



BETTER SHIPS, BLUE OCEANS

An aerial photograph of a large container ship sailing on a dark green sea. The ship's deck is filled with colorful shipping containers in shades of yellow, orange, and red. The ship's wake is visible in the water.

 **WEBB INSTITUTE**
An International College of Engineering

 **MARIN**
BETTER SHIPS, BLUE OCEANS

 **wind**
support

SUSTAINABILITY IN SHIP DESIGN CONFERENCE

NOVEMBER 7TH-8TH 2022

Sustainable Ship Design and Shipping:
on the influence of alternative power
sources, infrastructures and operations

Guilhem Gaillarde
Manager Ships Department

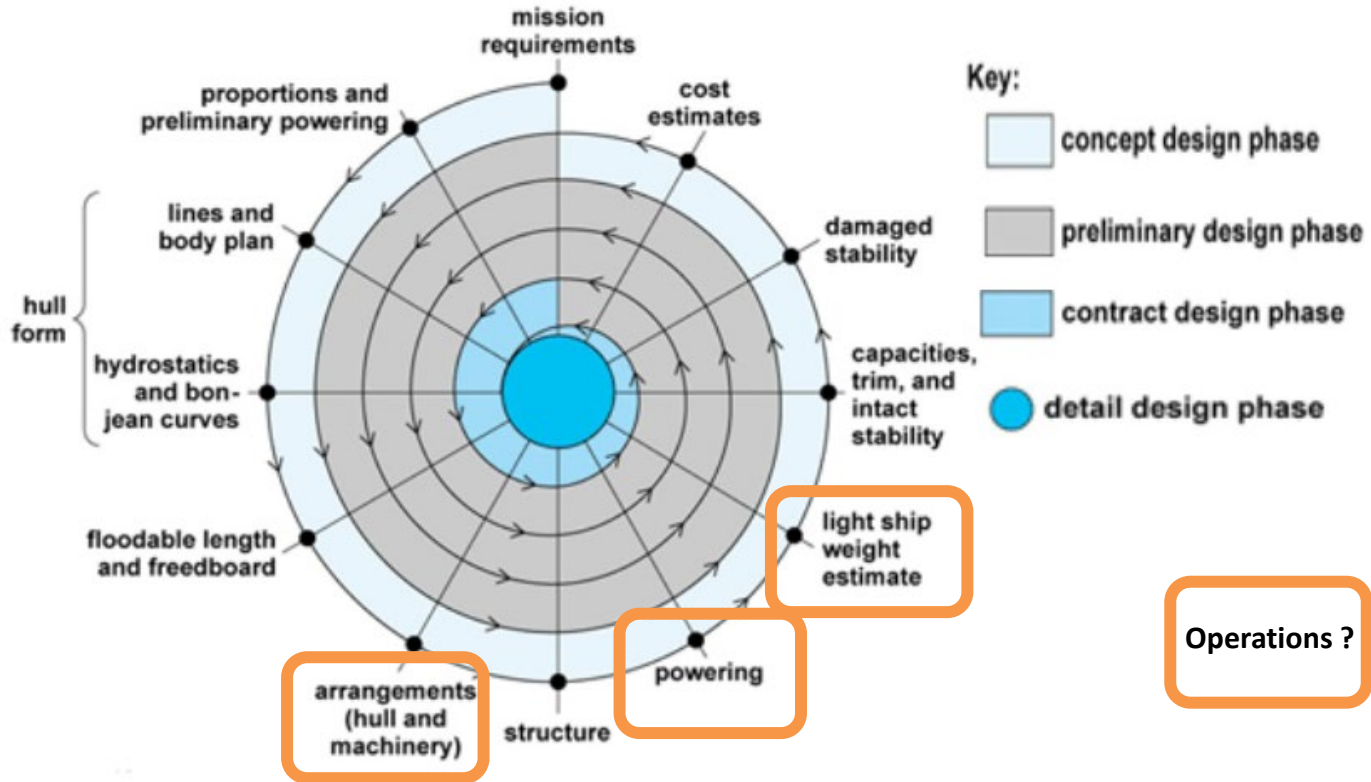
Sustainable Ship Design and Shipping: on the influence of alternative power sources, infrastructures and operations

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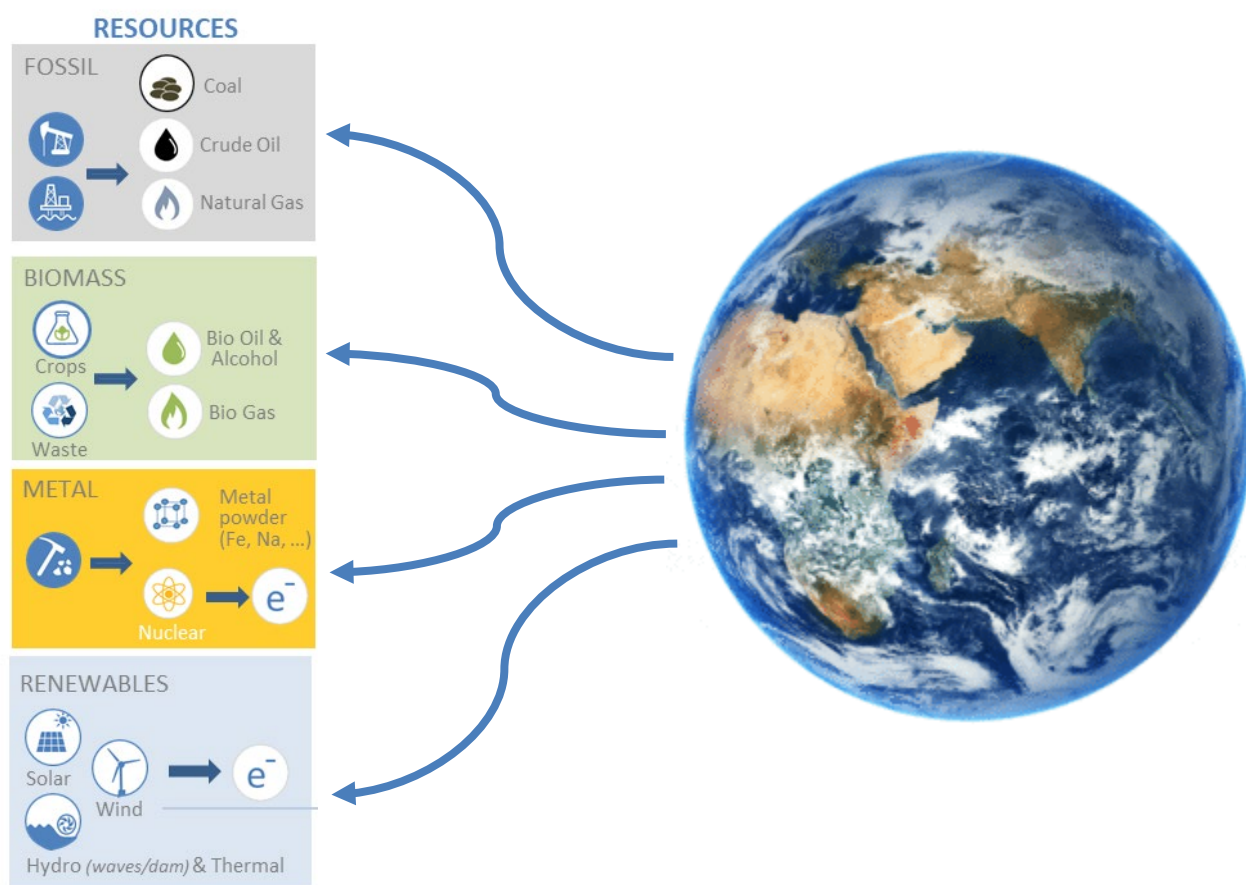
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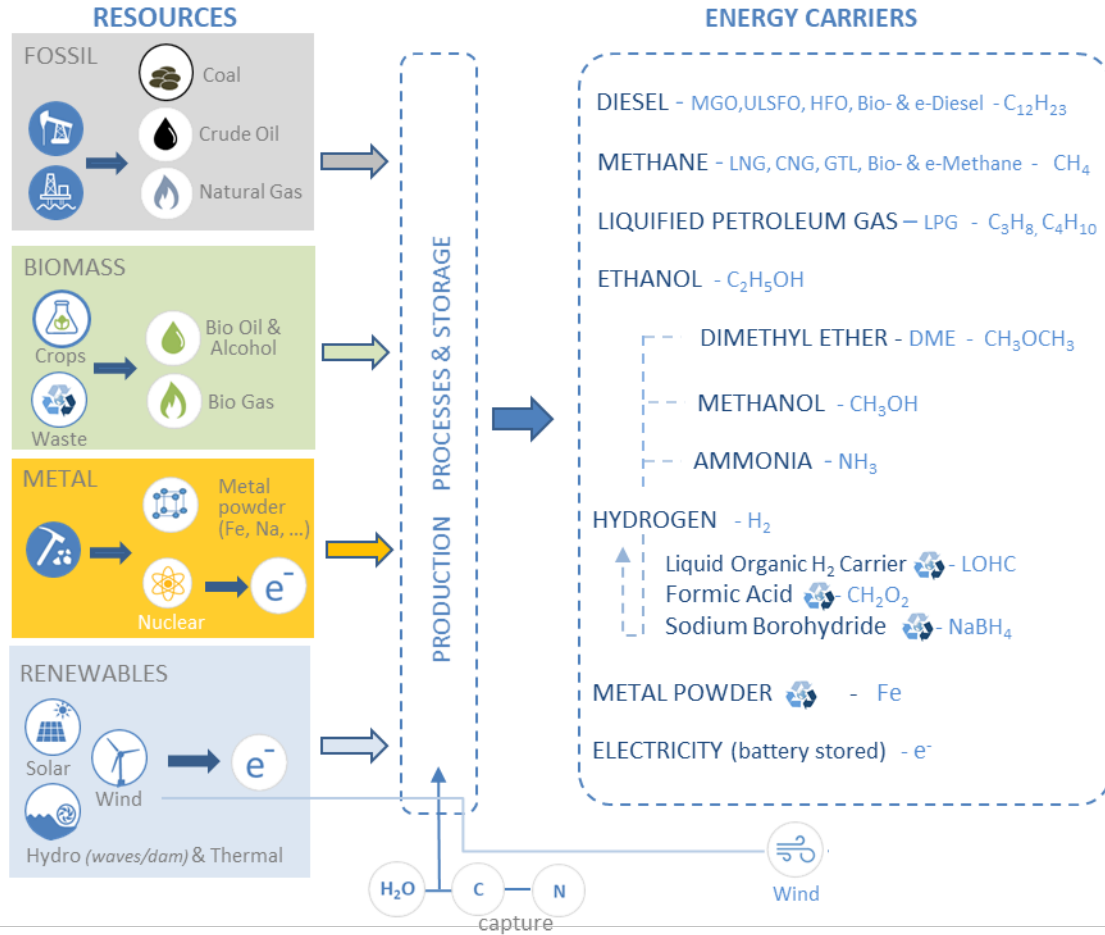


