MARINE VESSEL ELECTRIFICATION & HYBRID SYSTEMS

Athens, 30.06.2021

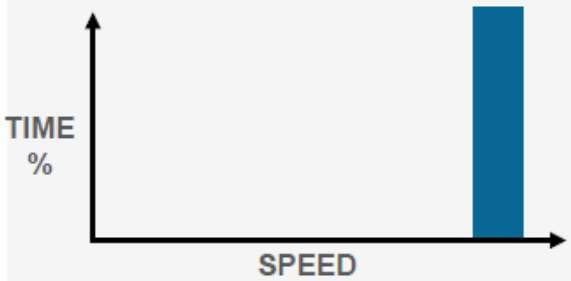
Giannis Moraitakis – *Senior Sales Manager Wärtsilä Greece*

WHY ELECTRIFICATION?
FLEXIBILITY FOR FUTURE OPERATIONAL PROFILES

PROPULSION DESIGN

Yesterday

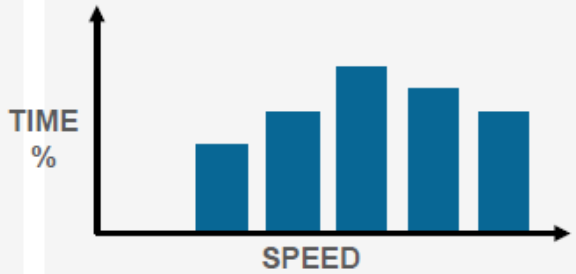
Design speed and draft



Non-optimal designs after slow steaming was introduced

Today

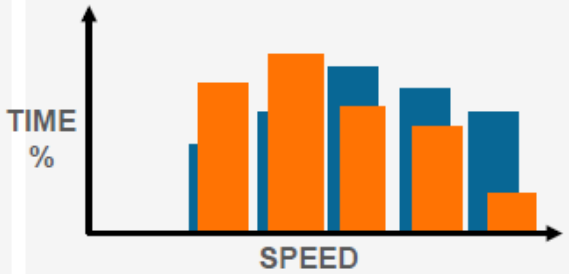
Current operational profile



Will decarbonisation move bring in next speed reduction?

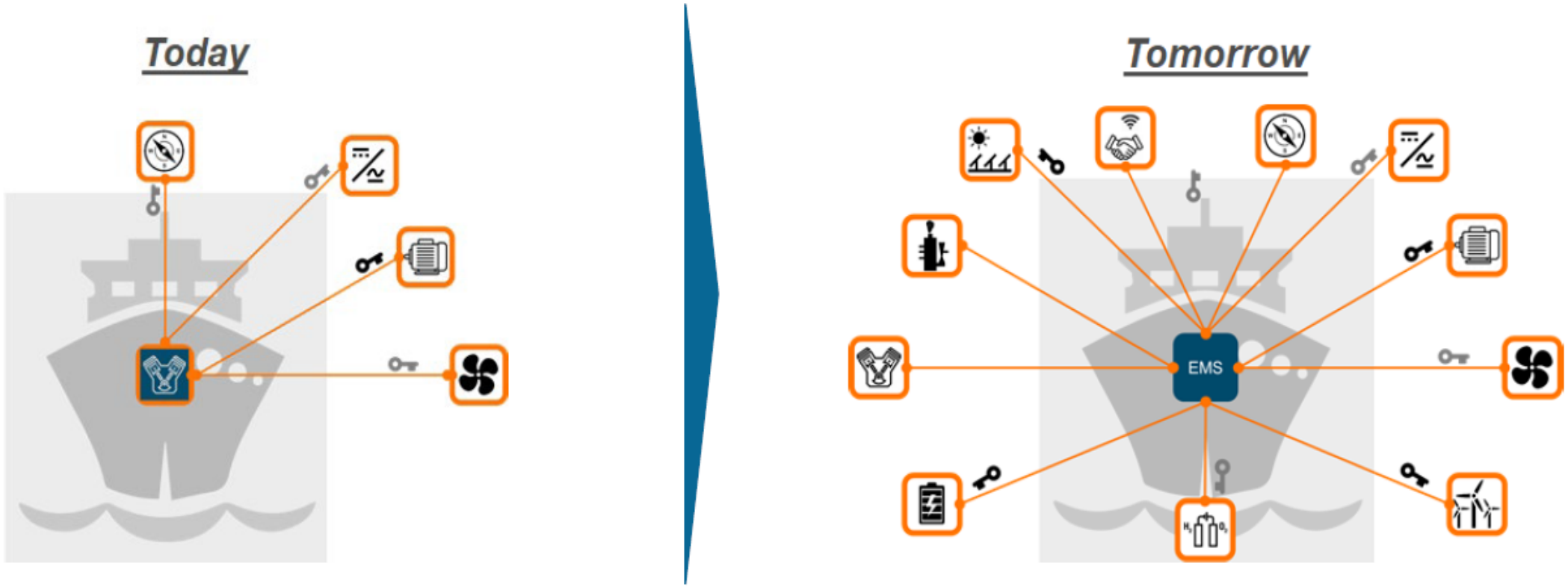
Tomorrow

Potential operational profiles



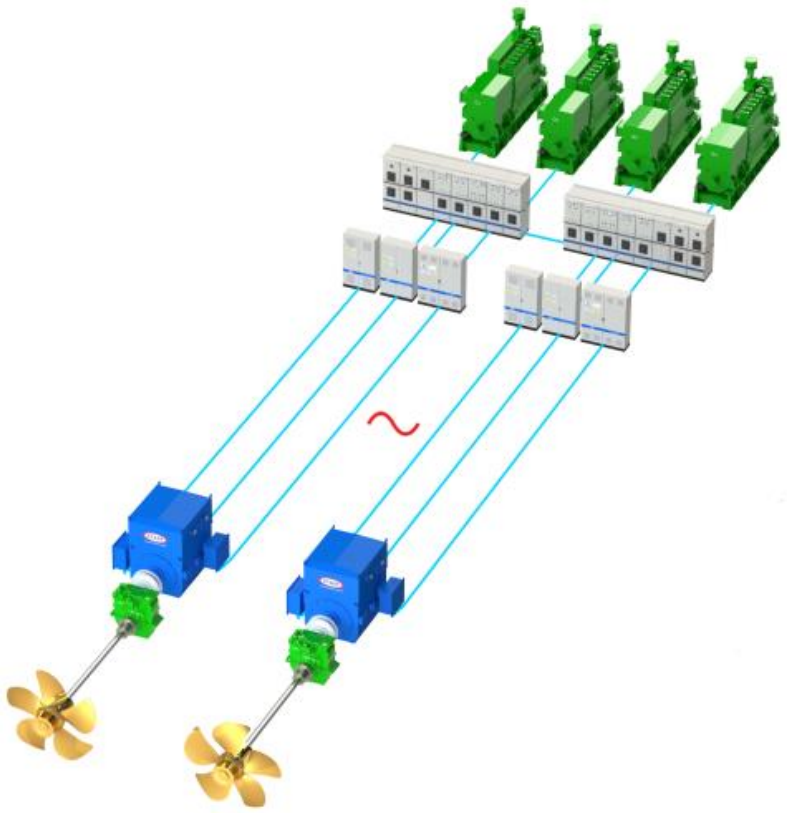
Allow alternative profiles and power sources

