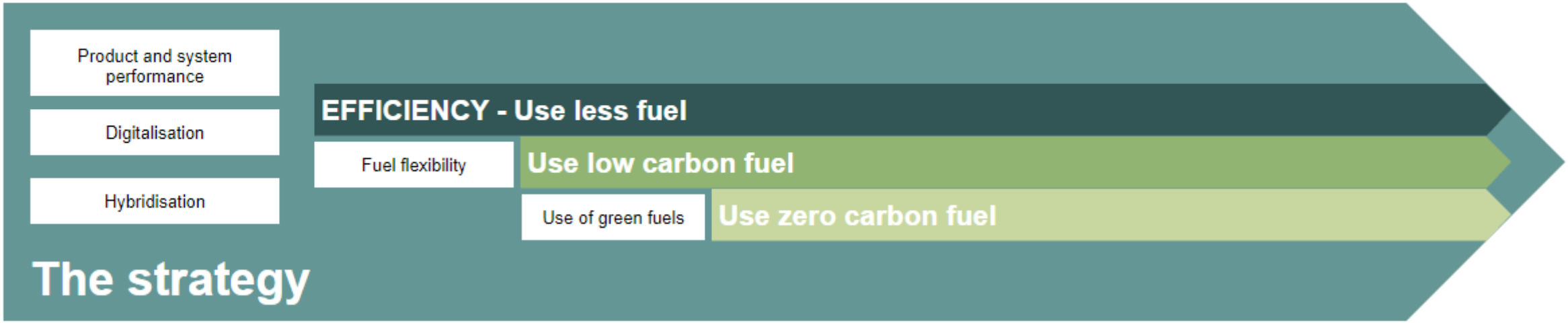
Future harbour – 2040



WÄRTSILÄ

HOW CAN WE DECARBONISE?

Decarbonisation will be a key driver in the coming years



Burn less fuel

Optimizing the voyage of a ship with the use of data. Efficient sailing route and JIT arrival are examples of this.
Minimizing vessels energy need by smart propeller and hull designs, solutions that improve hydrodynamic efficiency or minimize vessel friction in water such as Air Lubrication.

Go electric

A combination of power sources to provide the needed energy for the ship in the most efficient way. When complementing an Internal Combustion Engine with a battery hybrid system and FC technology great progress can be made. The use of wind- and solar energy is used more and more, and further the availability of shore power is increasing which allows for a direct use of green electricity with the least losses possible.

Change fuel type

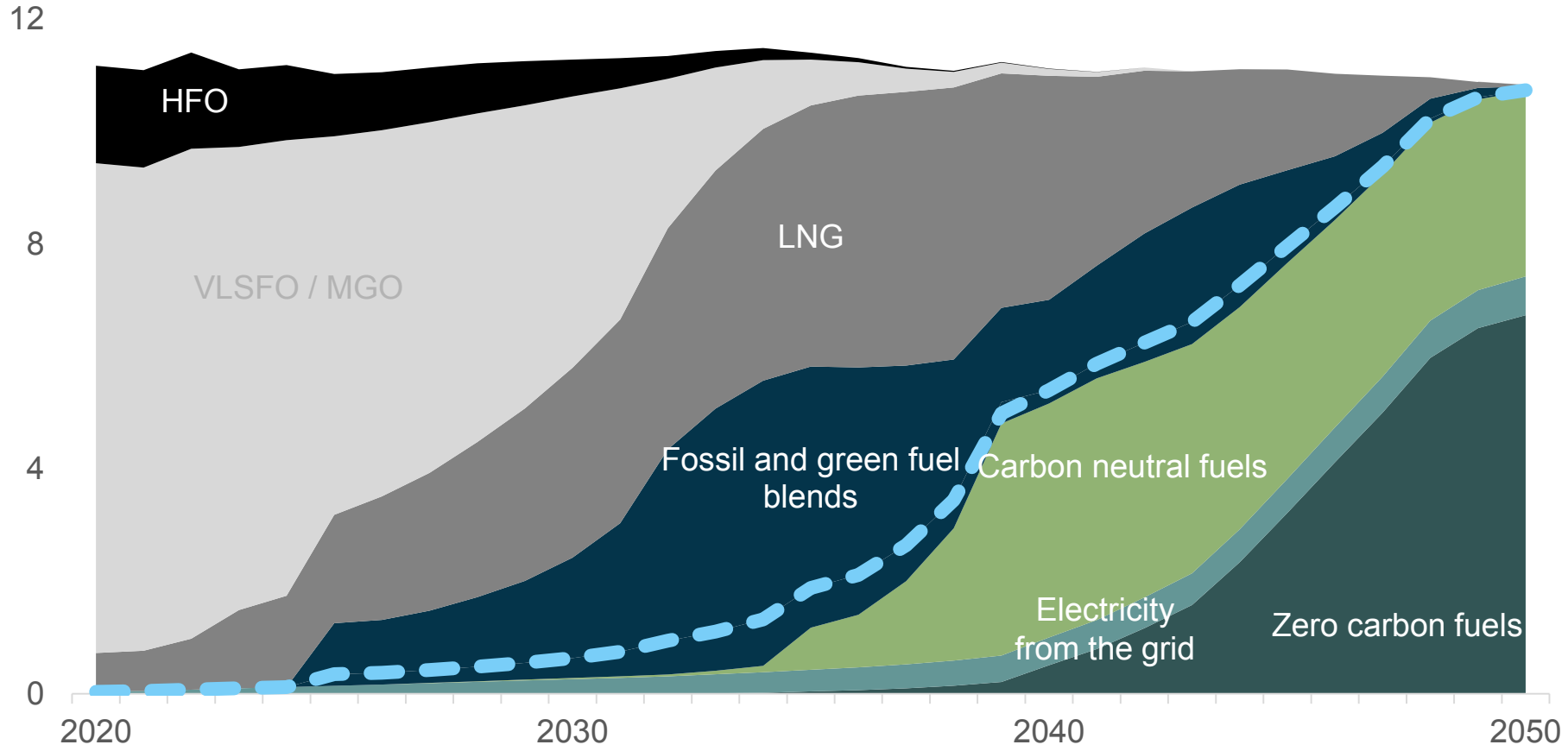
Future fuels with lower- or even zero-carbon in the footprint (combined with highest combustion efficiency). When we maximize efforts on step 1, 2 and 3 we can book a lot of progress, but we need low carbon/zero carbon fuels in order to reach the overall goal of Decarbonization. Some examples: Bio or Synthetic LNG, Bio or Synthetic Methanol, Ammonia and Hydrogen.