- On the influence of alternative power sources

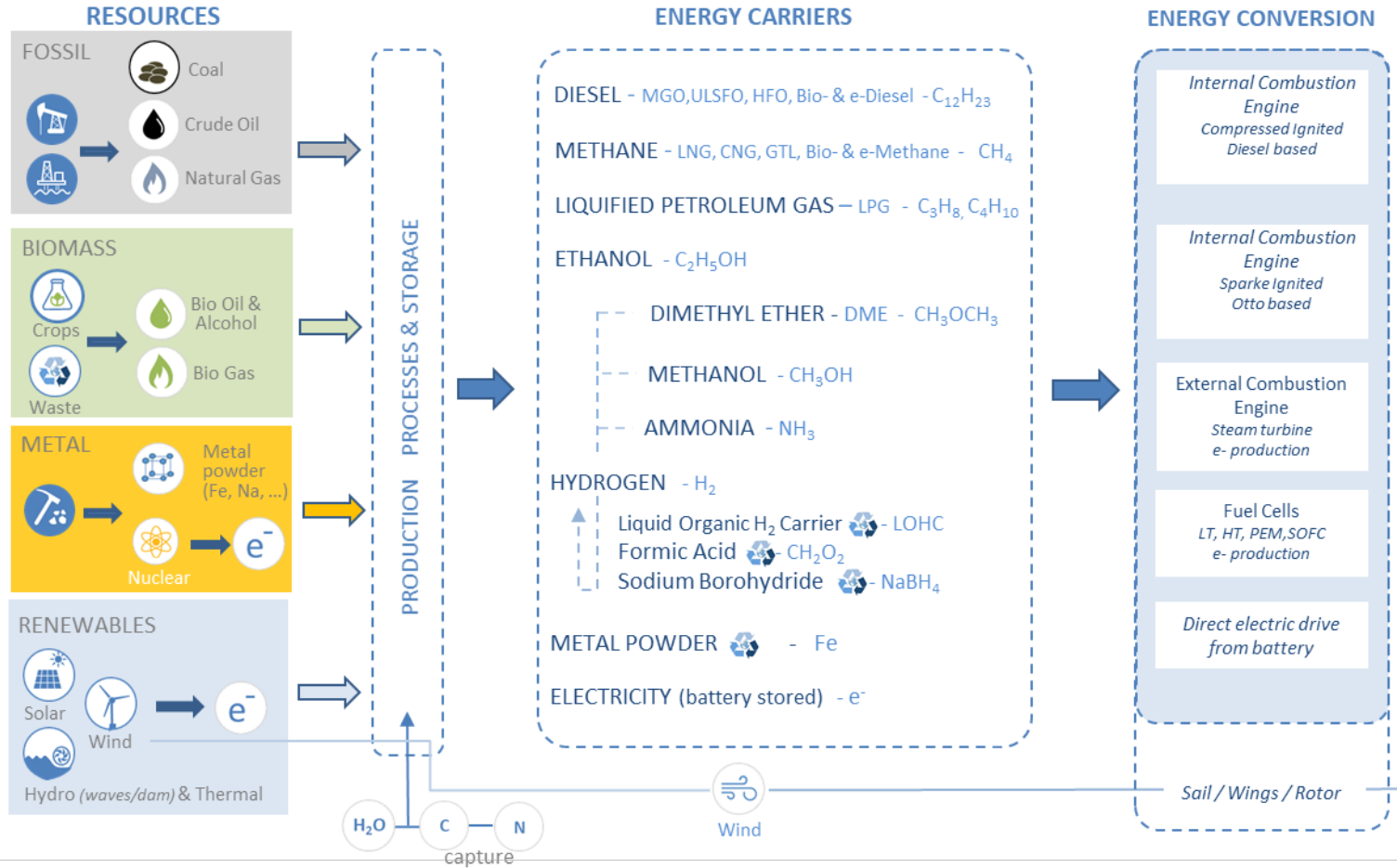
on the influence of **alternative power sources**, infrastructures and operations