TOMORROWS PROPULSION CONCEPTS
FROM ENGINE CENTRIC TO A SOFTWARE CENTRIC SET UP

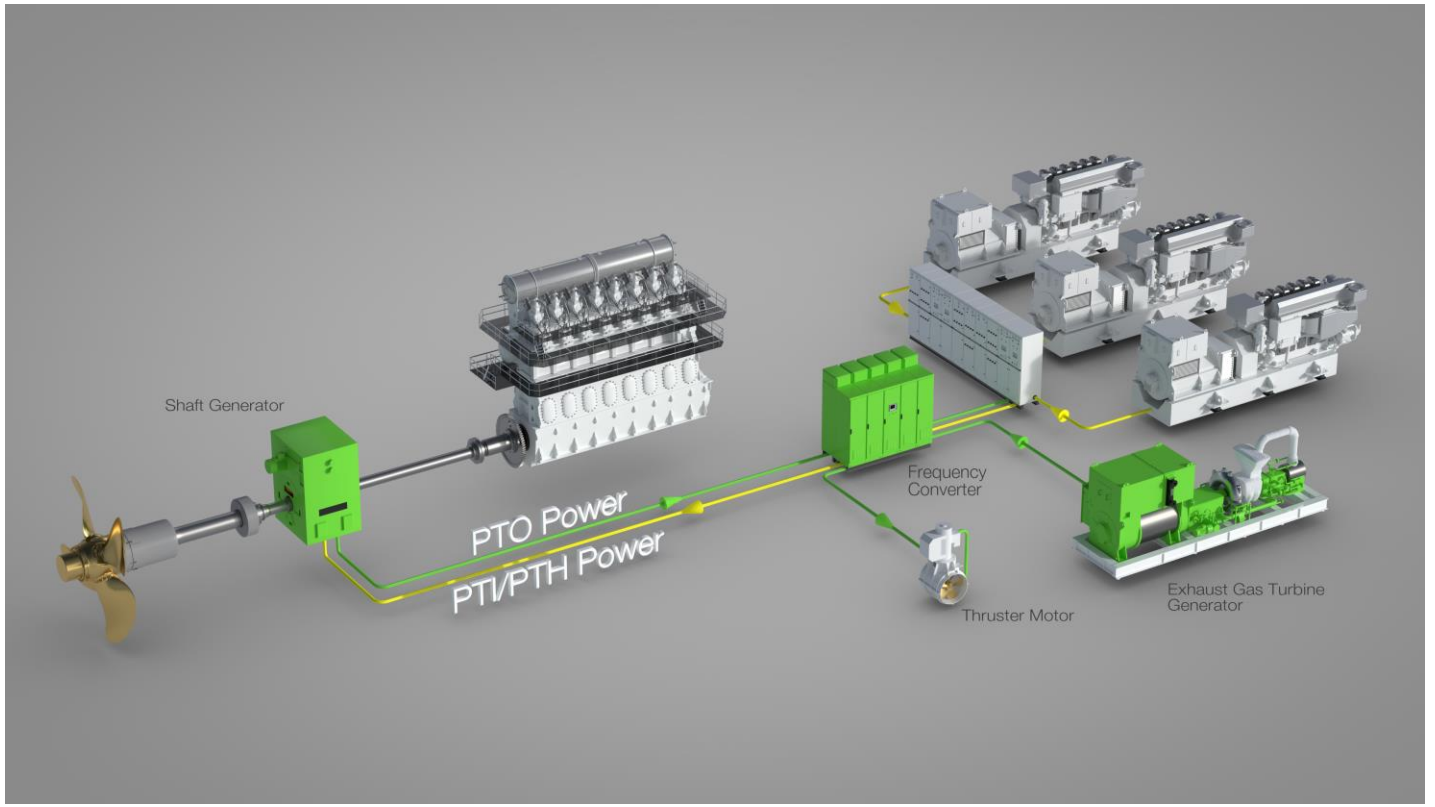


The performance focussed energy management system (EMS) is a new software category on a vessel and sits on top of the safety focussed Power Mmgt. System (PMS)

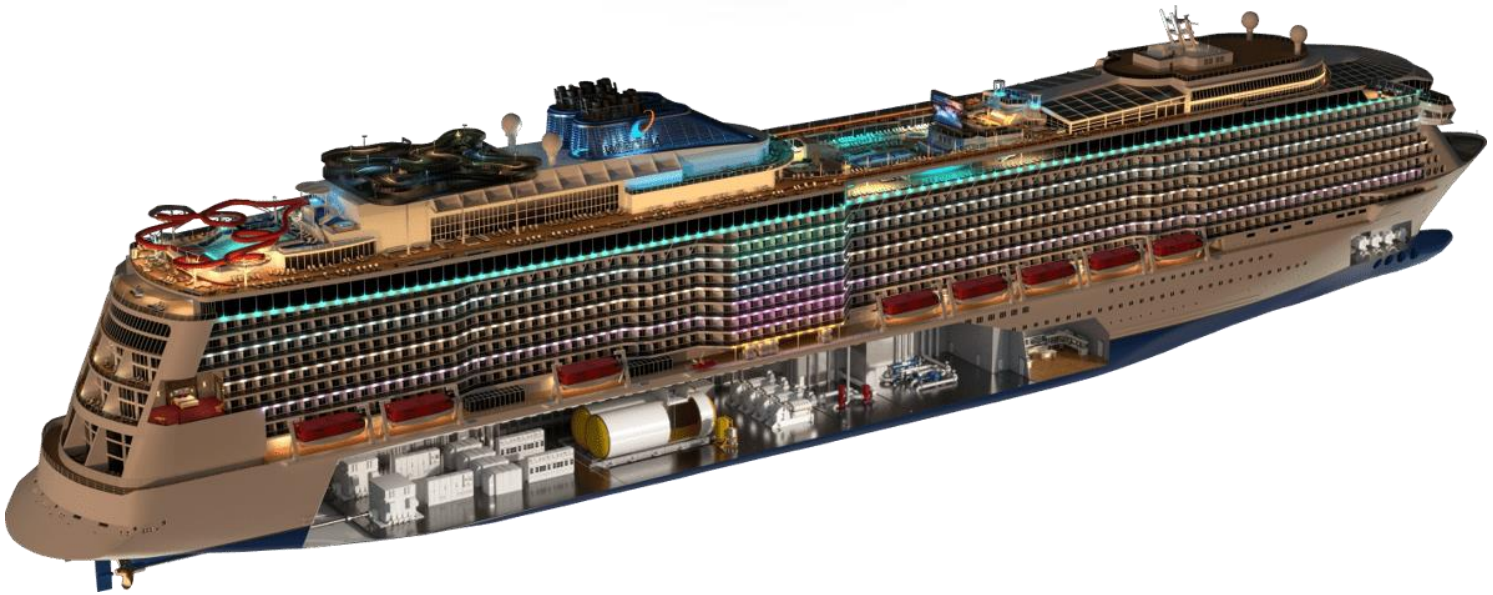
Electrical Propulsion



- Fully Electrical Propulsion.
- Mechanical Electrical Propulsion.
- Fuel and emission optimization in multiple design speed points.
- High flexibility.
- Higher Installation Cost.
- Higher transmission losses.



Examples of Vessels Using Electrical Propulsion

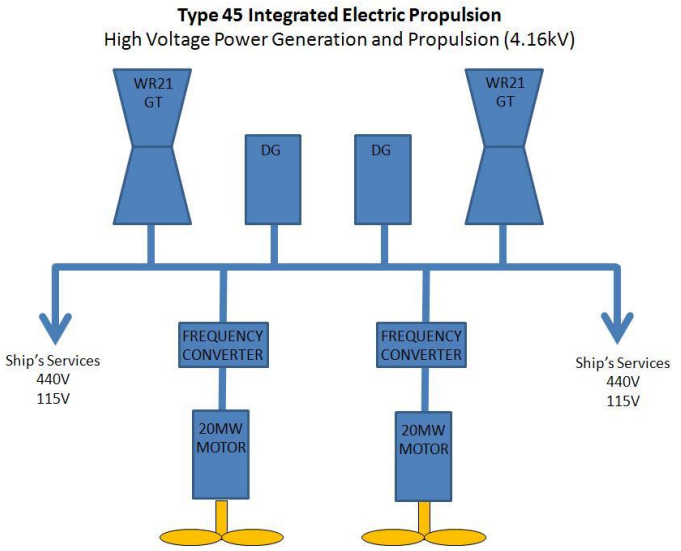


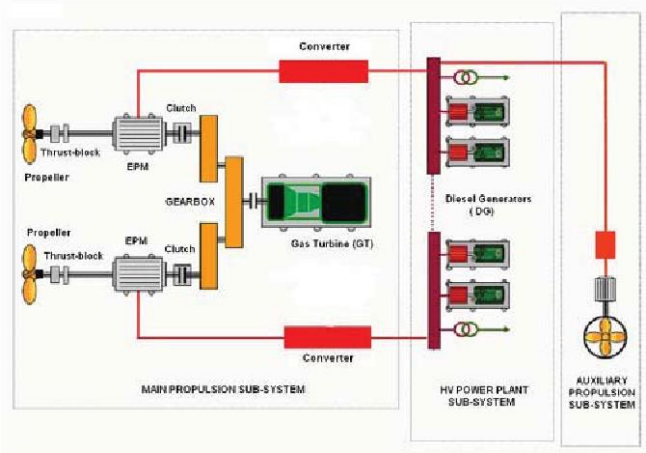
Military Vessels

USS Slater Ex. HS AETOS

- Launched 20 February 1944.
- Transferred to Greece 1 March 1951
- Decommissioned 5 July 1991
- Fully Electrical Propulsion, Ward Leonard Control DC System.