Adoption of new fuels is the key to decarbonising the maritime industry

High energy prices are accelerating decarbonisation

Moving from a single-fuel industry to multi-fuel

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



Source: DNV Maritime Forecast 2050 model, Wärtsilä internal estimates

2050 is a single vessel's lifespan away – customers need to invest in fuel flexibility to avoid risk of stranded assets

- Vessel lifespan: 25-30 years
- Critical decision criteria: i) Multifuel capabilities for blending with green fuels ii) Conversion capabilities for future fuels

Carbon neutral and zero carbon fuels in maritime

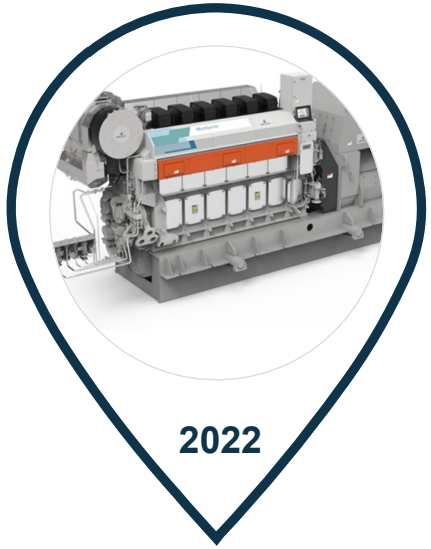
Methanol: delivering capability to power marine engines and achieve carbon neutrality

2015

Conversion of Stena Germanica ZA40 engines

2020

Development & demonstration of methanol technology



2022

W32 Methanol engine launch & MethanolPac

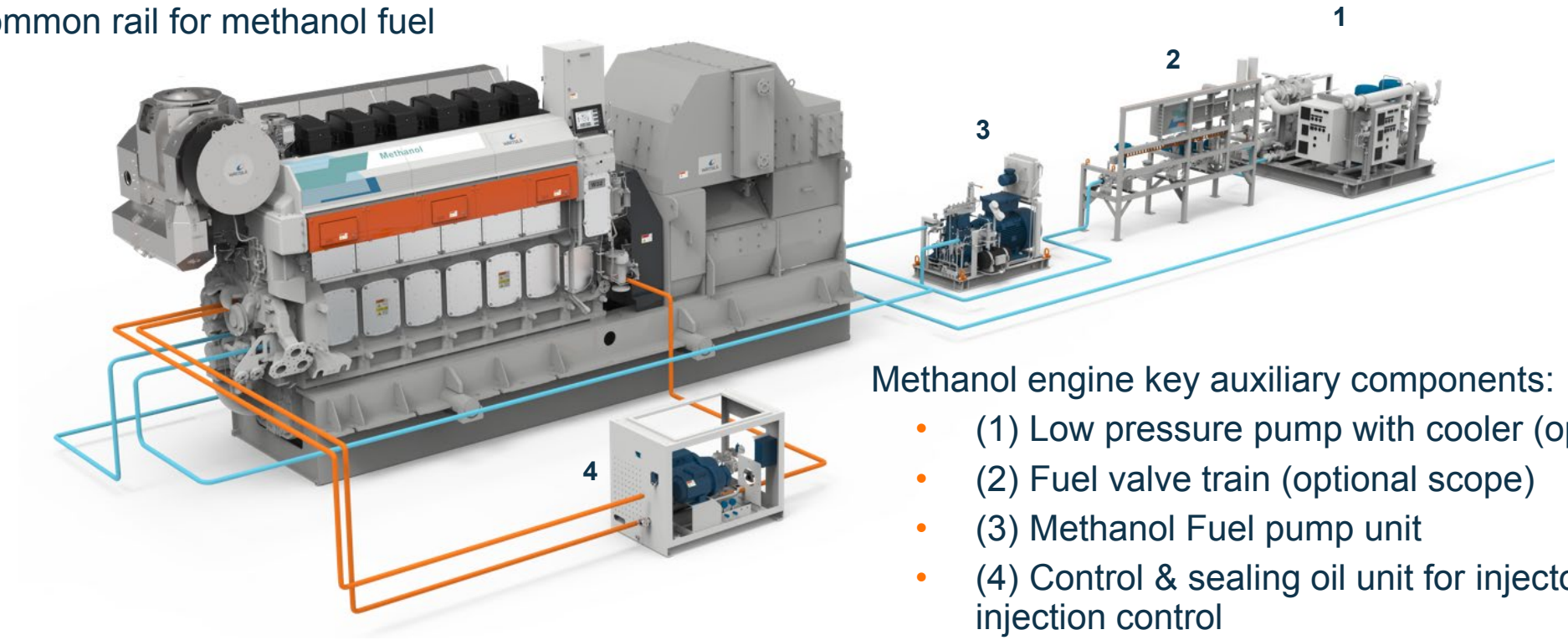
2023

Launch additional methanol engine types & retrofit options

System overview

Methanol engine key components:

- Multifuel injection system
- Cylinder heads - optimised for methanol combustion with pilot and main fuel
- Common rail for methanol fuel



Methanol engine key auxiliary components:

- (1) Low pressure pump with cooler (optional scope)
- (2) Fuel valve train (optional scope)
- (3) Methanol Fuel pump unit
- (4) Control & sealing oil unit for injector sealing and injection control
- Nitrogen generator for system purge (optional scope)

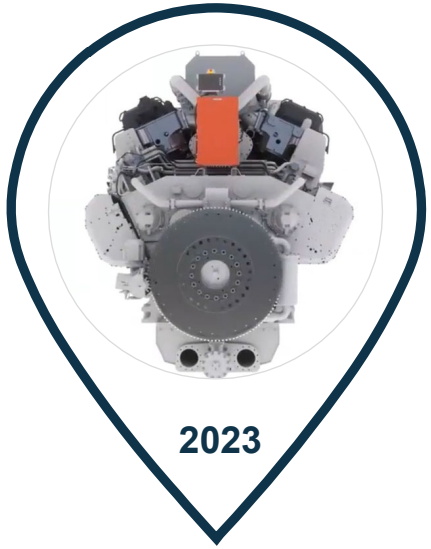
Ammonia: advancing from industrial chemical to zero-carbon ship fuel through R&D and collaboration