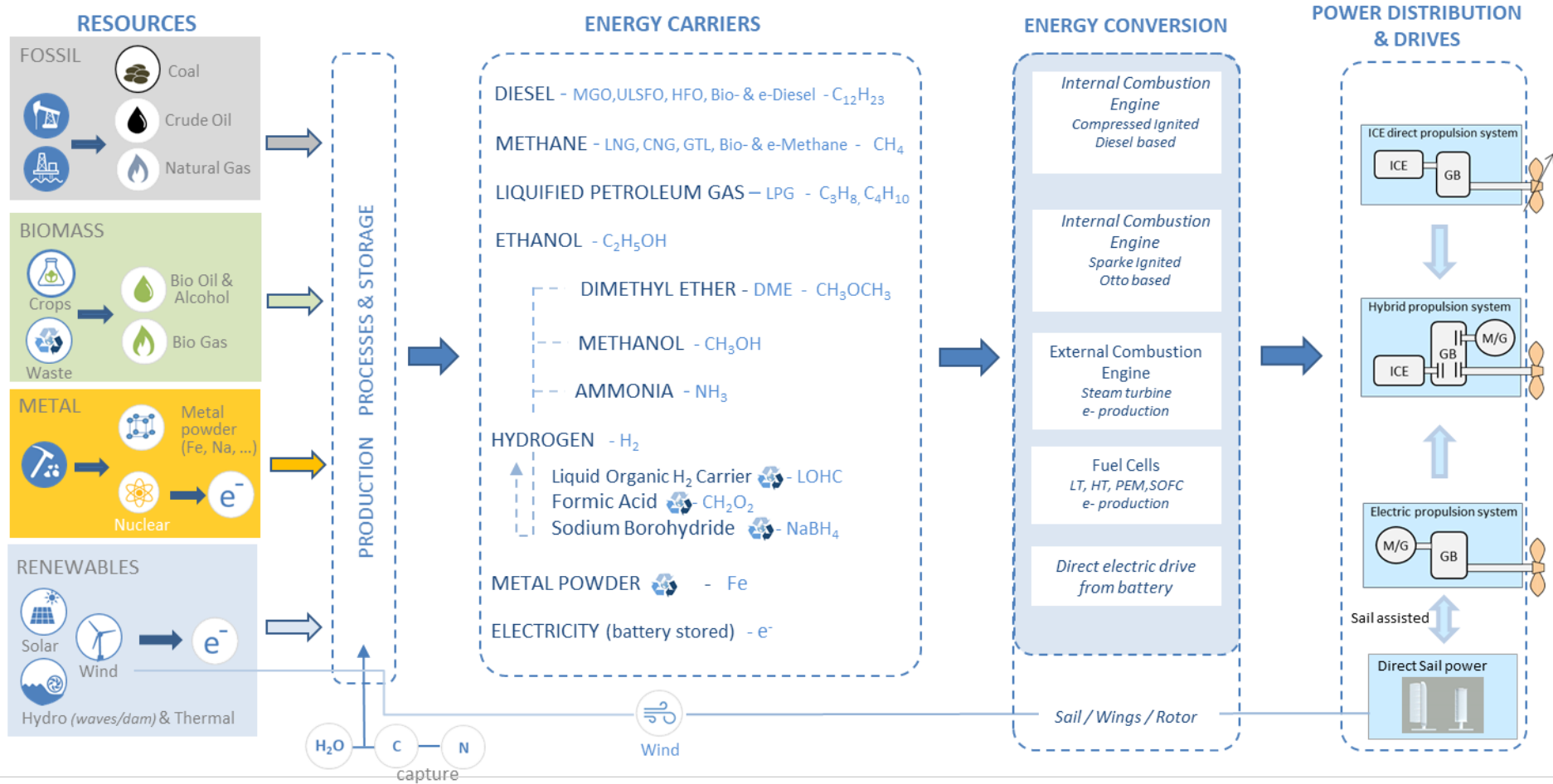
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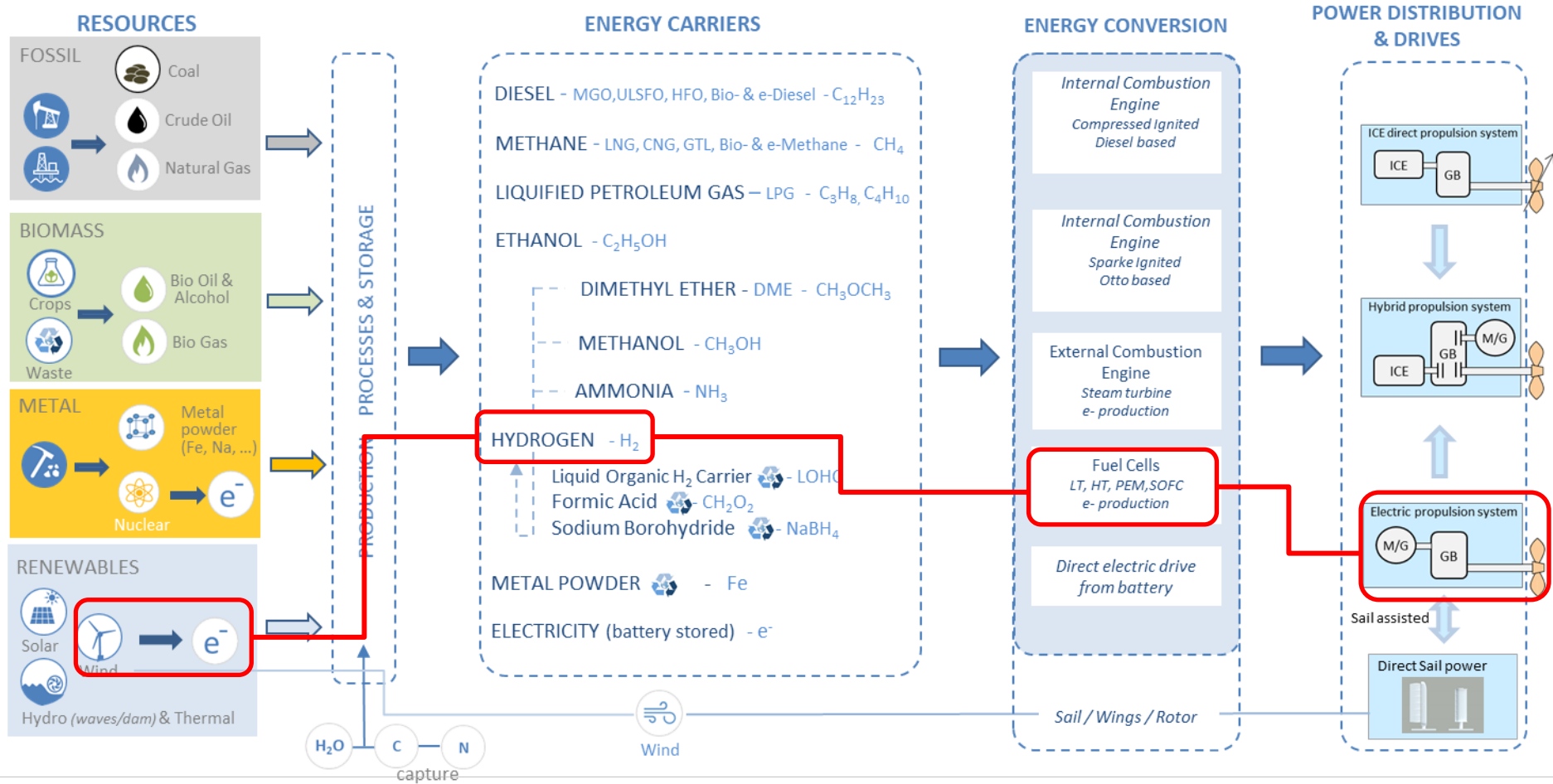
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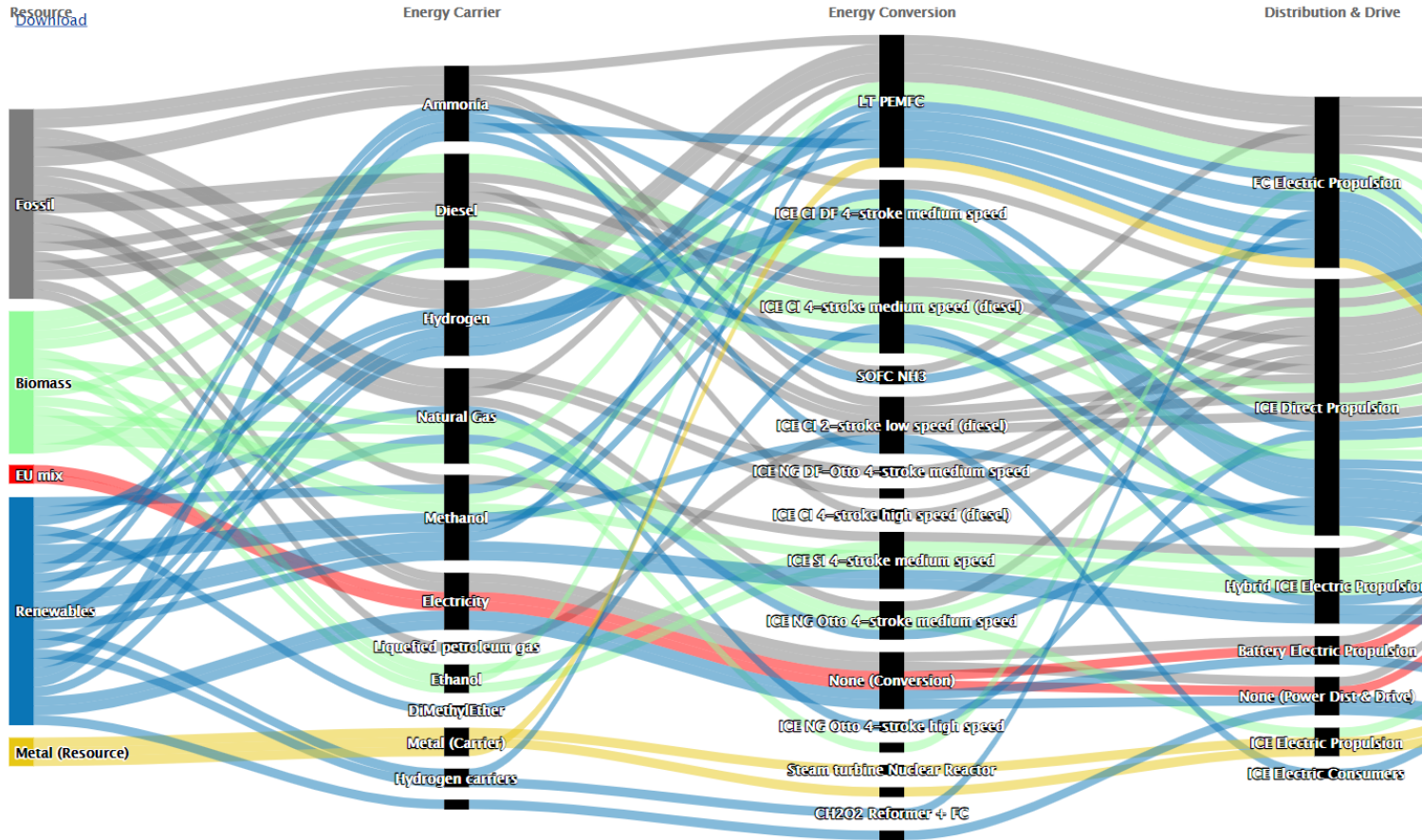
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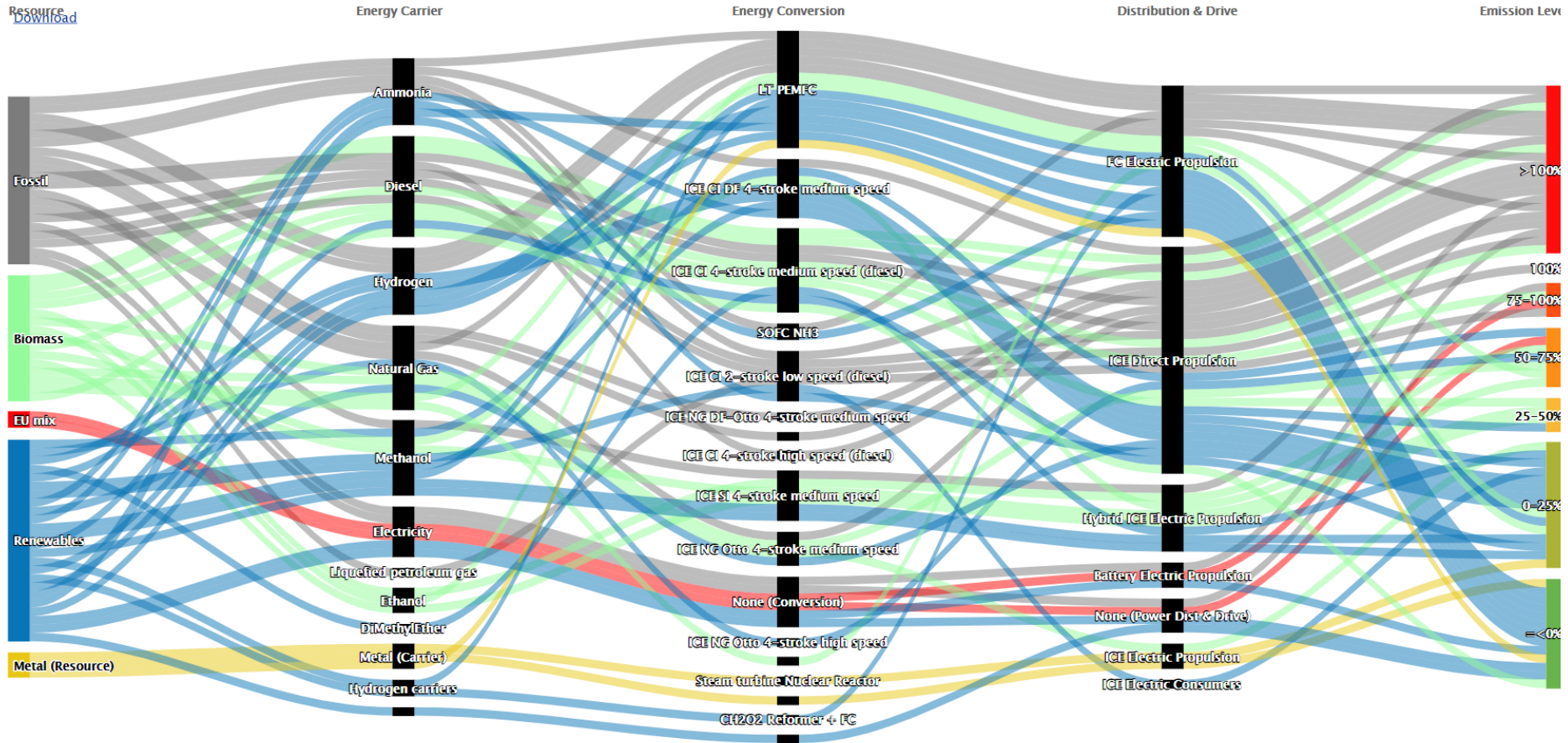
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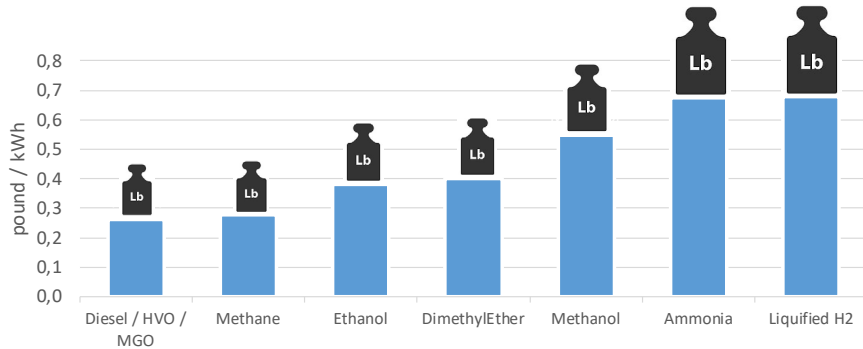
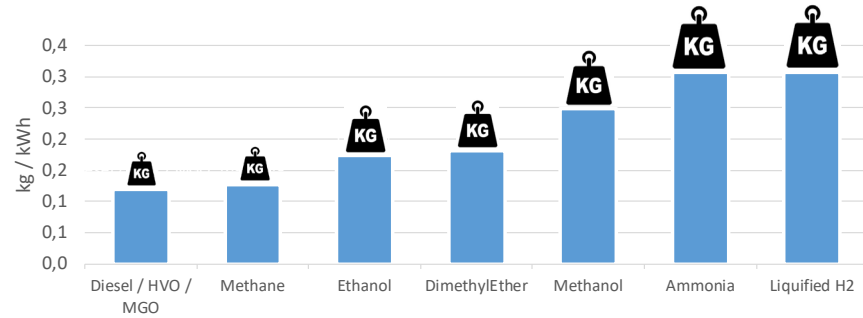
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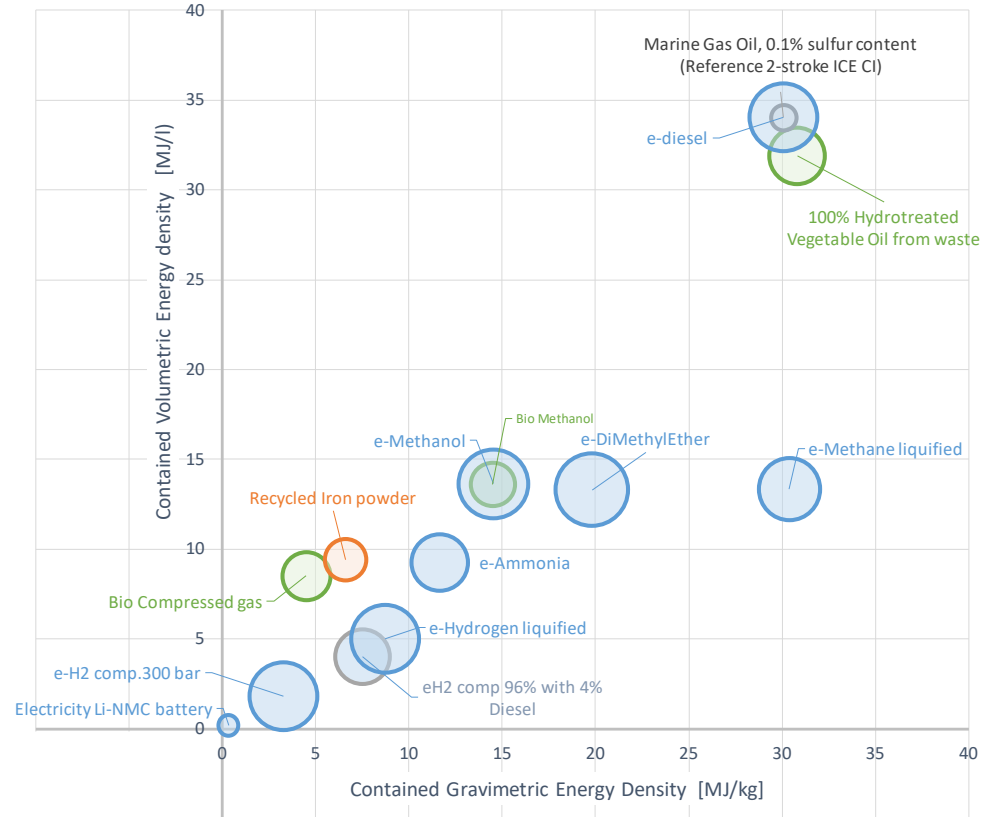