Military Vessels

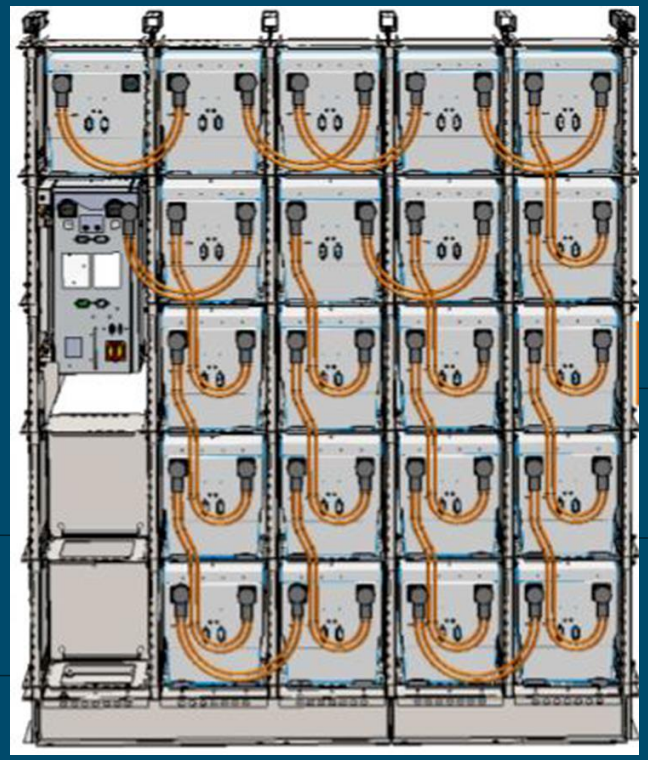


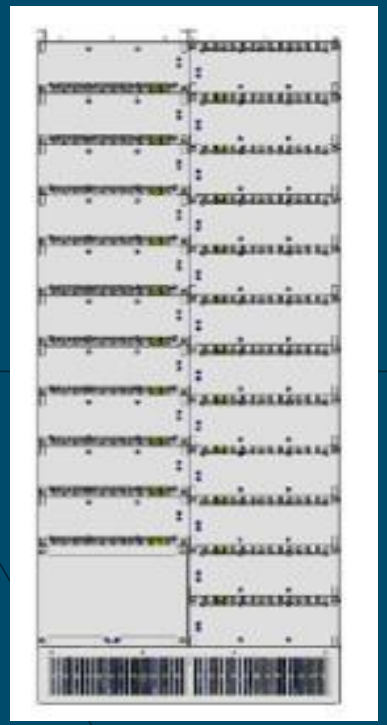


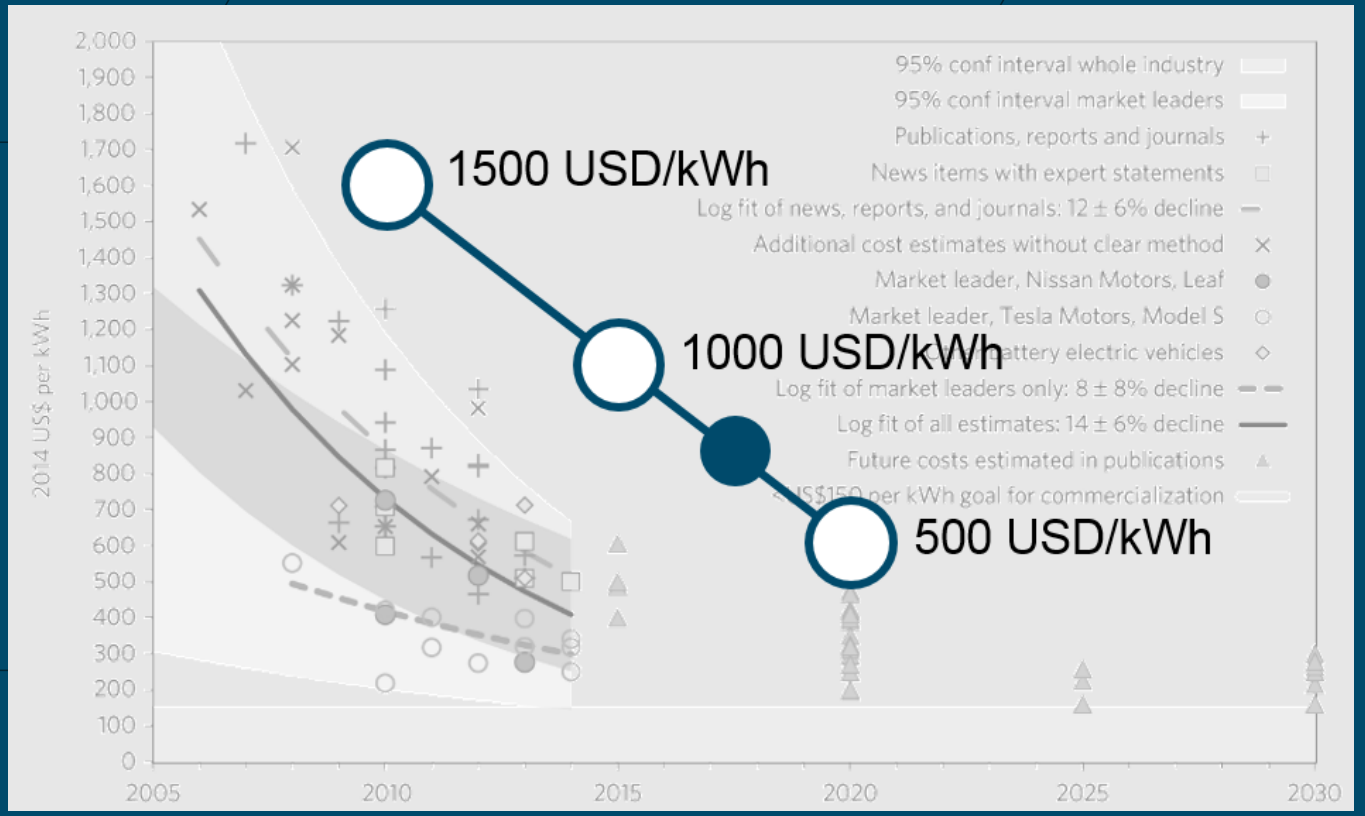
The Hybrids are here!