2021

First engine tests with ammonia blends

2022

Industry collaboration for solution validation



2023

Technical concept ready

2024

First ammonia engine delivery

Hydrogen: from blends to 100% hydrogen

2021

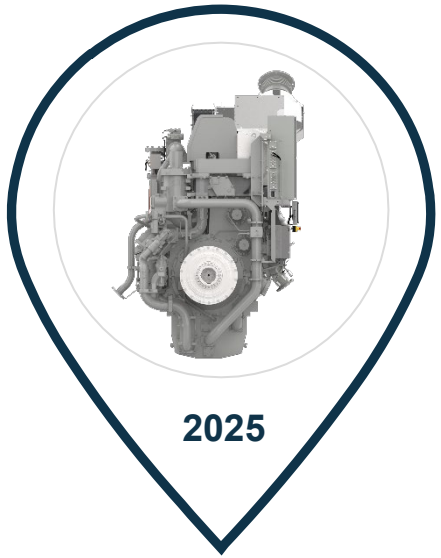
Engine development & testing

2022

Blending validation

2023

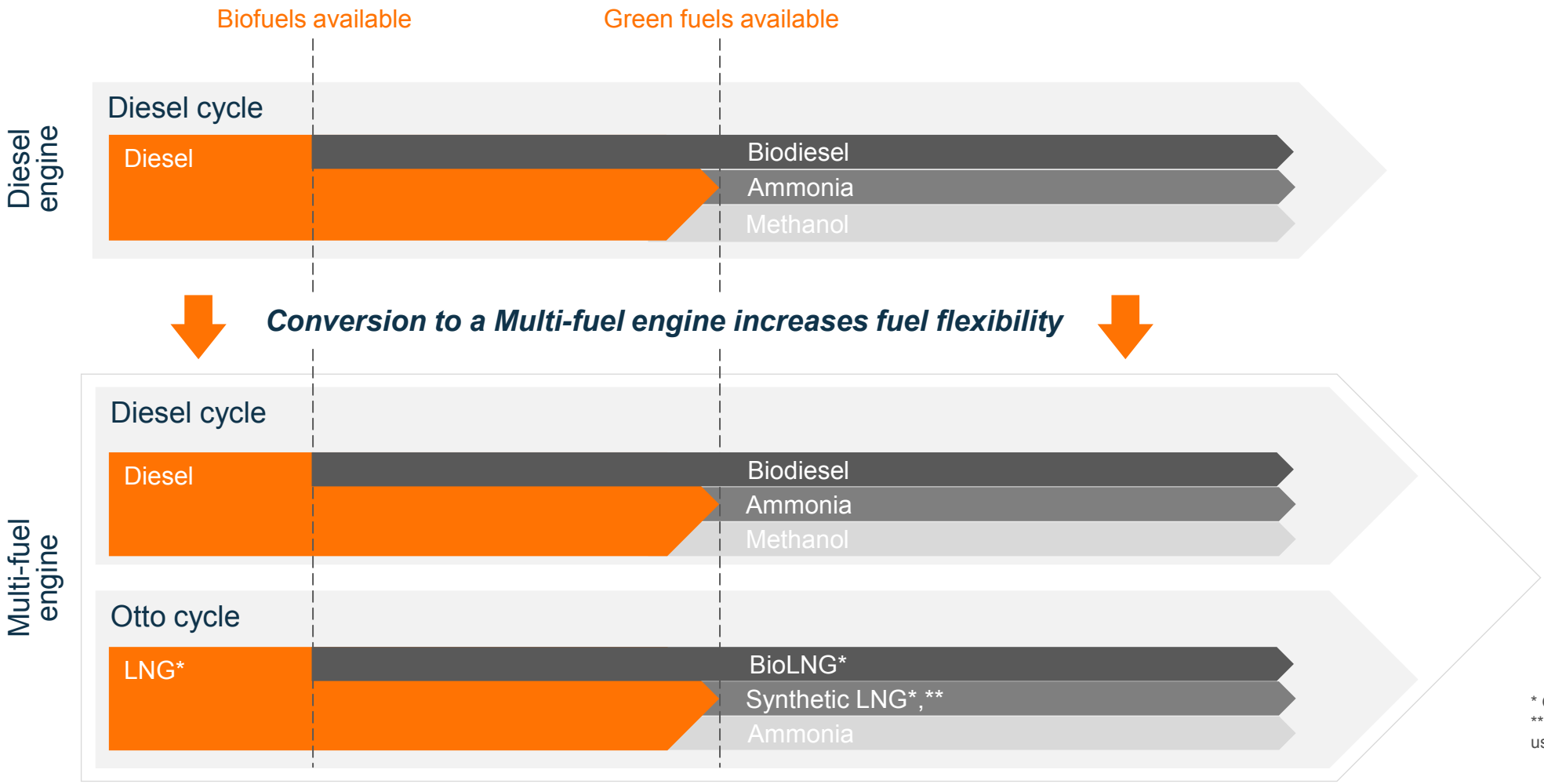
Engine demo



2025

Technical concept ready

THE COMBUSTION ENGINE CAN BE DECARBONISED USING LIQUID AND/OR GASEOUS FUELS

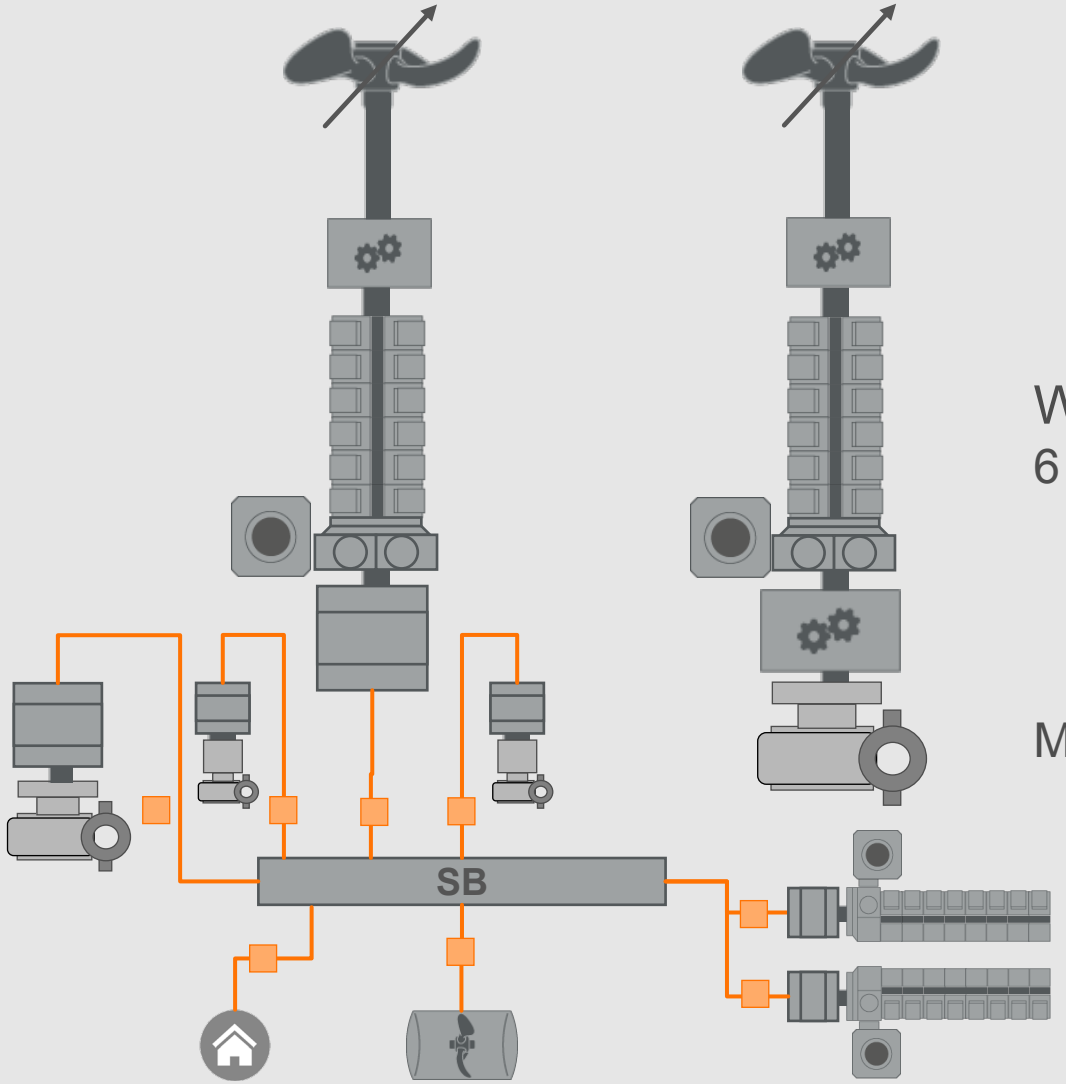


* Option to blend LNG with 25% (vol) H_2
** Synthetic refers to a fuel produced using Hydrogen as feedstock