How much weight 1 kWh stored onboard (including containment system)

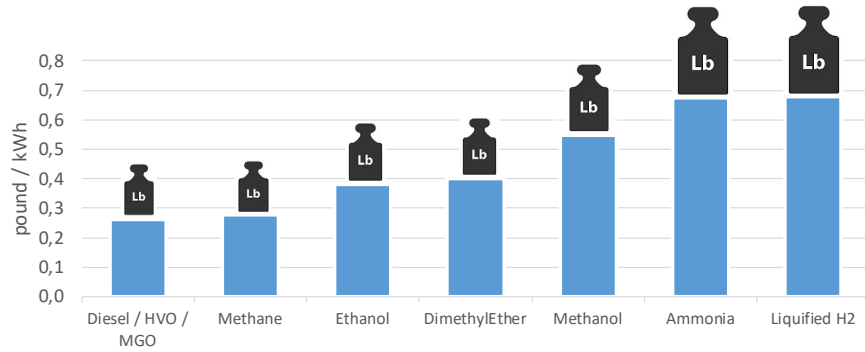


Physical properties of Sustainable Alternative Energy Carriers & price per energy unit

Selection of the solutions matching de 70% emission reduction

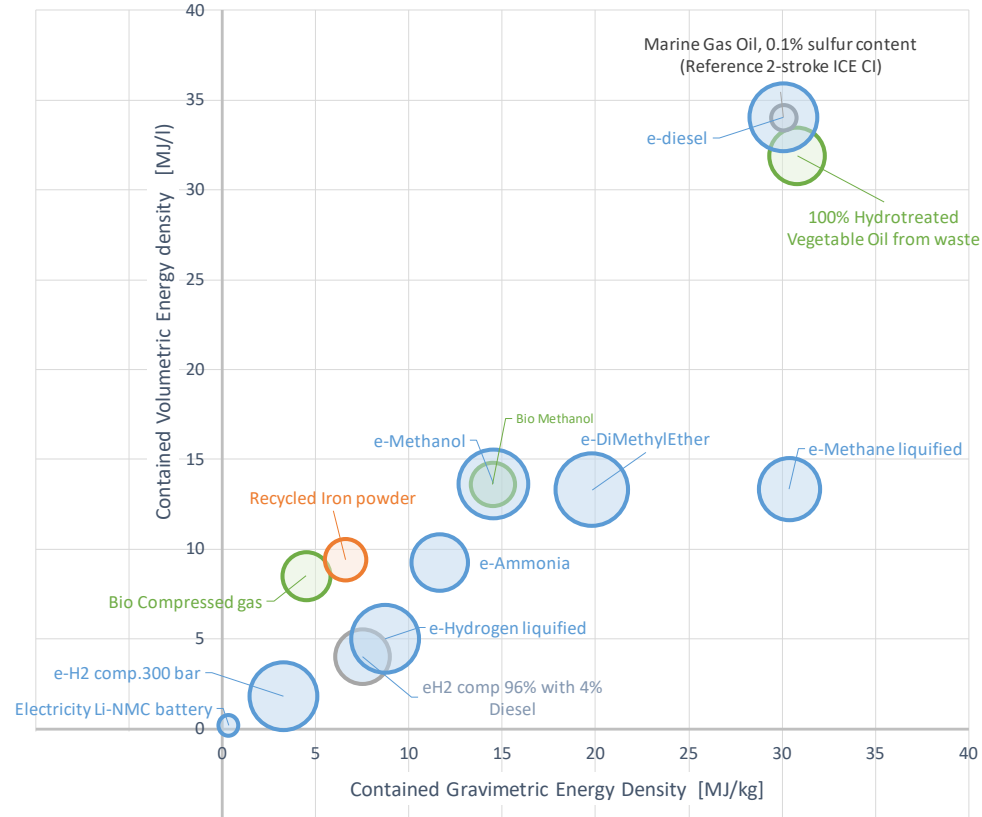


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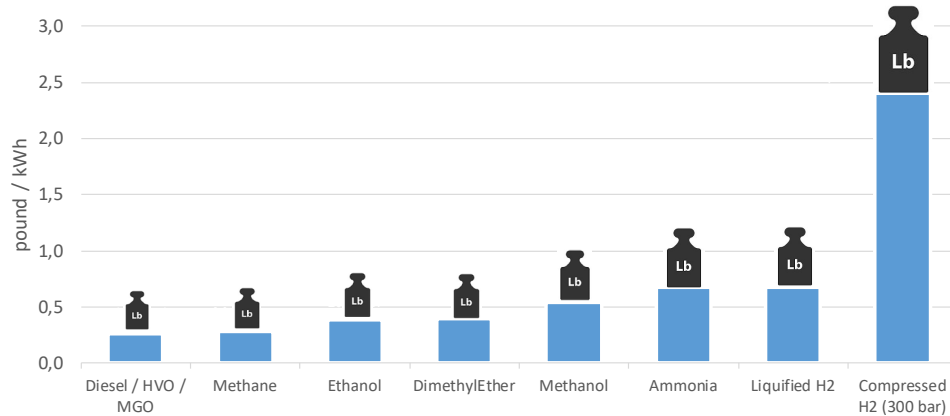