ENERGY STORAGE PRICES

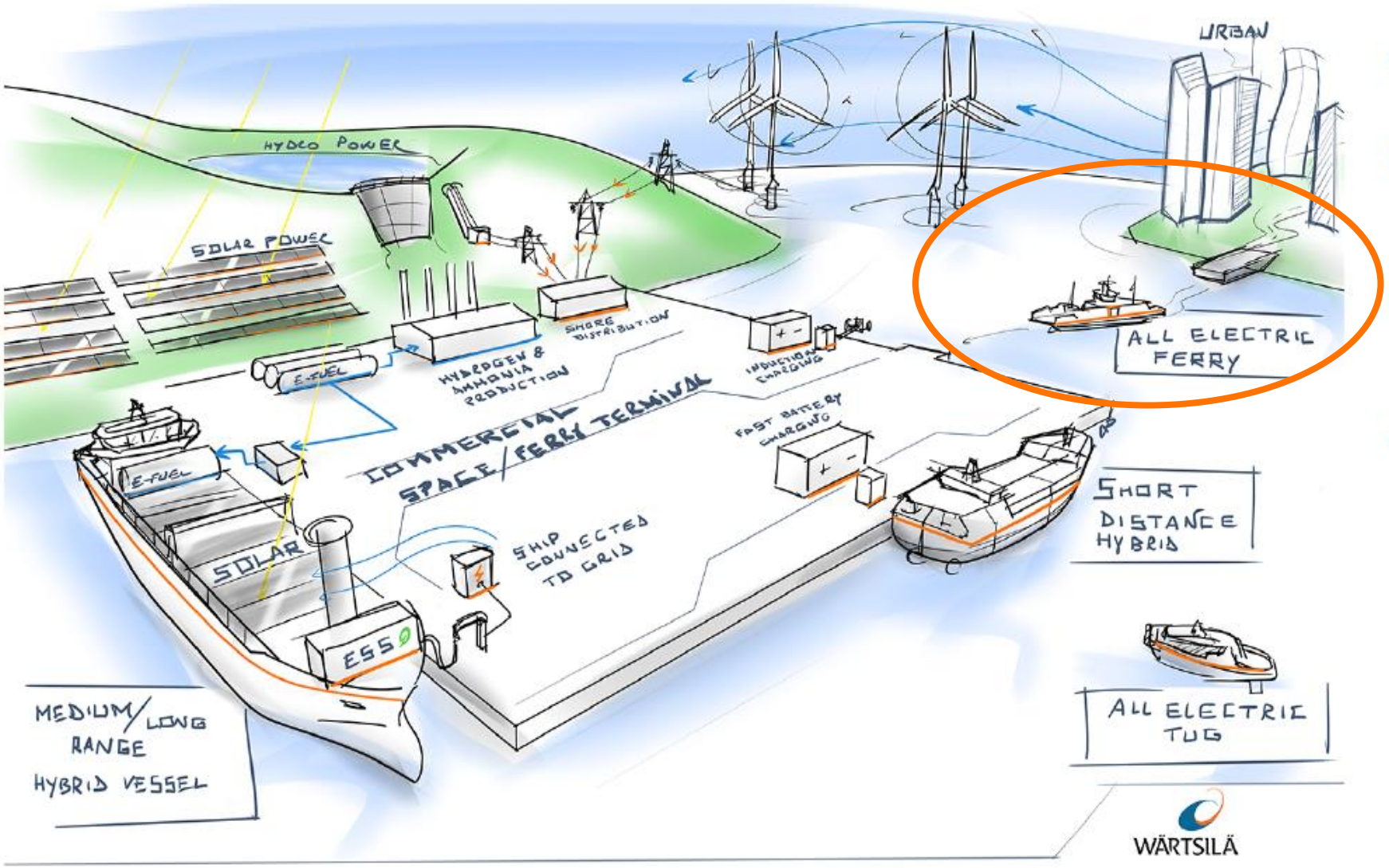
Weight **< 11%**
Volume **<52%**







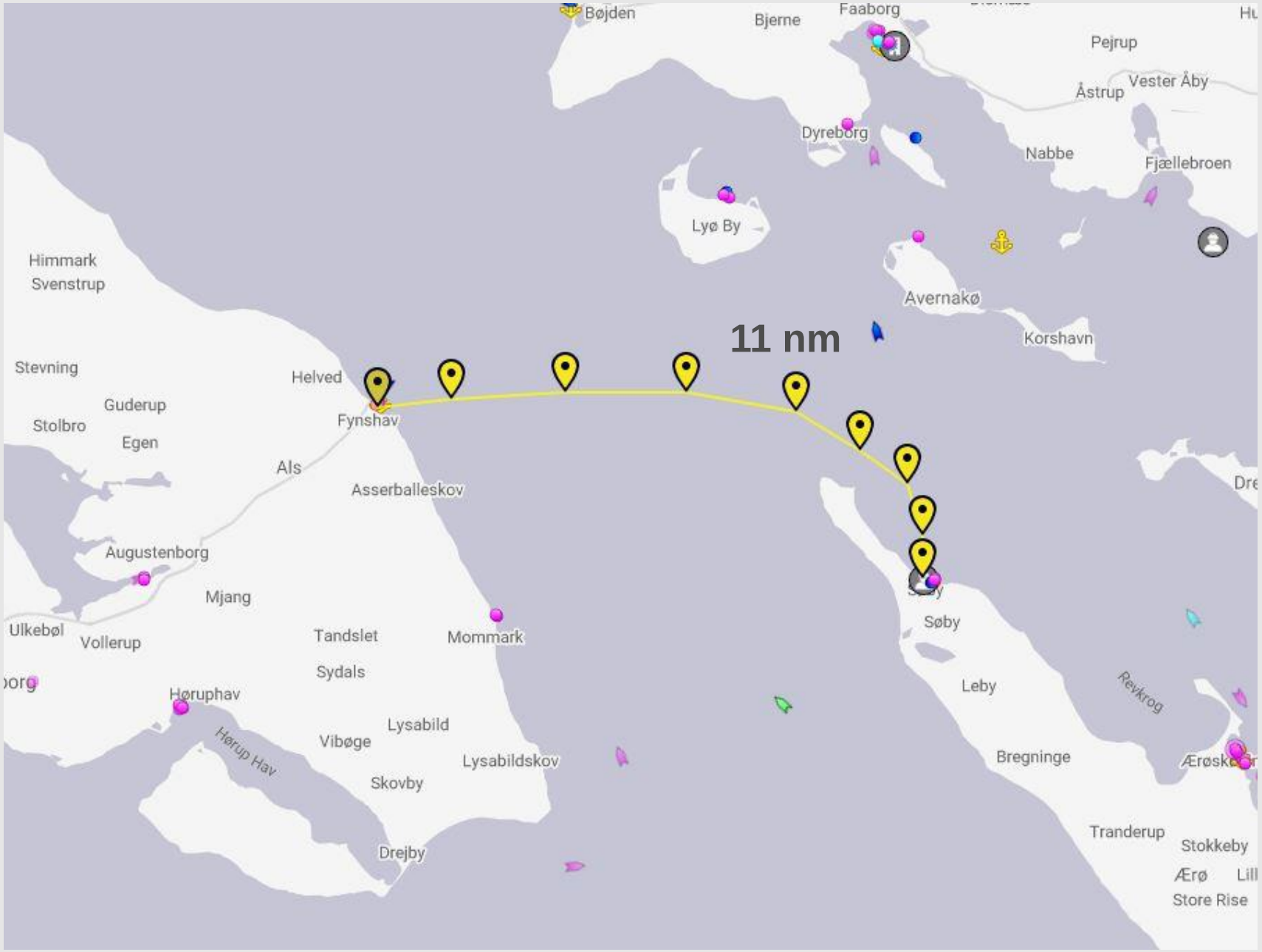
WHY ELECTRIFICATION
50% OF ELECTRICITY IN GRIDS IS ALREADY GREEN



- National grids have high % green energy sources
- Whenever a vessel is **using and fuelling** this reduces CO2
- Most ports will have shore connection option in the near future
- This will be a standard design feature in new builds

ELLEN

IMO: **9805374**
Name: **ELLEN**
Vessel Type : **Ro-Ro/Passenger Ship**
Flag: **Denmark [DK]**
Gross Tonnage: **996**
Summer DWT: **200 t**
Size: **59.4 x 13.4 m**
Year Built: **2019**
Classification Society: **DNV GL**
Speed: **13-15 Knots**
Capacity: **31 Cars / 198 passengers**
Propulsion: **Only Electric**
Propellered Power: **2X750KW**
Battery Size: **4.3 MWh**

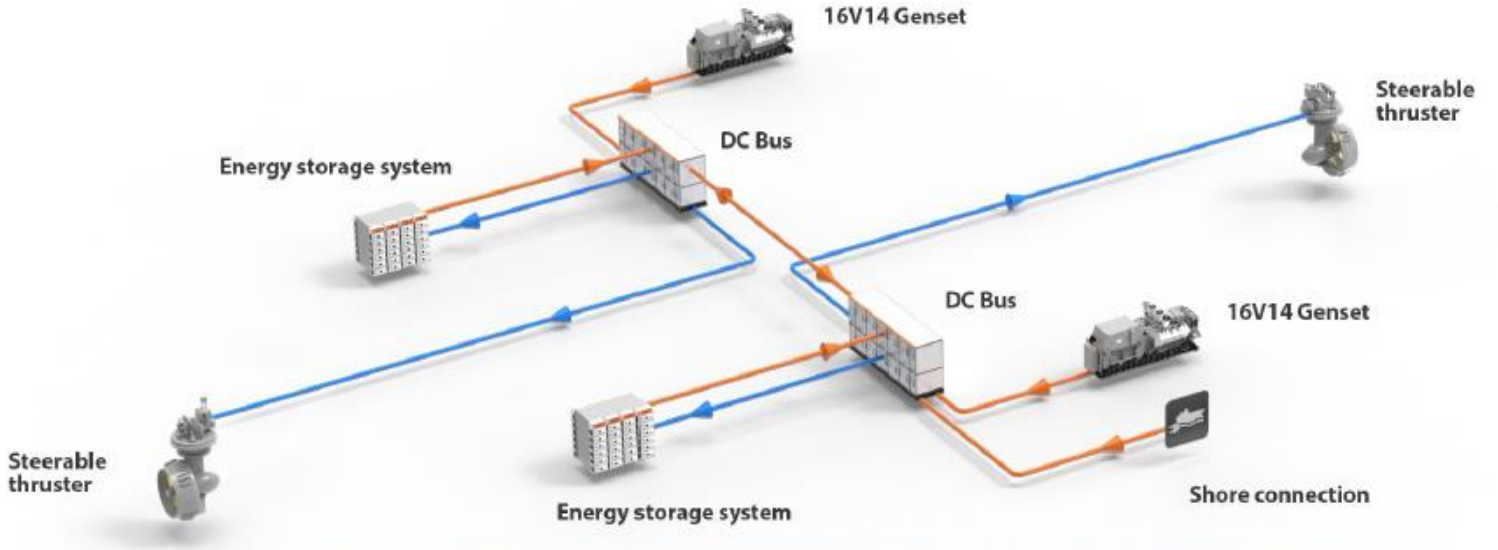

11 nm
Bøjden
Bjerne
Faaborg
Pejrup
Åstrup
Vester Åby
Dyreborg
Nabbe
Fjællebroen
Lyø By
Himmark
Svenstrup
Avernakø
Korshavn
Stevning
Helved
Guderup
Stolbro
Egen
Fynshav
Als
Asserballeskov
Augustenborg
Mjang
Ulkebøl
Vollerup
Tandslet
Mommark
Sydals
Søby
Leby
Revkrog
Høruphav
Lysabild
Vibøge
Lysabildskov
Hørup Hav
Skovby
Bregninge
Drejby
Tranderup
Stokkeby
Ærø
Store Rise