Conventional configuration

W12V32
6 960 kW

W12V32 pump engine
6 240 kW



Electrical jet pumps
and submersible pump

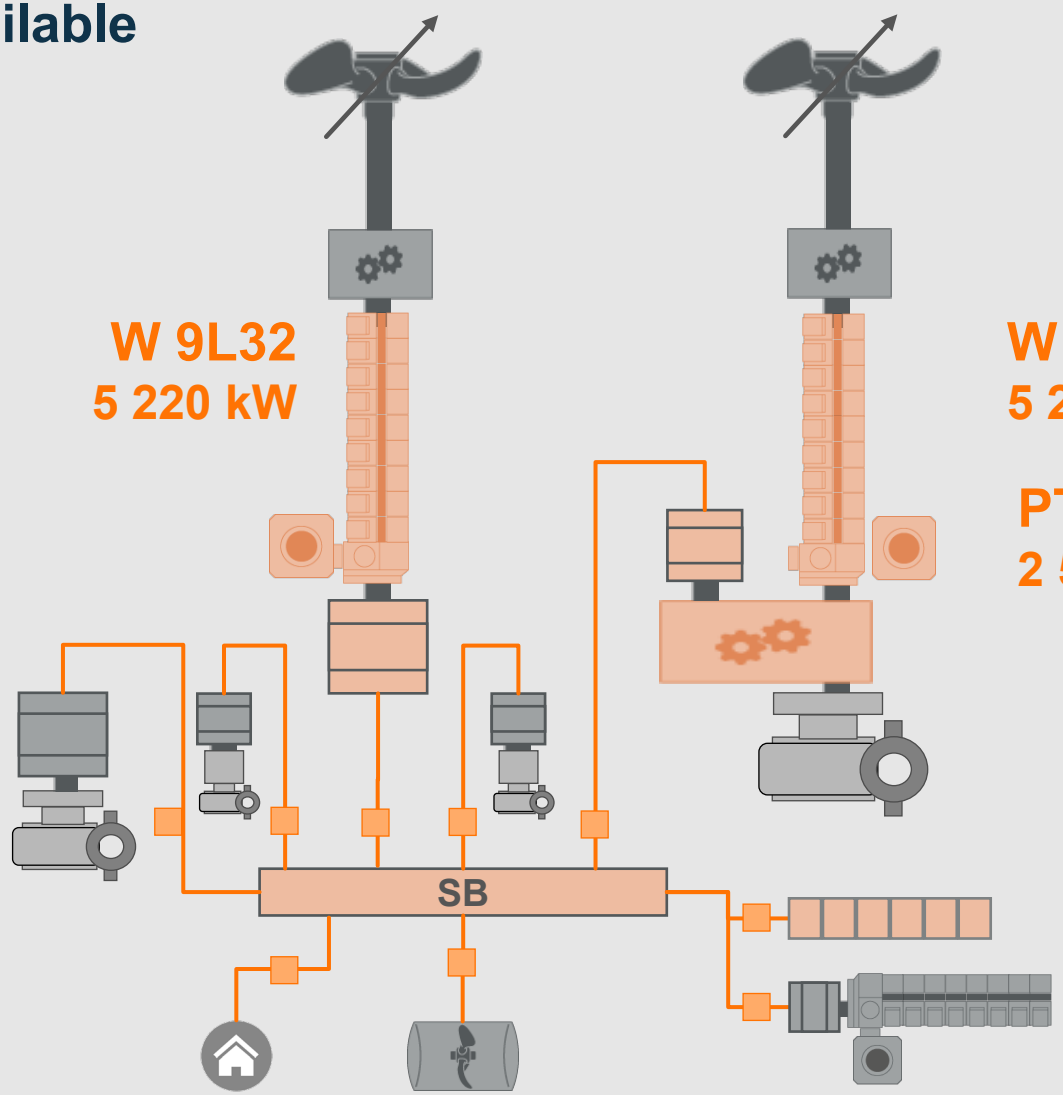
Mechanical dredge pump