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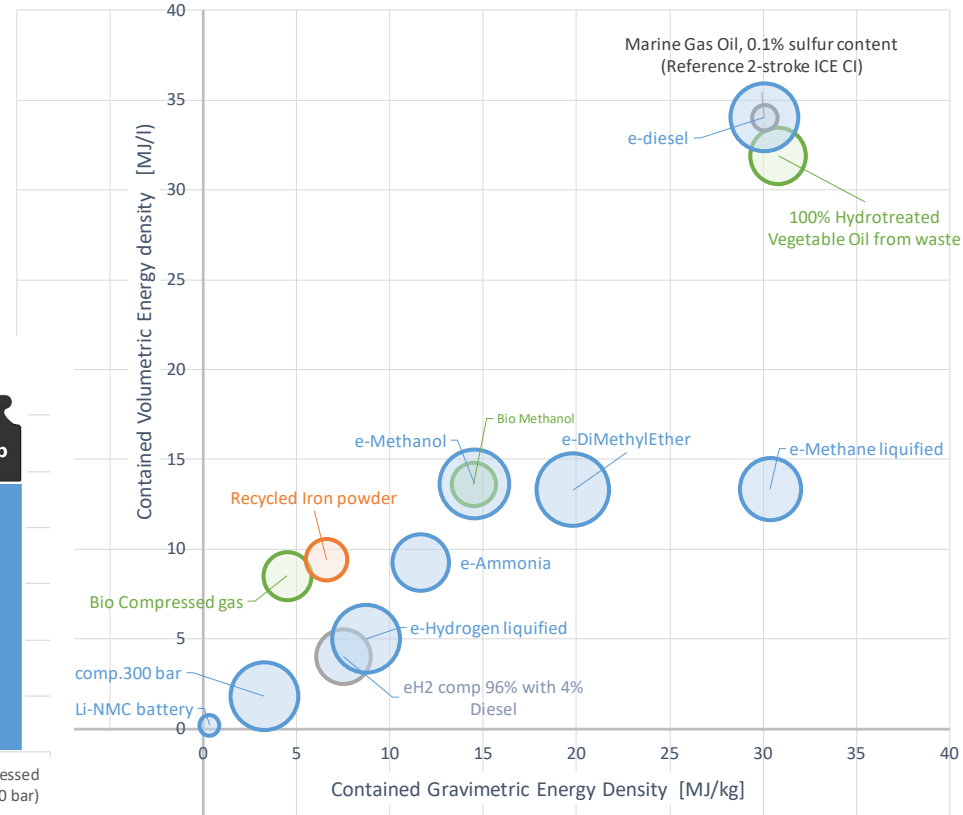


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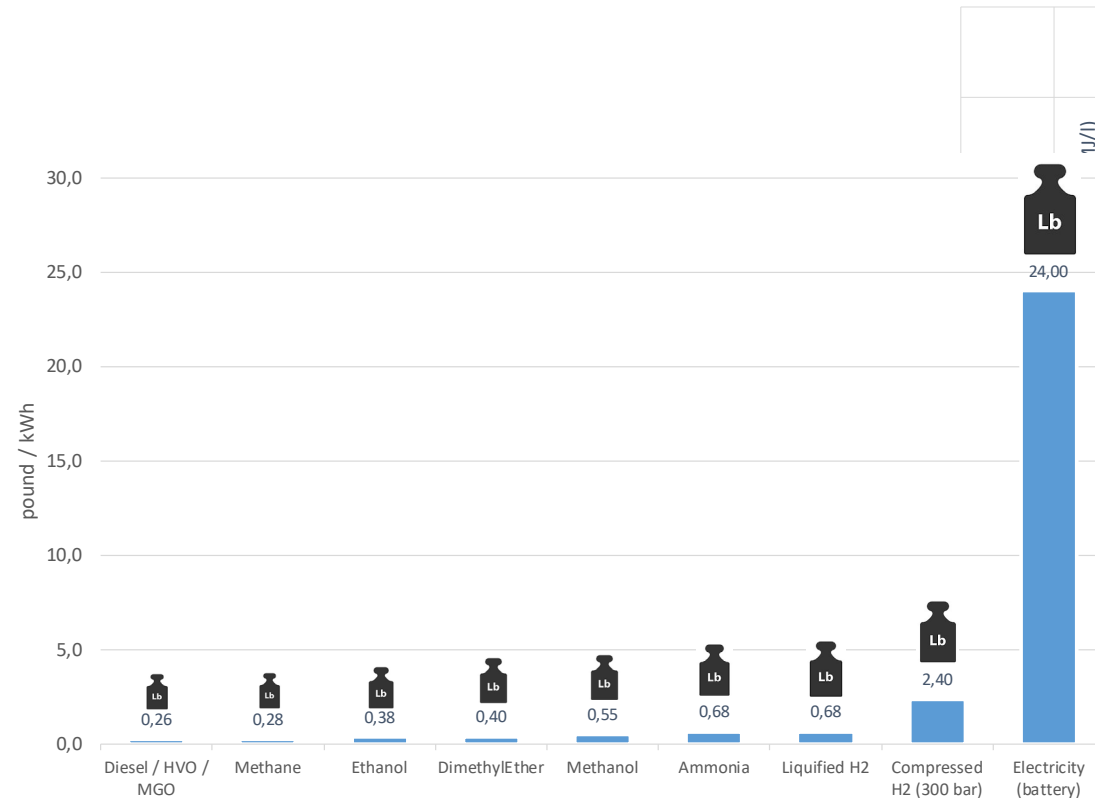
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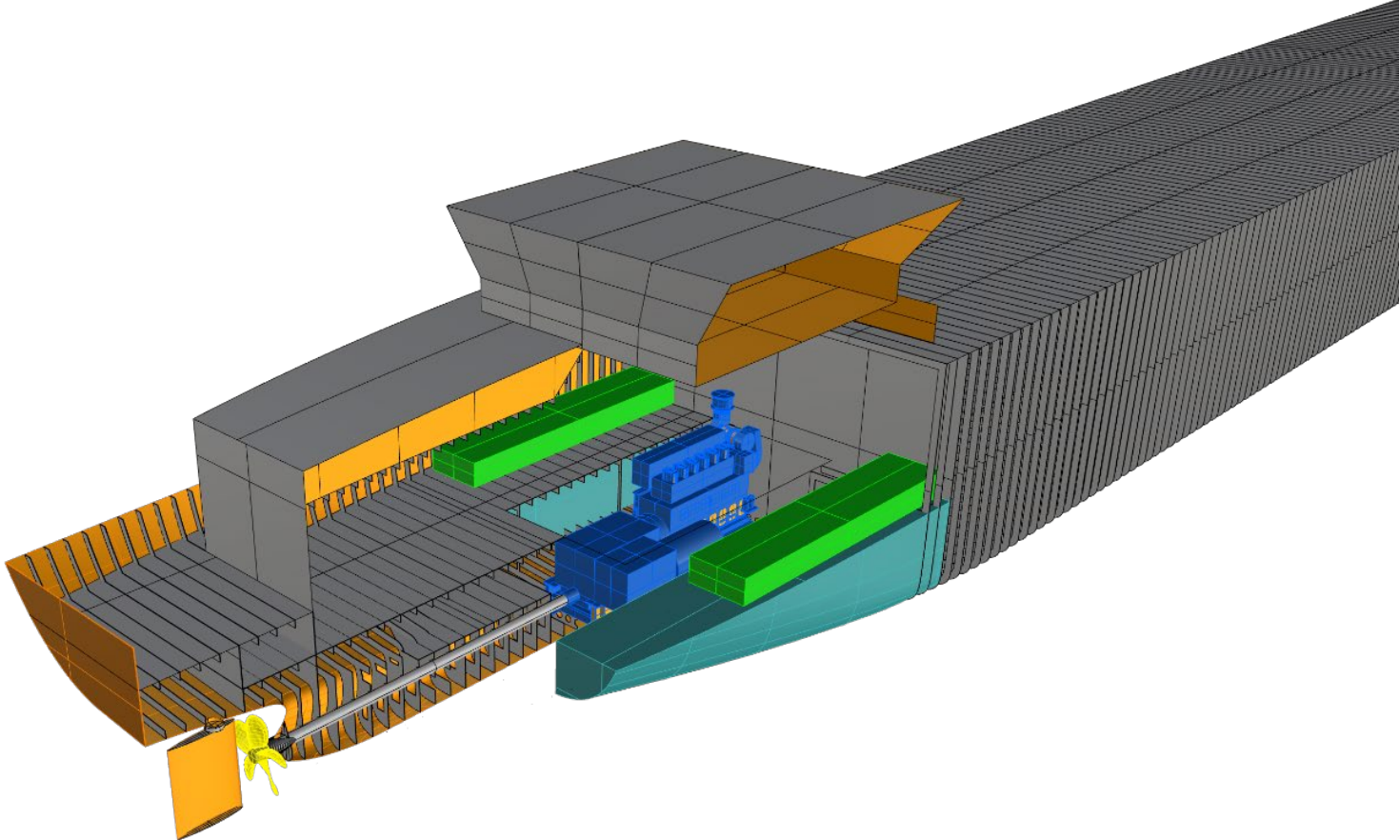