FULLY ELECTRIC FERRIES

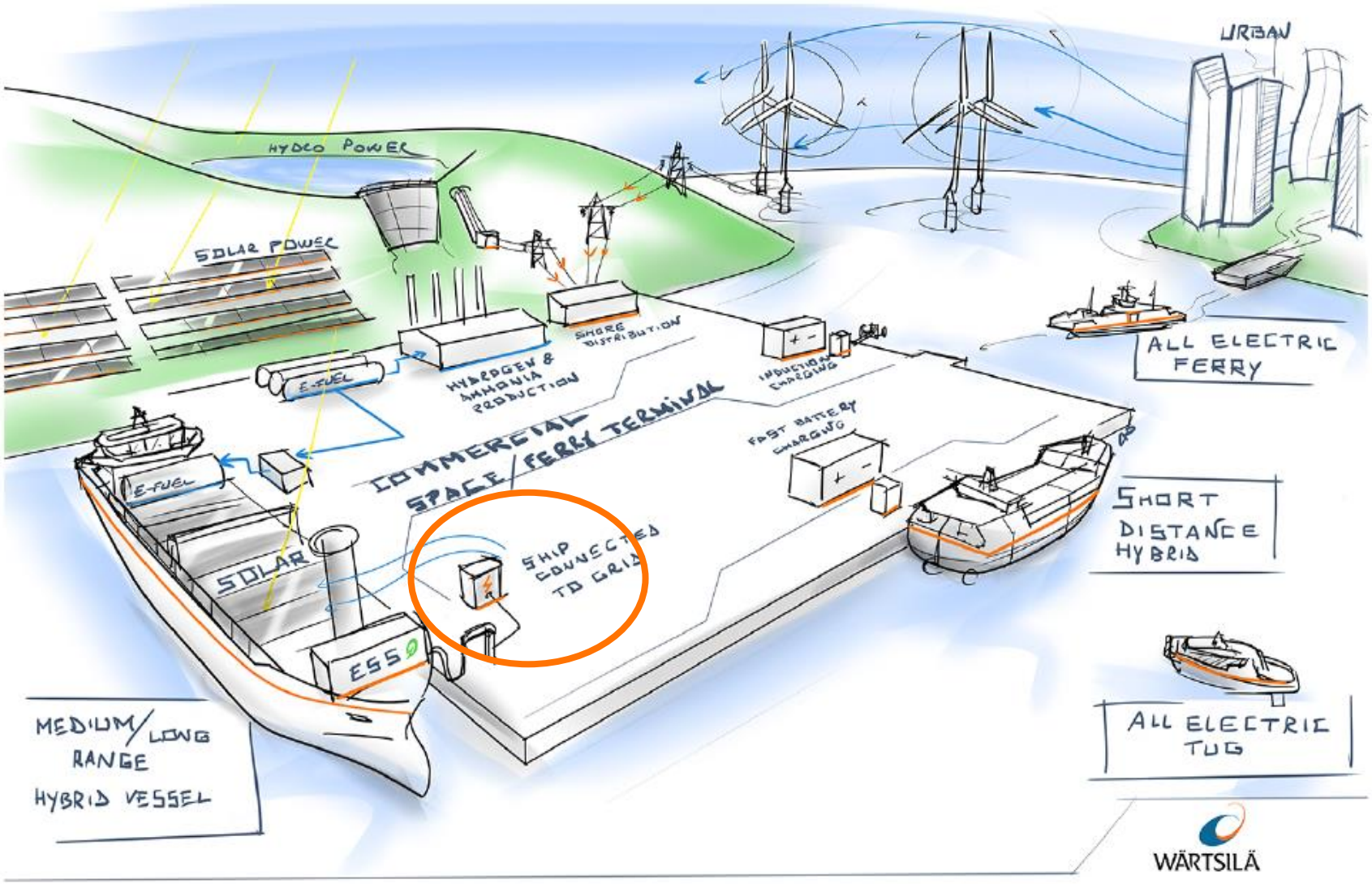
Base Case: 4S DE or DM
Wartsila Solution: Full Electric

Key Features & Benefits of Integrated Solution:

- Full electric operation, zero emission
- Integration of vessel and shore system
- Optimization of energy consumption
- Service availability



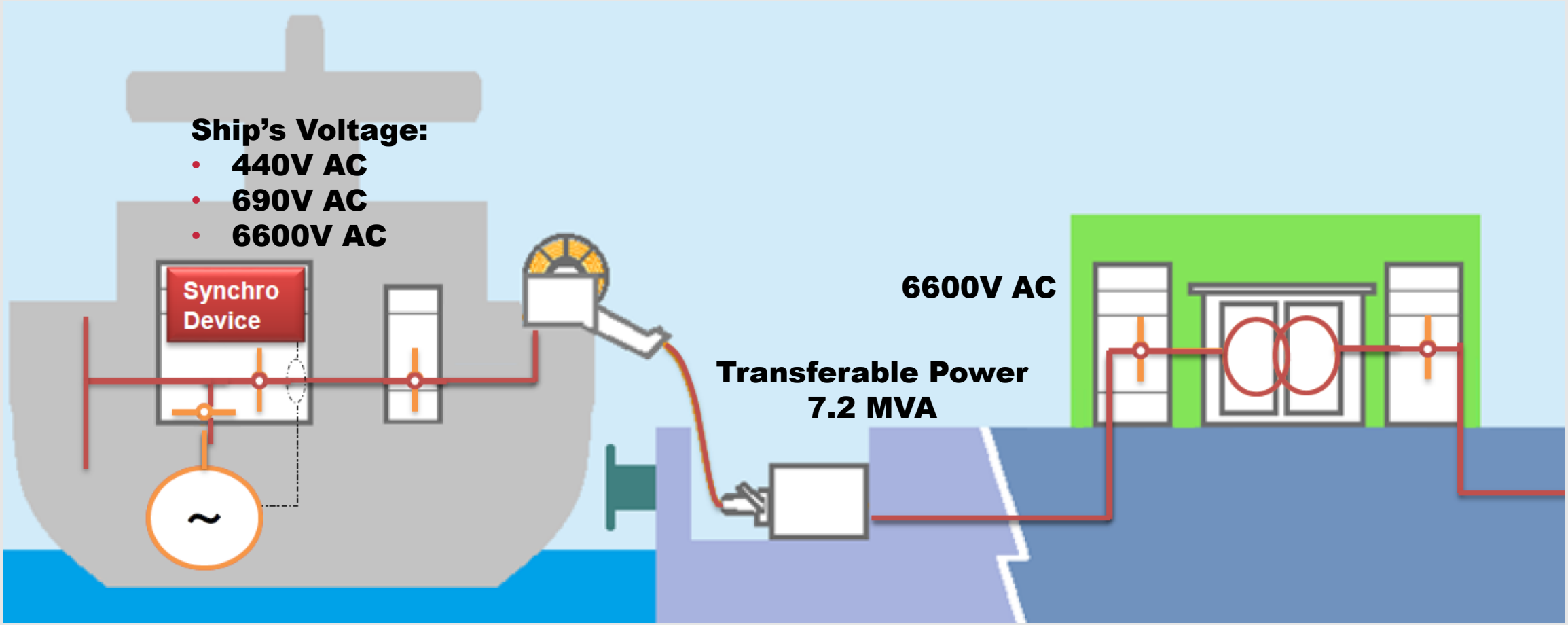
WHY ELECTRIFICATION
50% OF ELECTRICITY IN GRIDS IS ALREADY GREEN



- National grids have high % green energy sources
- Whenever a vessel is **using and fuelling** this reduces CO2
- Most ports will have shore connection option in the near future
- This will be a standard design feature in new builds