Auxiliaries 2x W8L20

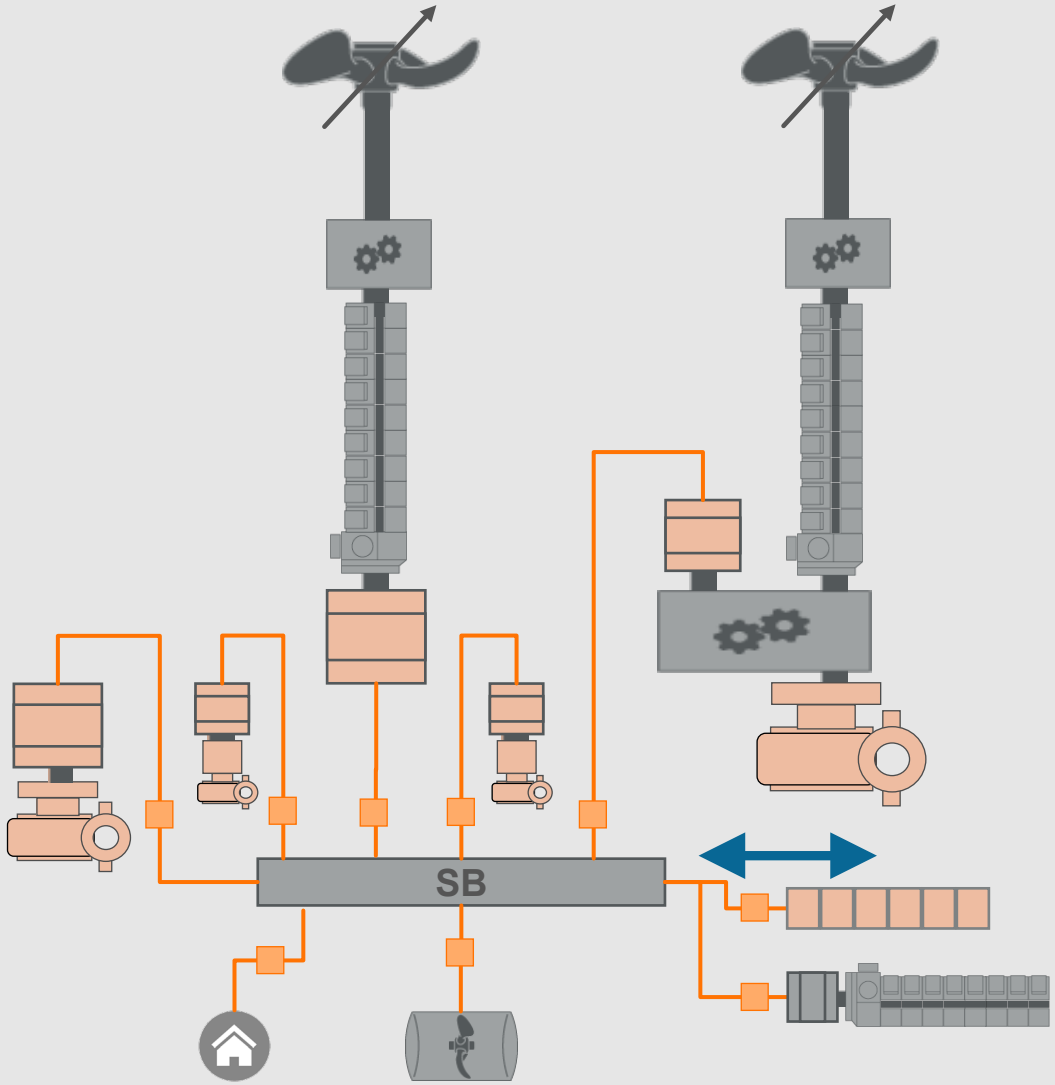
HY for Dredger

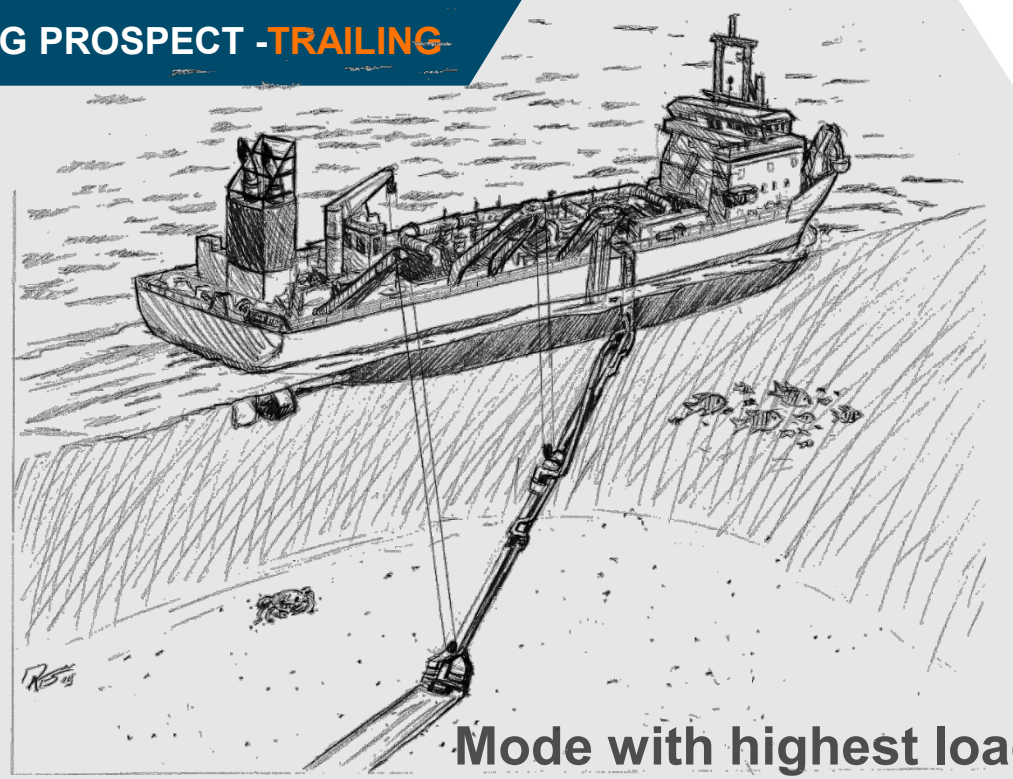
What fuel types are available today for dredgers?:

- Diesel
- Bio diesel
- Renewable diesel
- LNG
- Renewable methane
- Methanol



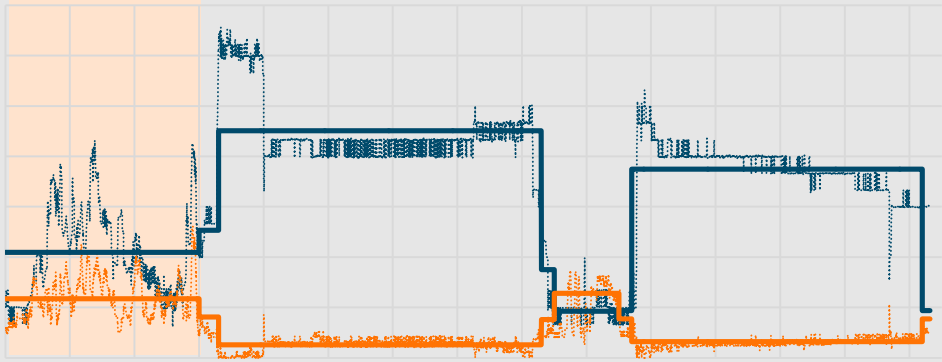
WÄRTSILÄ HY FOR DREDGER FUNCTION AND ENGINE LOADING PROSPECT -TRAILING



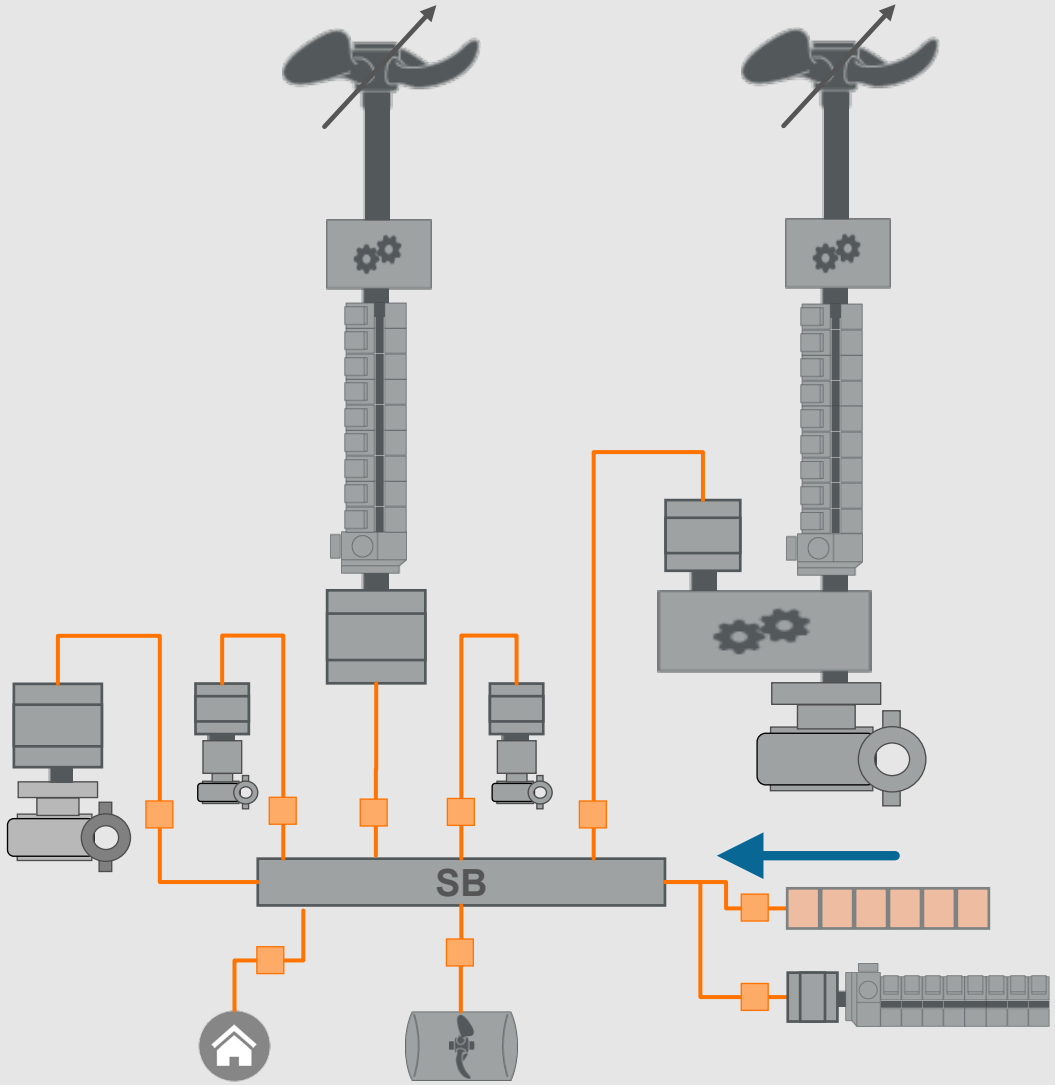


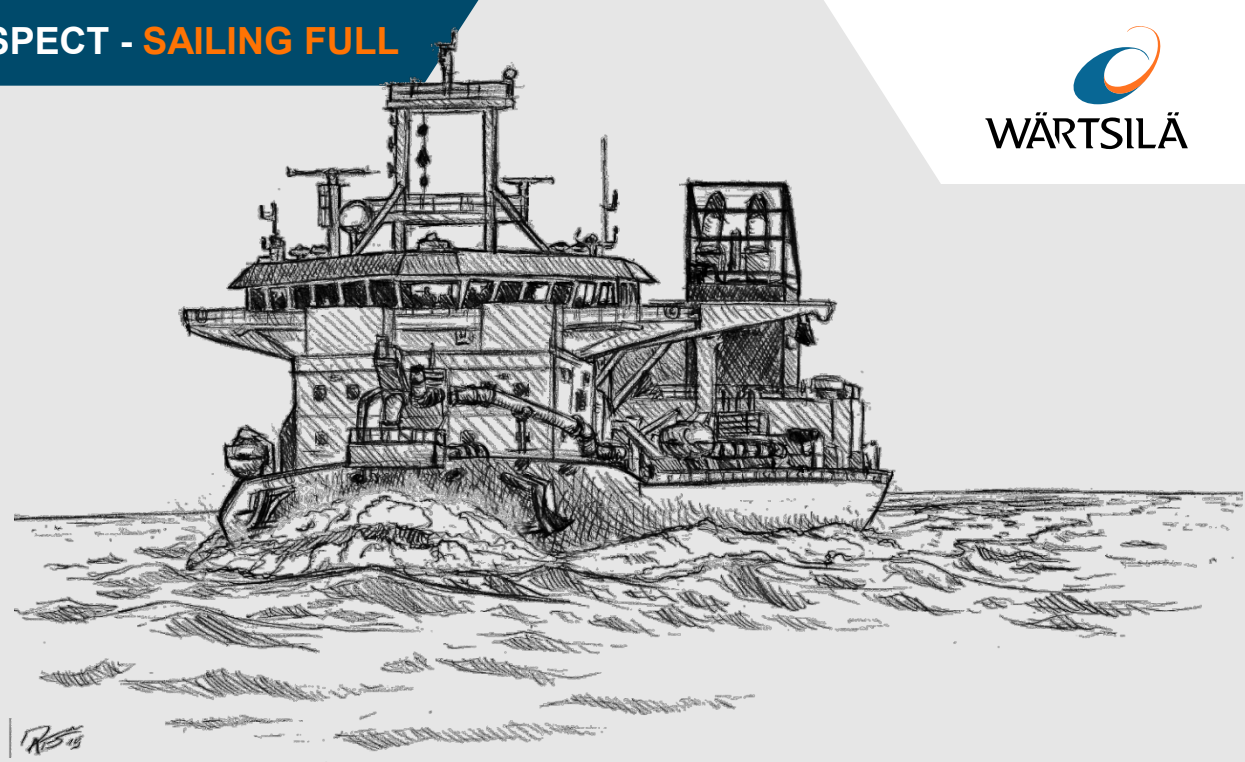
Mode with highest load fluctuations

- ✓ ESS manage the fluctuations through peak shaving
- ✓ Engines at stable load



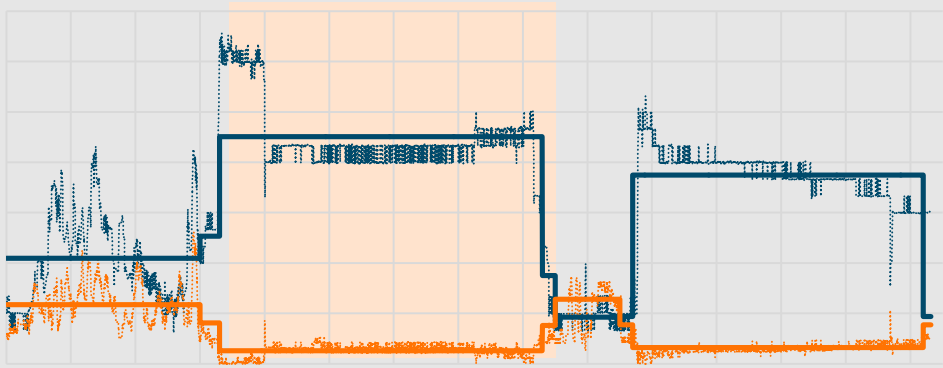
WÄRTSILÄ HY FOR DREDGER FUNCTION AND ENGINE LOADING PROSPECT - SAILING FULL