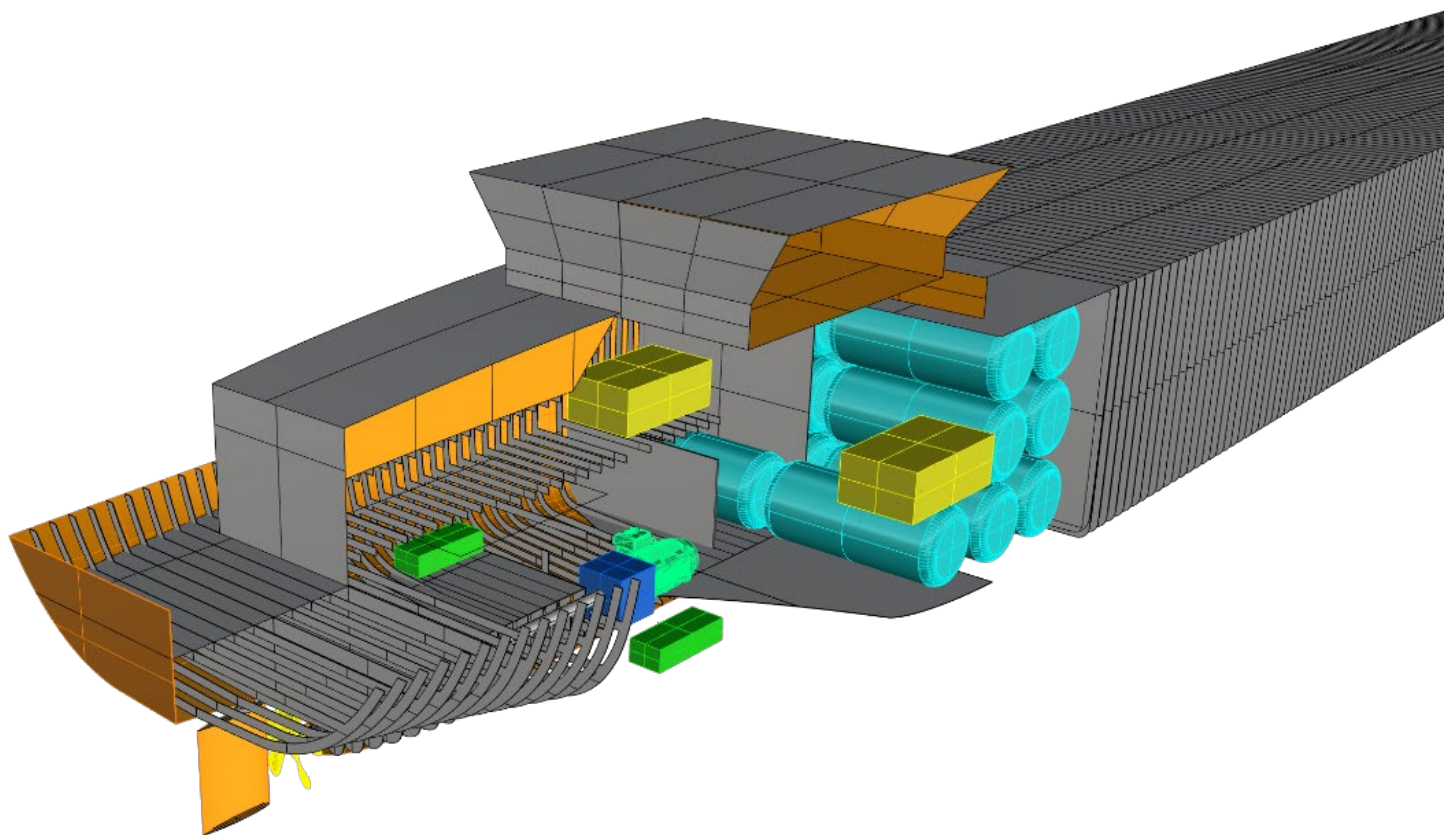
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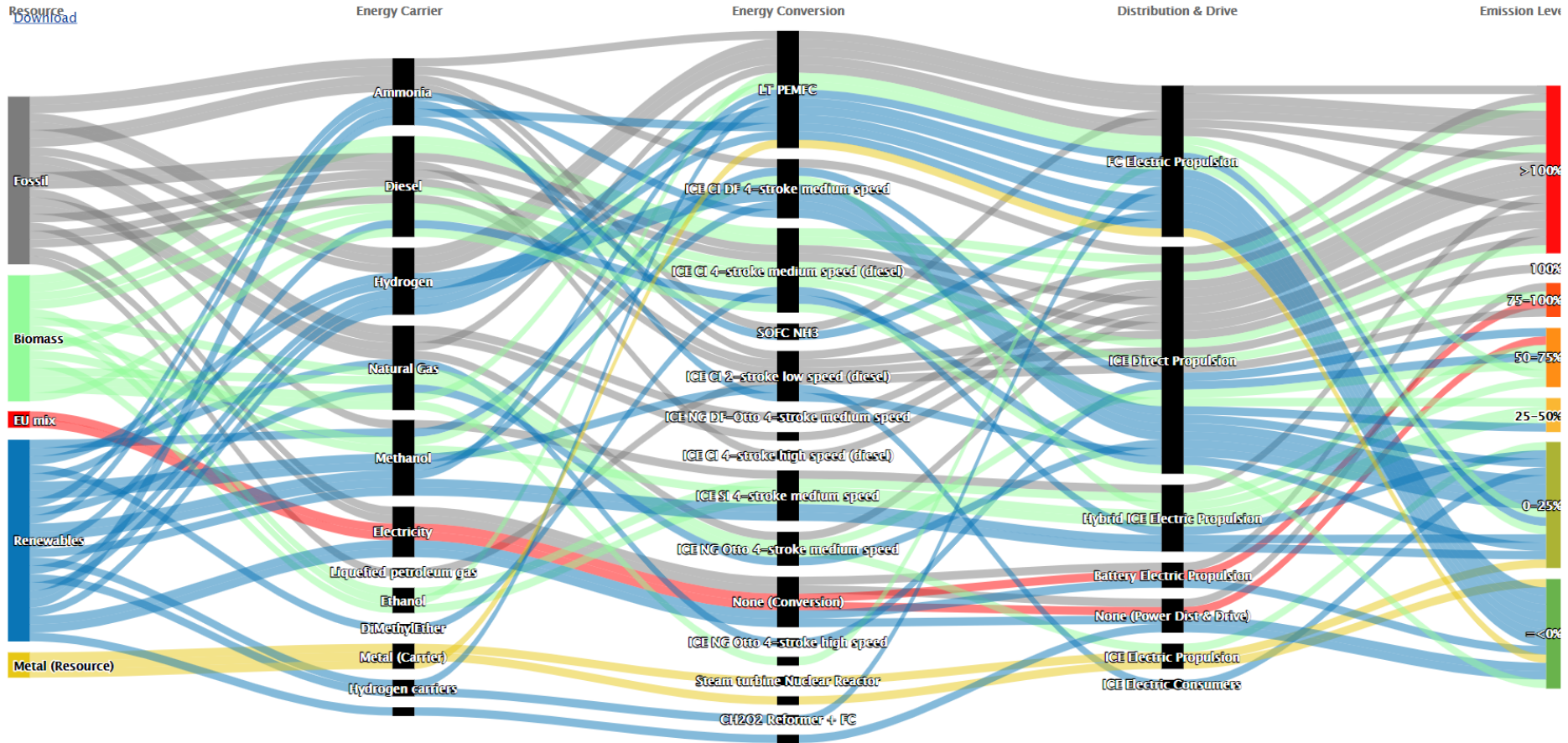
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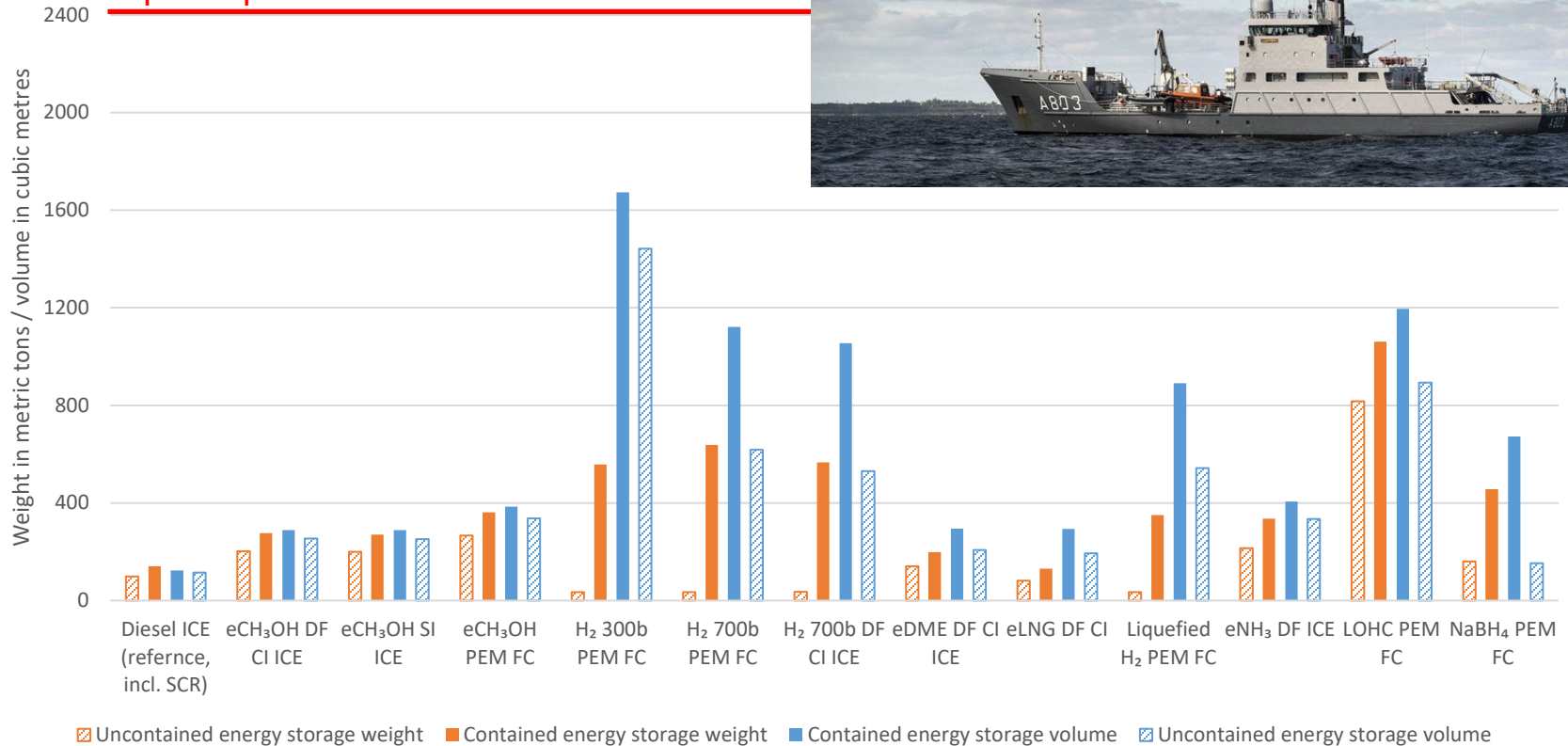