AMP Alternative Maritime Power

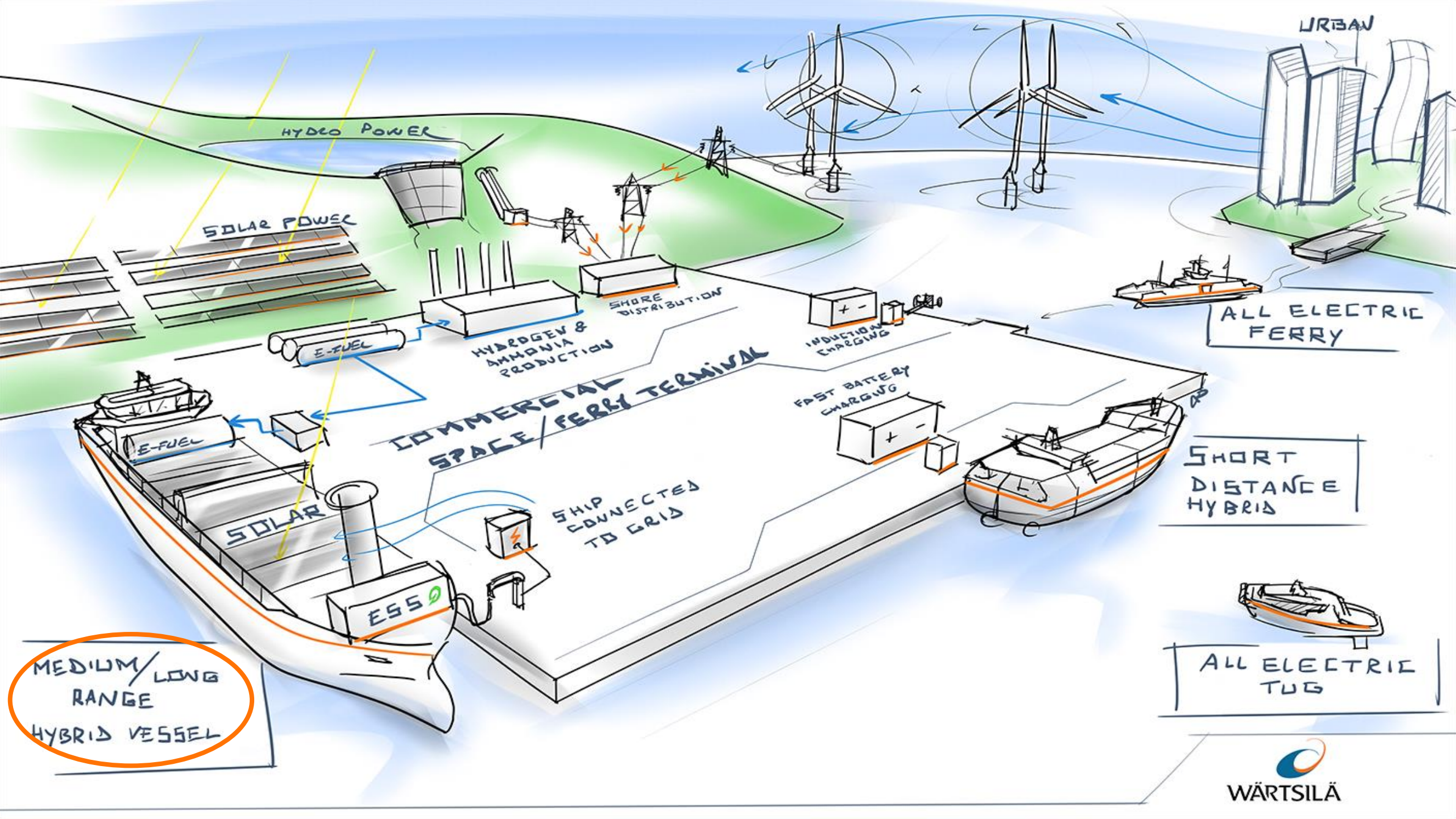
Shore Power Connection technology



The state of California, **USA** has regulated since **2020, 80 percent** of the power required by berthed ships must come from a shoreside supply.

The **Chinese Government** also is recommending that **shore connection** systems - or 'cold ironing' - be provided **by all new bulk and cruise terminals**.

Future **EU directives** will oblige member states to **implement** alternative infrastructure networks, including **shore power, by 2025**.


URBAN
HYDRO POWER
SOLAR POWER
SHORE DISTRIBUTION
E-FUEL
HYDROGEN & AMMONIA PRODUCTION
INDUCTION CHARGING
ALL ELECTRIC FERRY
COMMERCIAL SPACE/FERRY TERMINAL
FAST BATTERY CHARGING
E-FUEL
SOLAR
ESS
SHIP CONNECTED TO GRID
SHORT DISTANCE HYBRID
MEDIUM/LONG RANGE HYBRID VESSEL
ALL ELECTRIC TUG
WÄRTSILÄ

CURRENT CONFIGURATION

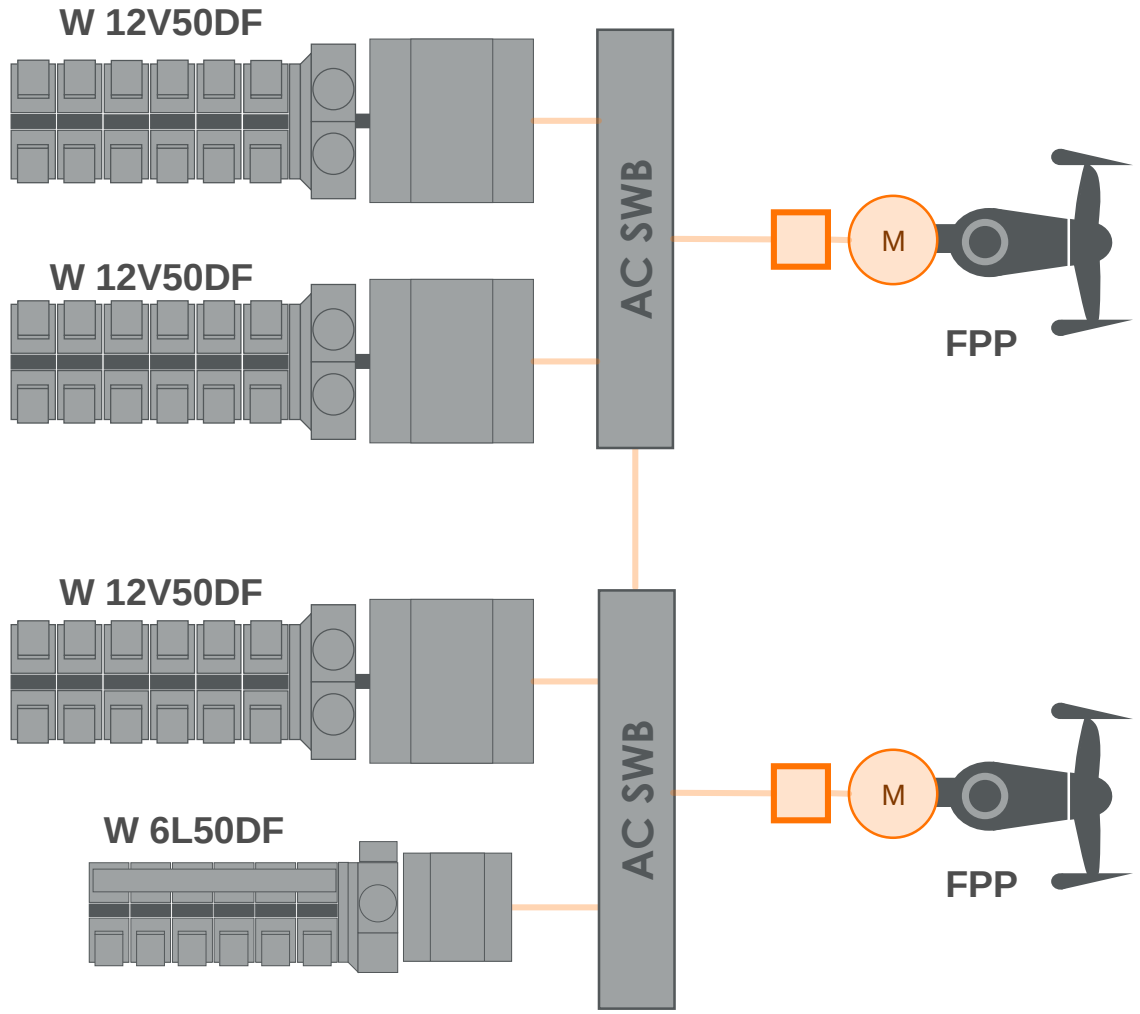
4x Main Engines:

3 x W12V50DF
(3x 11700 kW)
1x W6L50DF
(1x 5850 kW)

Total installed power:
39 900 kW

Propulsion:

2 x FPP



WÄRTSILÄ HY CONFIGURATION

4x Main Engines:

3 x W12V50DF
(3x 11700 kW)
1x W6L50DF
(1x 5850 kW)

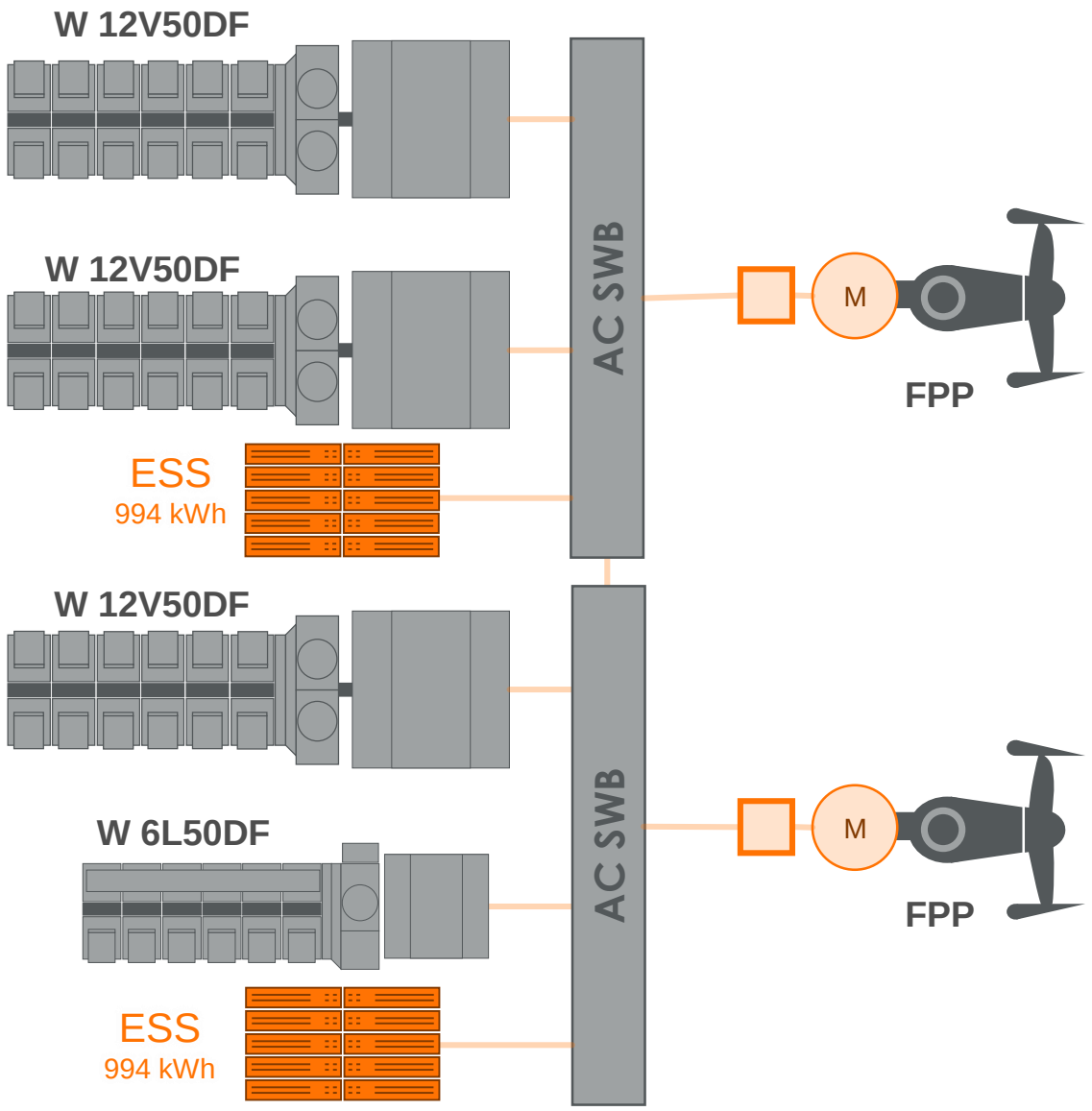
Total installed power:
39 900 kW

Propulsion:

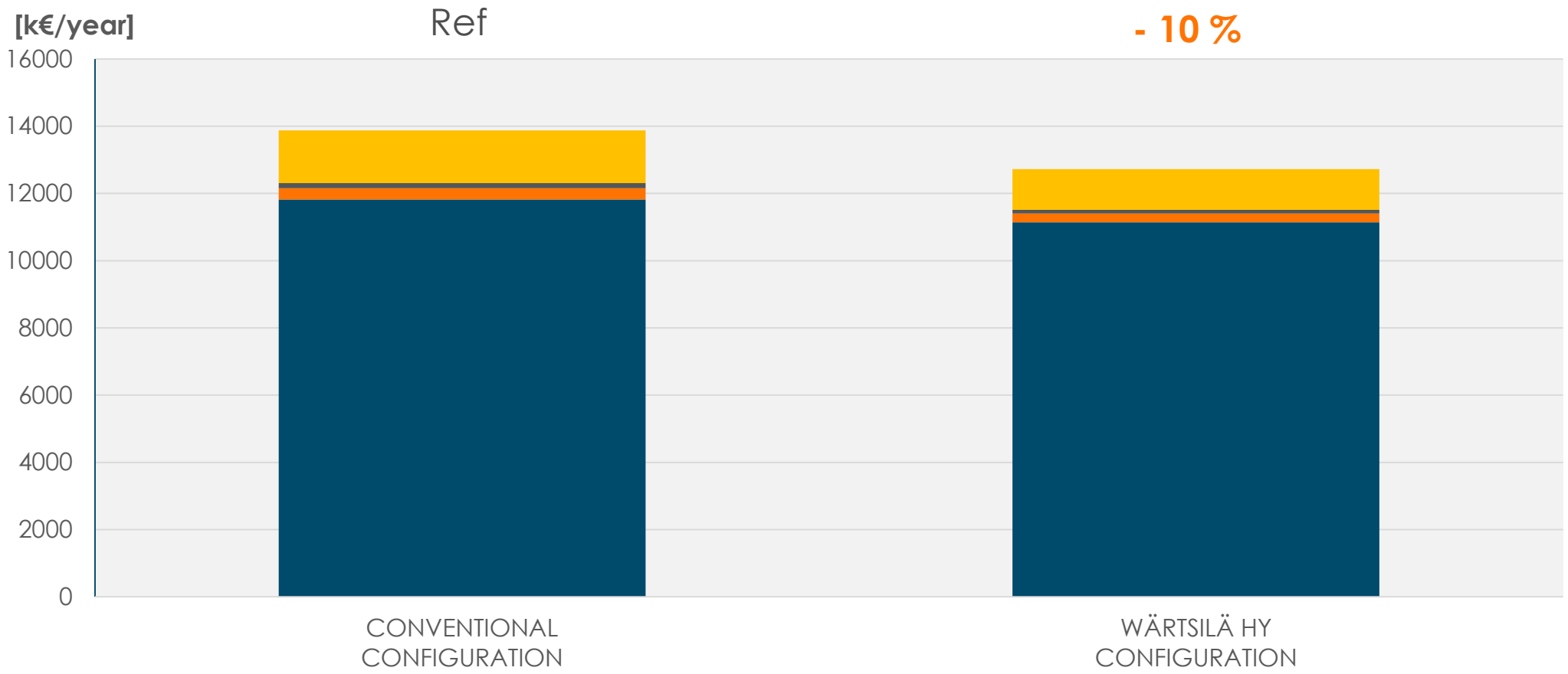
2 x FPP

Battery Pack:

1984 kWh (3 C-rate)