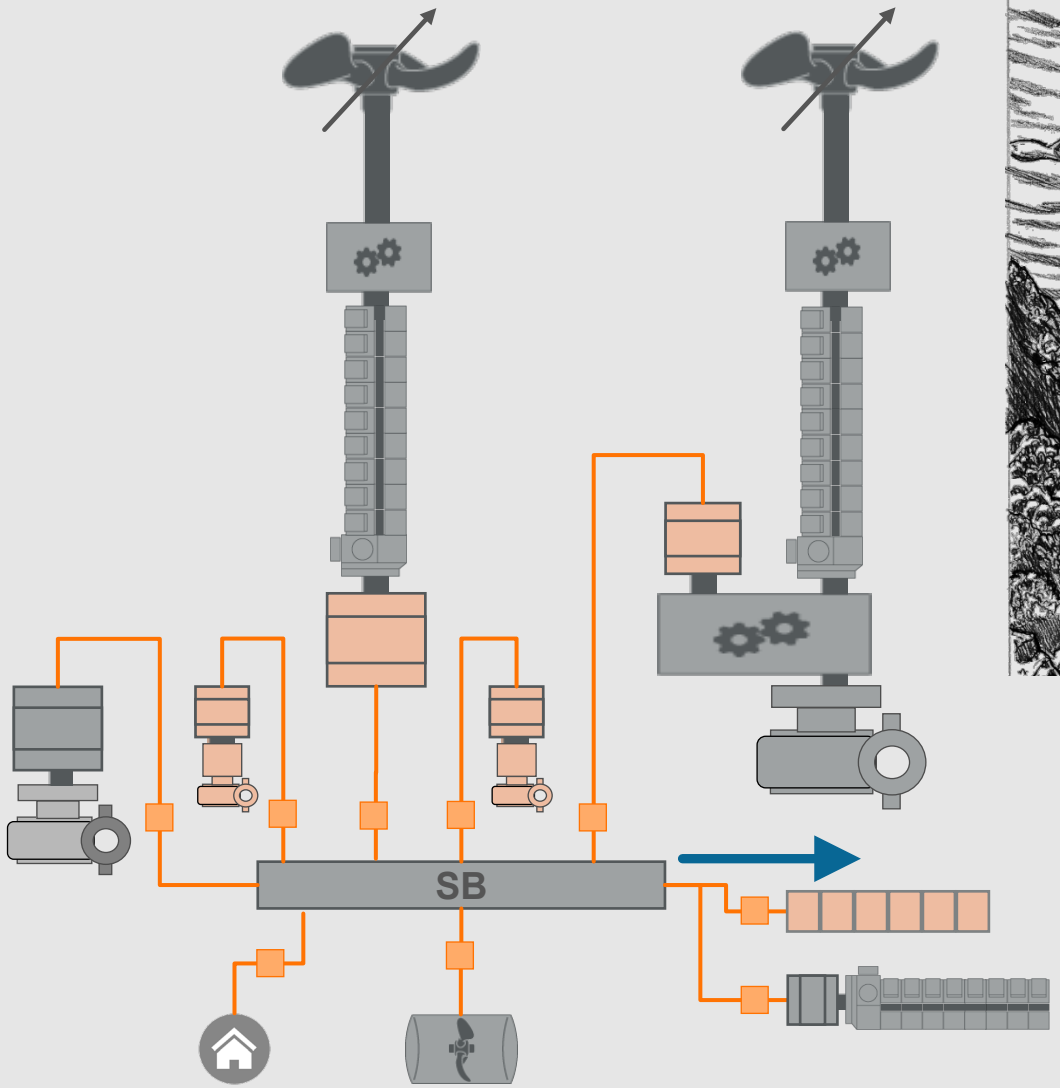


High speed with huge draught

- ✓ ESS cover hotel load
- ✓ Engines for max propulsion

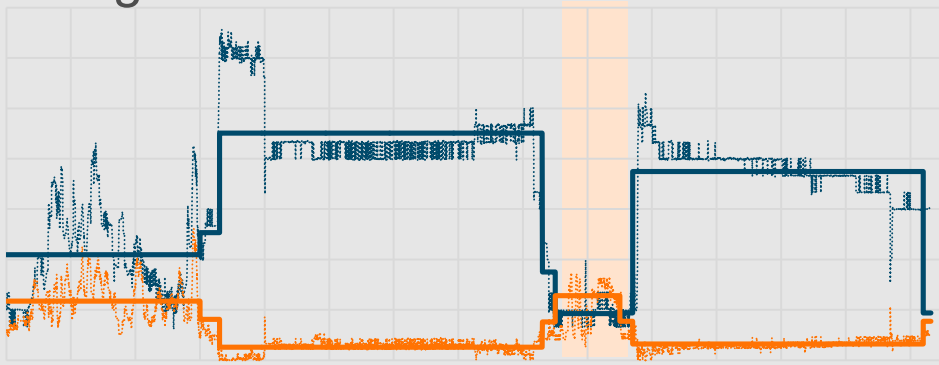


WÄRTSILÄ HY FOR DREDGER FUNCTION AND ENGINE LOADING PROSPECT - DUMPING

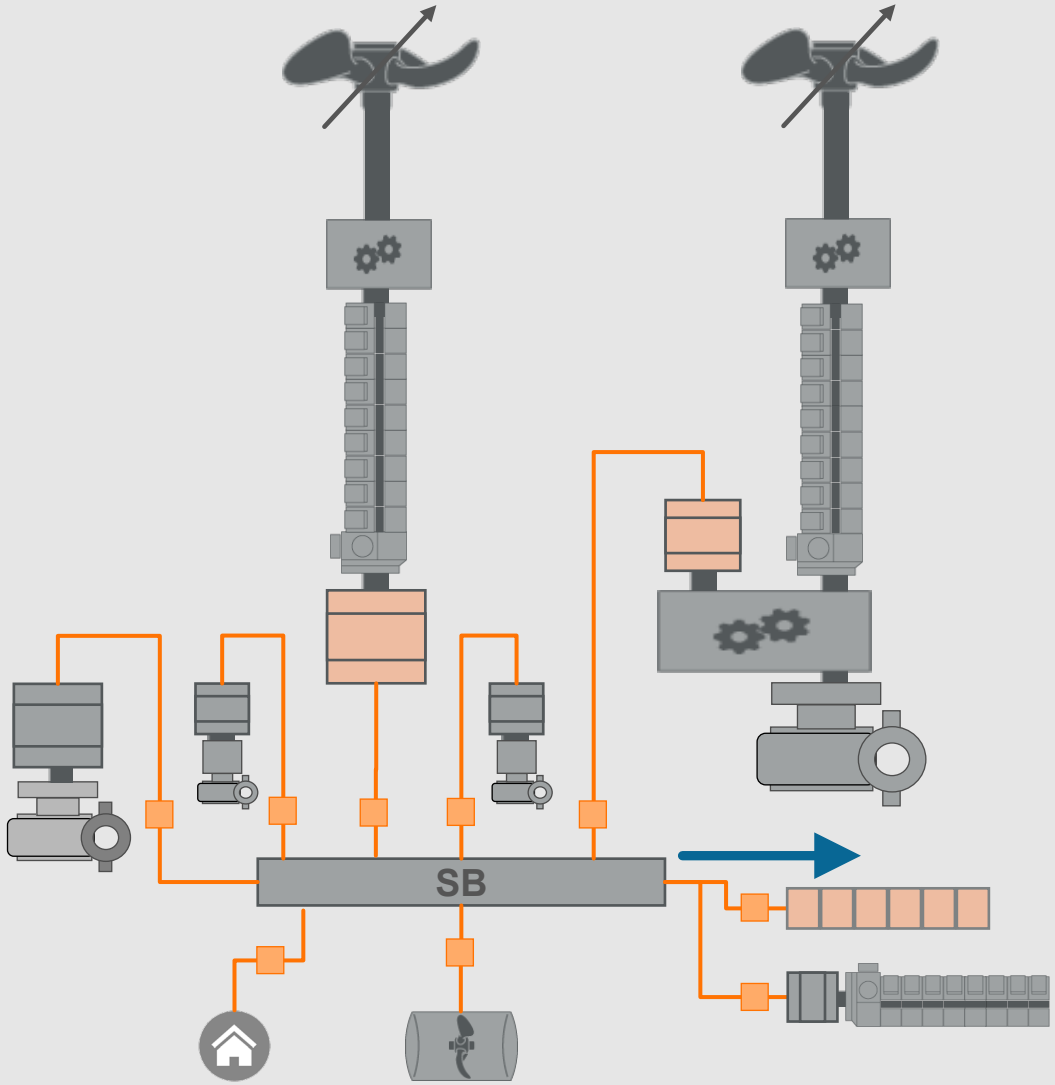


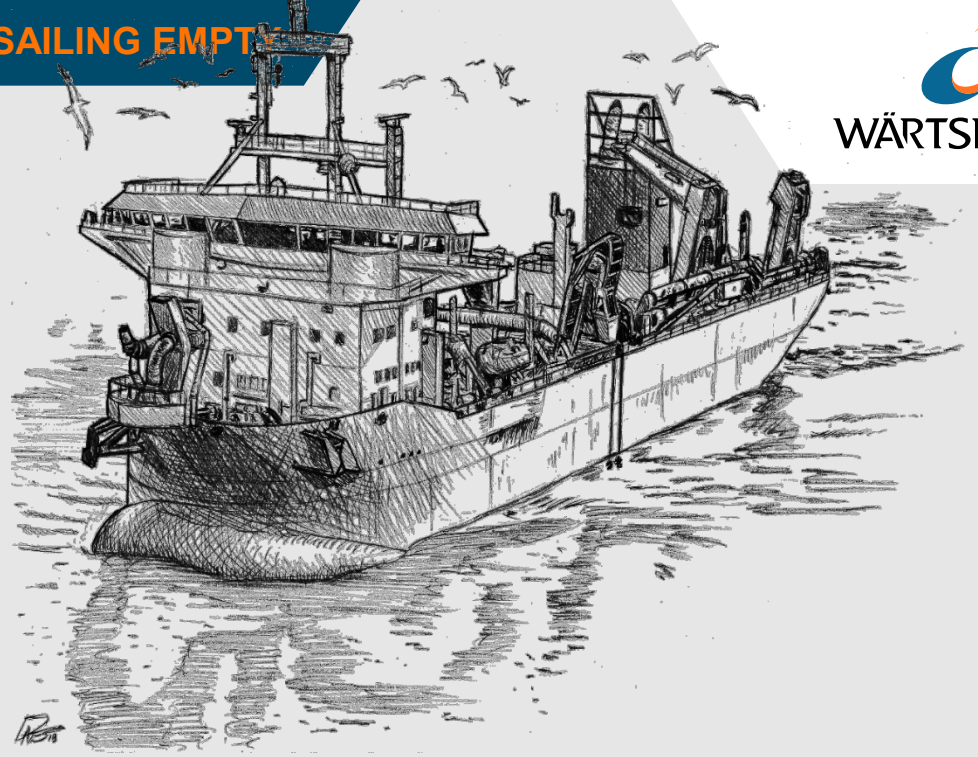
High fluctuations with medium loads

- ✓ ESS charging and peak shaving
- ✓ Engines at stable load



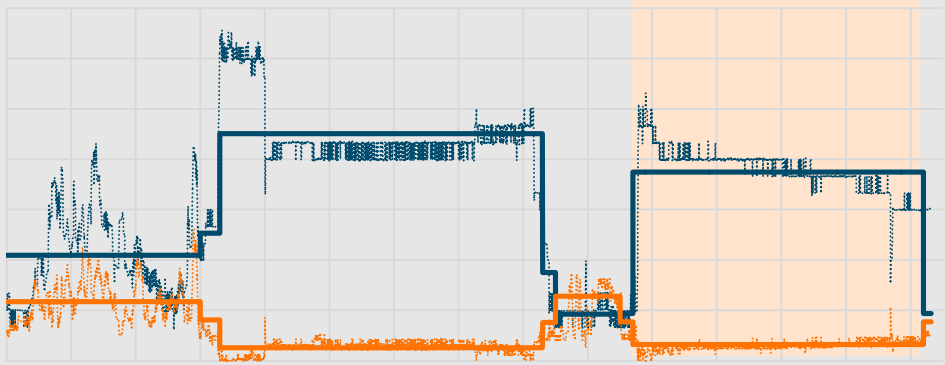
WÄRTSILÄ HY FOR DREDGER FUNCTION AND ENGINE LOADING PROSPECT - SAILING EMPTY





High speed with light draught

- ✓ ESS charging and peak shaving
- ✓ Engines for fast propulsion



Summary of benefits from hybridization of dredgers:

- Reduced engine installed power
- Reduced running hours
- Higher average engine loading
- Fuel consumptions savings
- Decreased carbon emissions

- Can we enter and exit port on batteries?
- What if we use renewable fuels and future proof the design?

A new playing field requires
a new way of doing business


WÄRTSILÄ