on the influence of alternative power sources, infrastructures and operations



Ship's displacement



on the influence of alternative power sources, infrastructures and operations



Diesel DME CH₃OH

Power suppliers

Propulsion control panel

Propulsion Control and Power Management PLC

Speed setpoint

Automatic

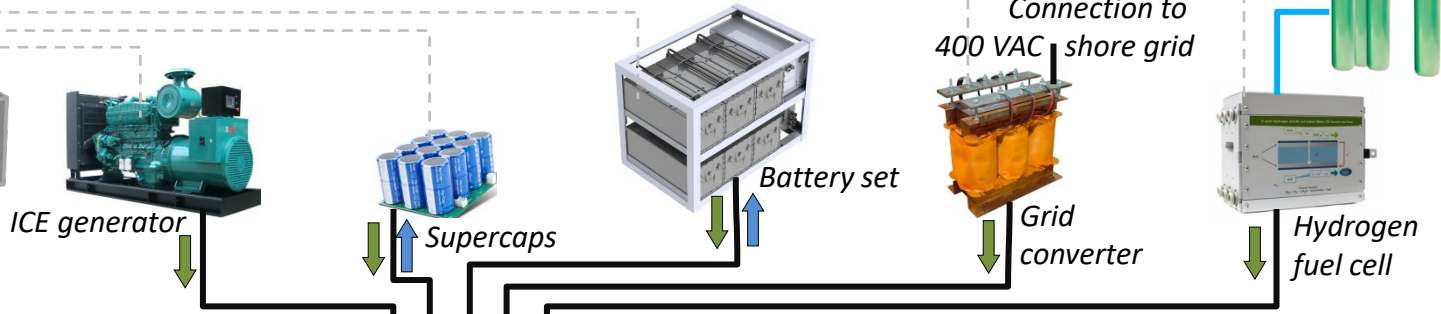
- ICE direct
- ICE electric
- Battery electric
- Off

Propulsion mode

- ICE generator
- Zero emission
- Off

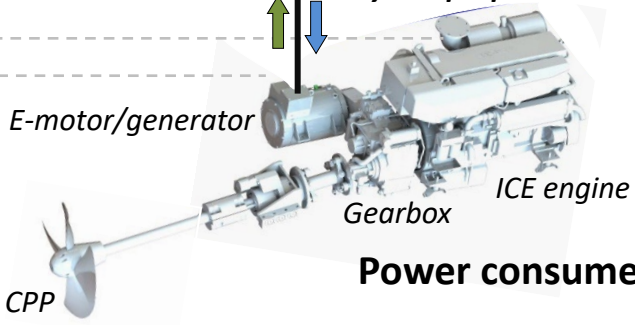
Elec. Power mode

- ICE direct



Electric distribution

Hybrid propulsion set



Aux consumers



Power consumers

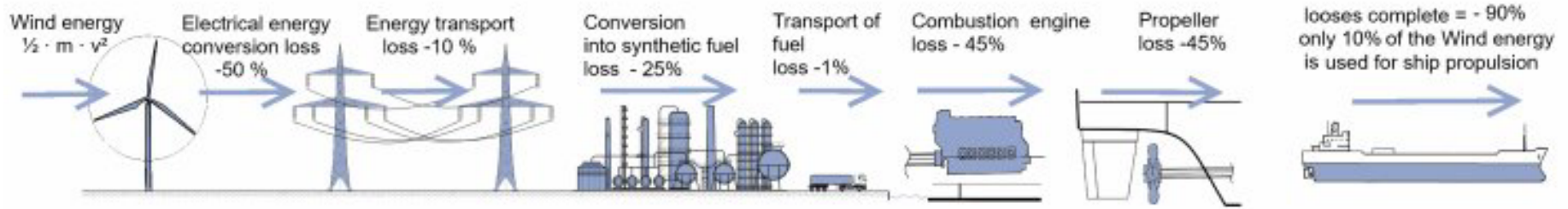
- Electric power
- - - Control
- ↓ Power supply to the DC grid
- ↓ Power consumption or charging



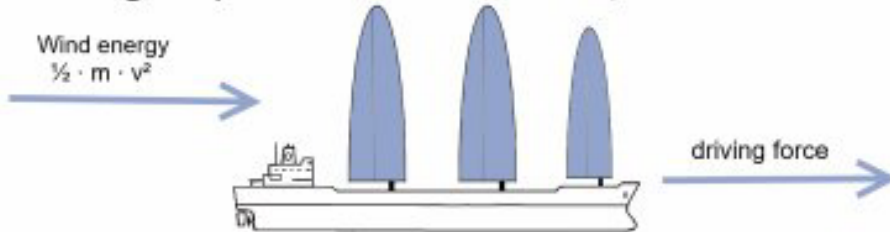
- Model-based System Engineering (MBSE) can support the selection of solution and its implementation into the design of the ship (just to ensure no single power system and functional system is forgotten)

A step further in changes in ship design:

The most sustainable energy is the energy you don't use...



sailing ship : the short way from wind energy to driving force



advantages of a sailing ship:

- uses high wind potential on the open sea
- No losses due to energy conversion
- No losses due to energy transport
- No land-based infrastructure necessary
- One sailing ship replaces 10 land based wind power plants
- No fuel costs for the shipping company (wind is for free)
- less dependency of shipowners on fuel producers