OPEX

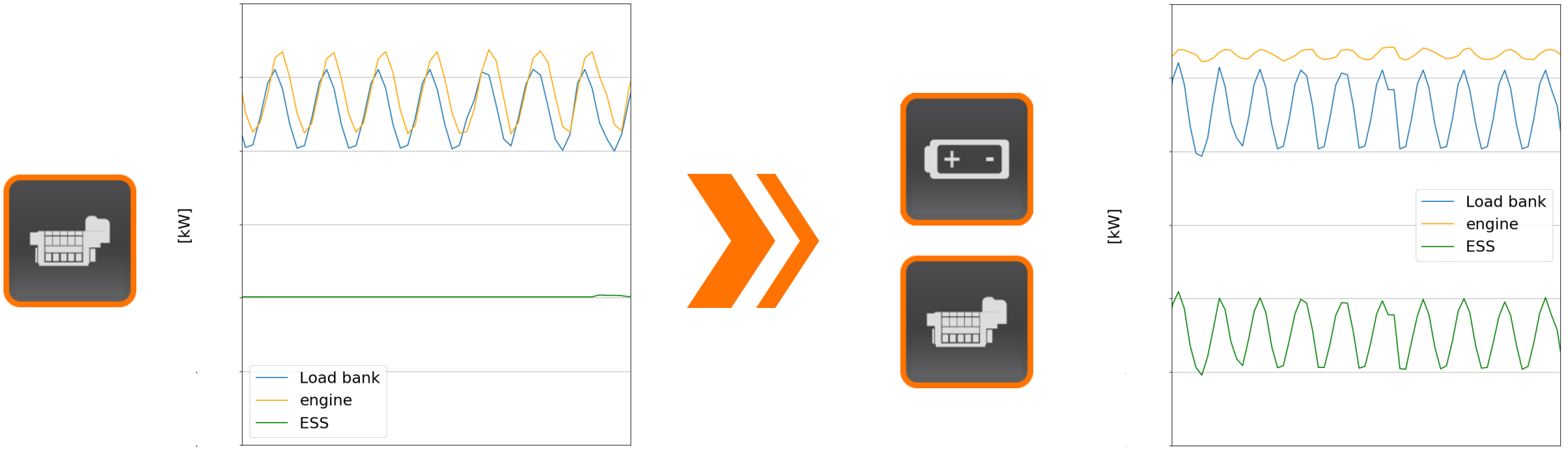


Assumptions:

- MGO 450 EUR/ton
  LHV 42,700 kJ/kg
- LNG 400 EUR/ton
  LHV 49,200 kJ/kg
- LUBE oil 2300 EUR/ton

PEAK SHAVING

Engine's performance **optimization** all the time



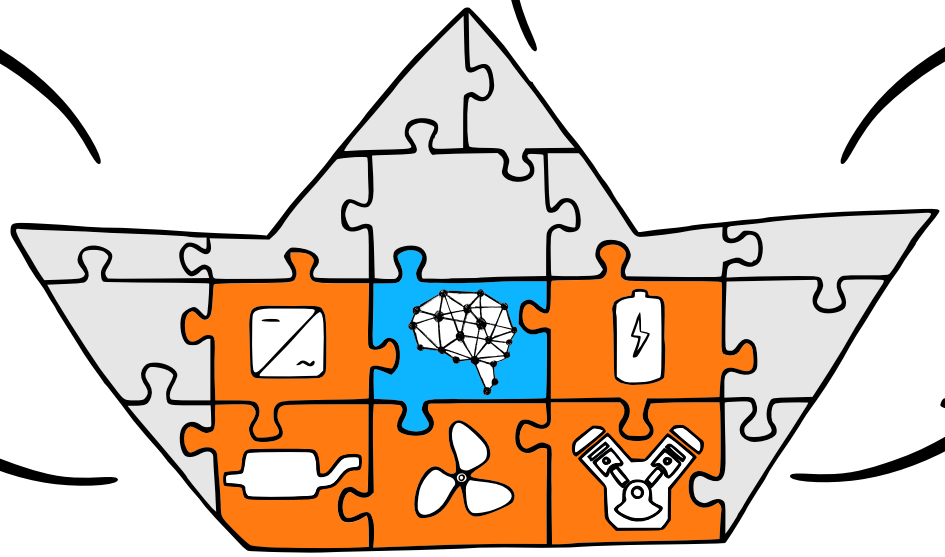
✓ **Stable Engine load**

✓ **Optimum Fuel consumption**

Smokeless operations

Lower fuel cost

Less maintenance



Improved noise and vibration levels

Minimized exhaust emissions

Greater operation flexibility

Enhanced system redundancy

AND THE HY-LIGHTS GO ON

VIKING PRINCESS
Eidesvik Offshore AS

NORWEGIAN GANNET
Havline

HAGLAND CAPTAIN
Hagland Shipping AS

MF FOLGEFONN
Norled AS

AURORA SPIRIT
Teekay

JUANITA
Ugland Supplier AS

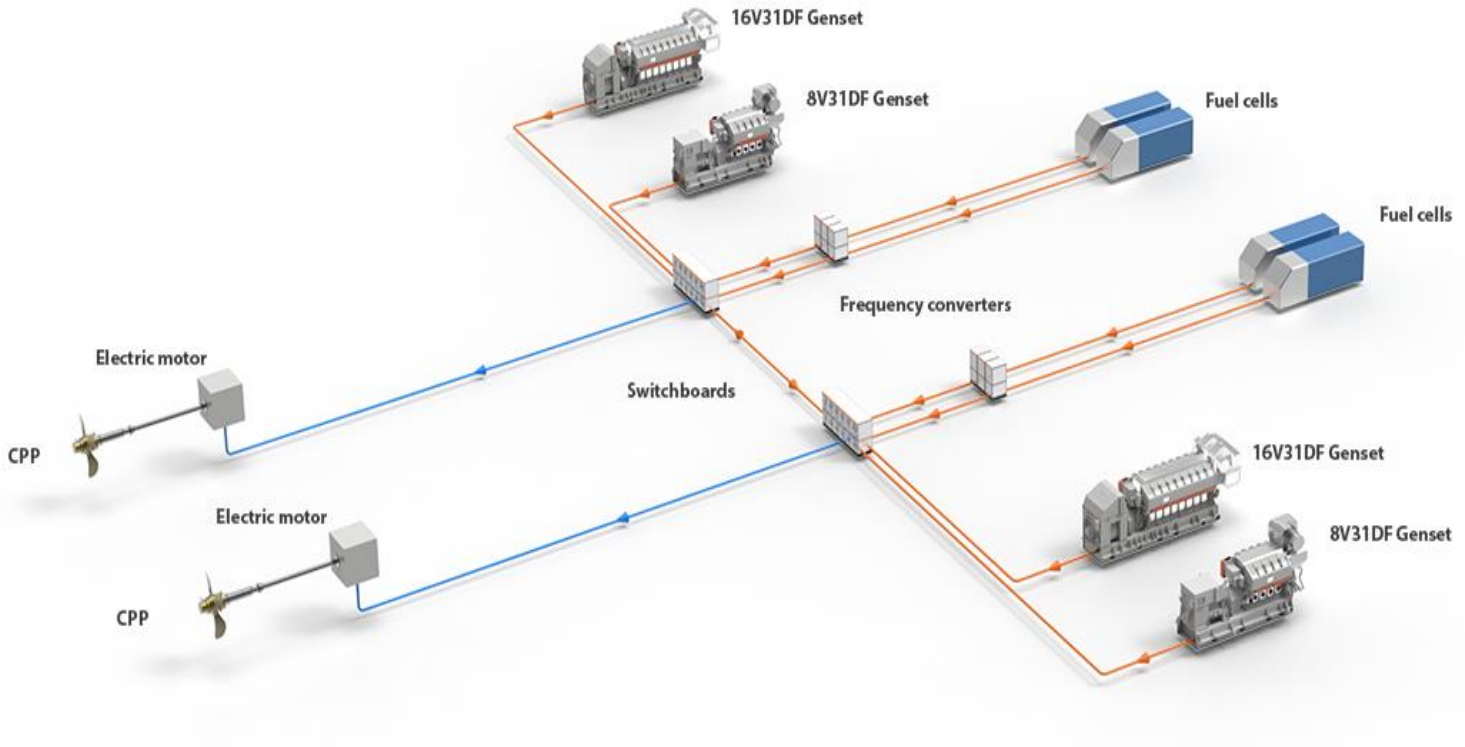
OCEAN STAR
Atlantic Offshore AS

PAOLO TOPIC
Marfin Management S.A.M.

HARVEY ENERGY
Harvey Gulf International Marine LLC

•••

FUTURE FUEL INTEGRATION



Electrical Propulsion Systems can easily be adapted to future fuels.

The 4-stroke engines can be retrofitted to burn methanol, LNG, LPG, H2 or Ammonia

Fuel cells can be easily incorporated in the electric grid of the vessel.

Conclusions

- Electrification is one building block towards decarbonization.
- New regulations and local requirements will force vessels towards electrification.
- Electrically enhanced propulsion system reduces operating costs and GHG emissions.
- Electric propulsion systems can be more easily adapted to new fuels.


WÄRTSILÄ