on the influence of alternative power sources, infrastructures and operations



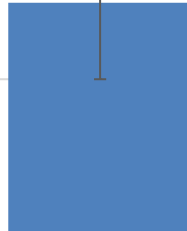
100%
80%
60%
40%
20%
0%

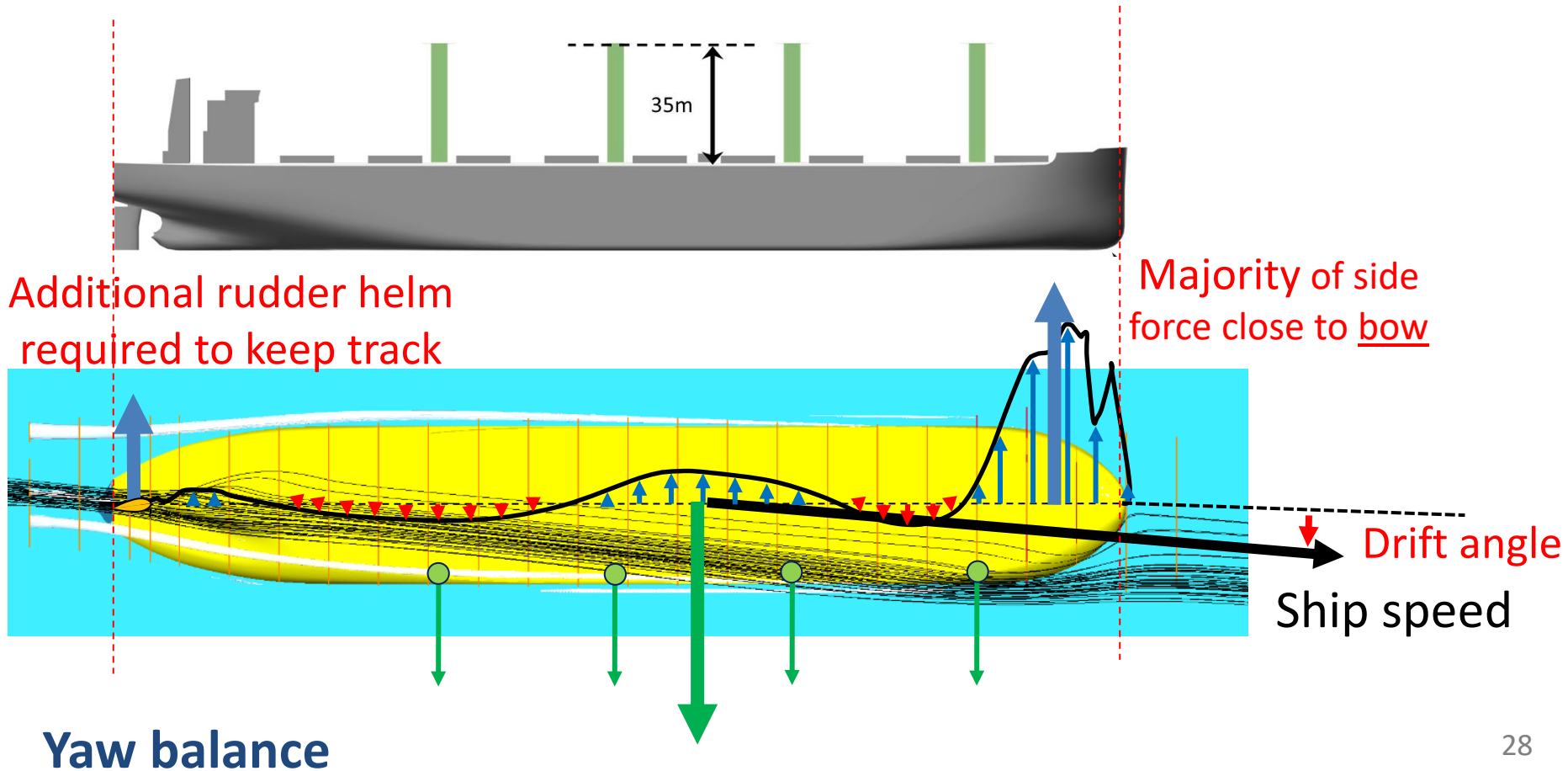


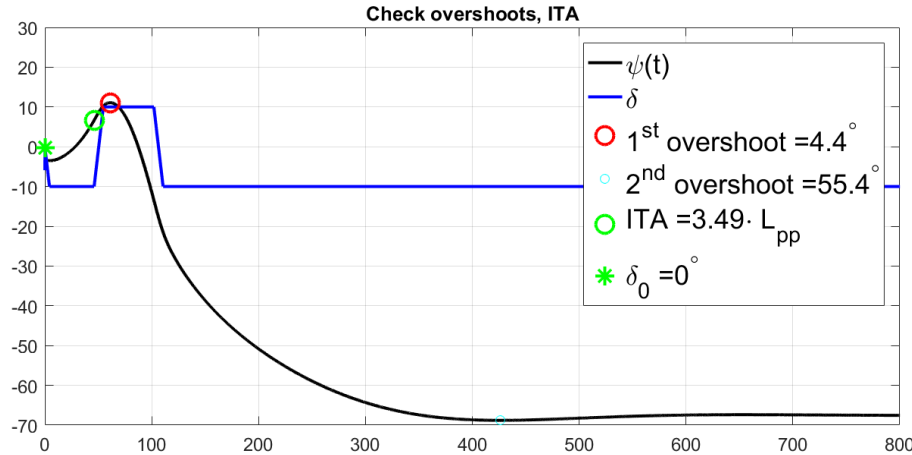
Present retrofits

New builds short term

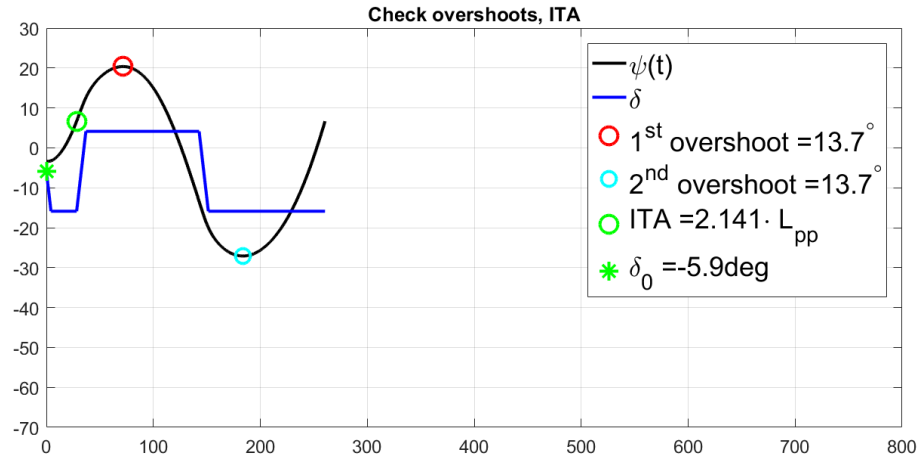
New builds long term





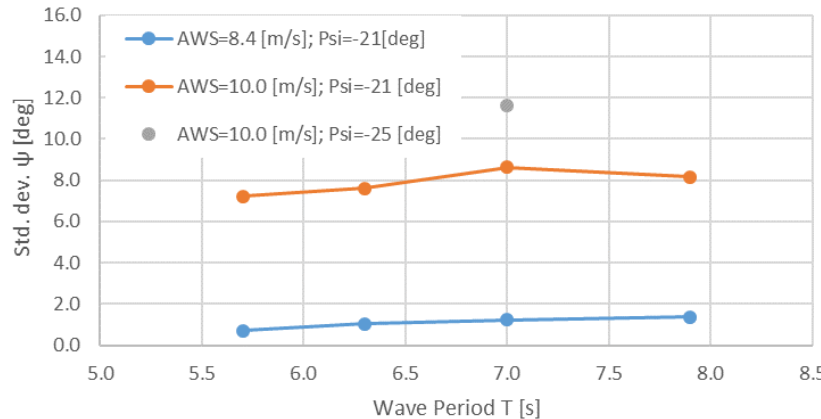


- Course keeping and turning ability may either improve or worsen depending on many factors
- Possibly, additional measures are needed to ensure safe operations
- Currently WISP JIP 2 investigates these aspects

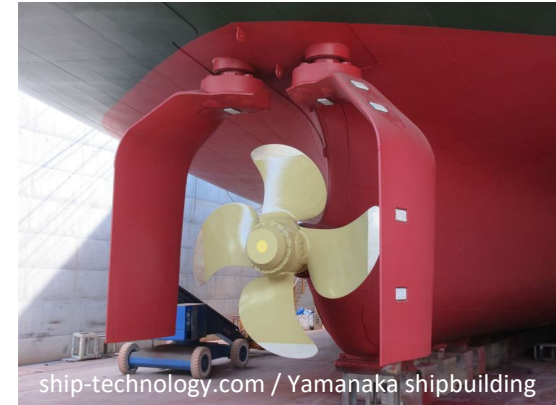


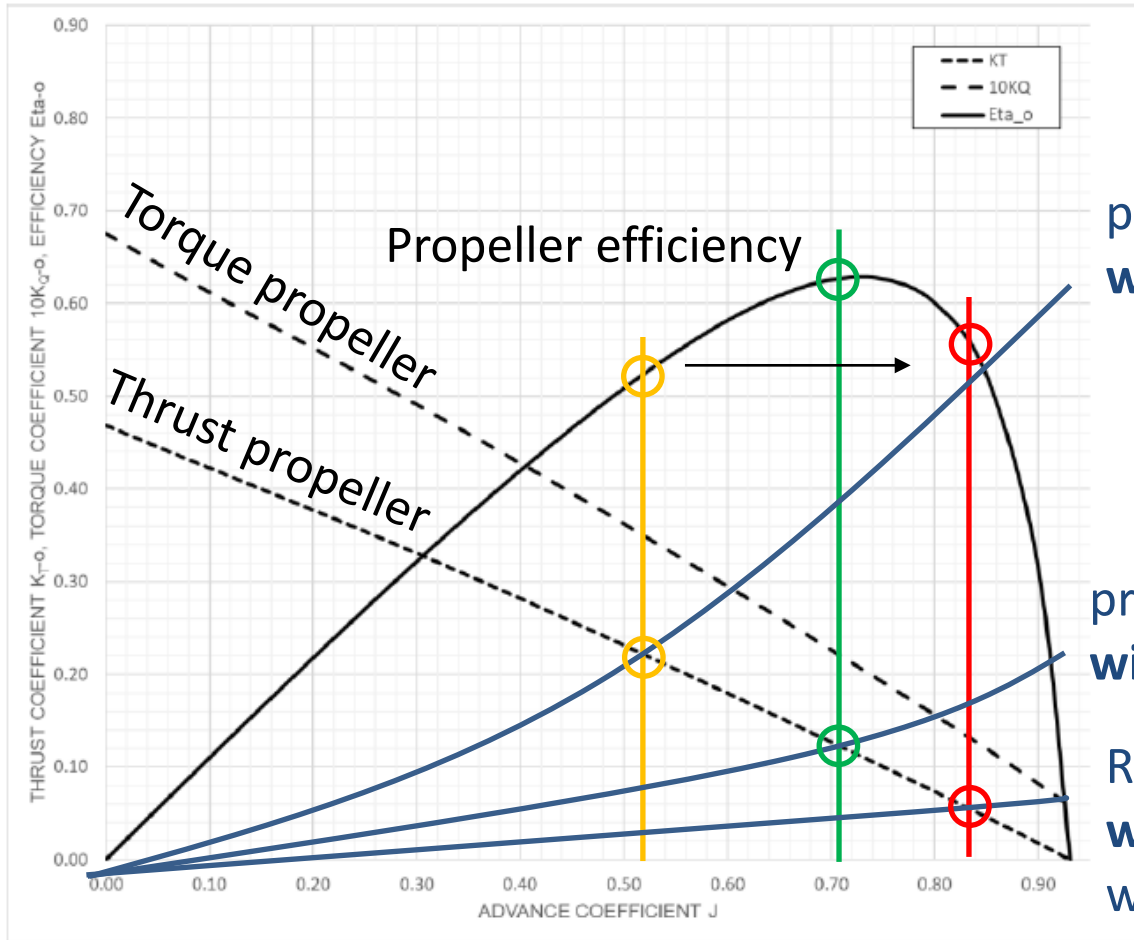
- Seakeeping in stern quartering wind and seas was tested
- More effort to keep course in high winds (30% thrust delivered by the rotors)
- Roll damping improved

Std. Dev. Yaw



- Design changes:
 - Change hull dimensions (more draught, ...)
 - Use V-shaped sections or box keels (in stern area)
 - Avoid wide flat transom
 - Enlarge skegs and bilge keels
 - Use appendages (like keels or dagger boards)
 - High-lift/multiple rudders
- Most of these modifications come with performance degradation when sailing straight, in low wind.
- Find best compromise considering operational profile.



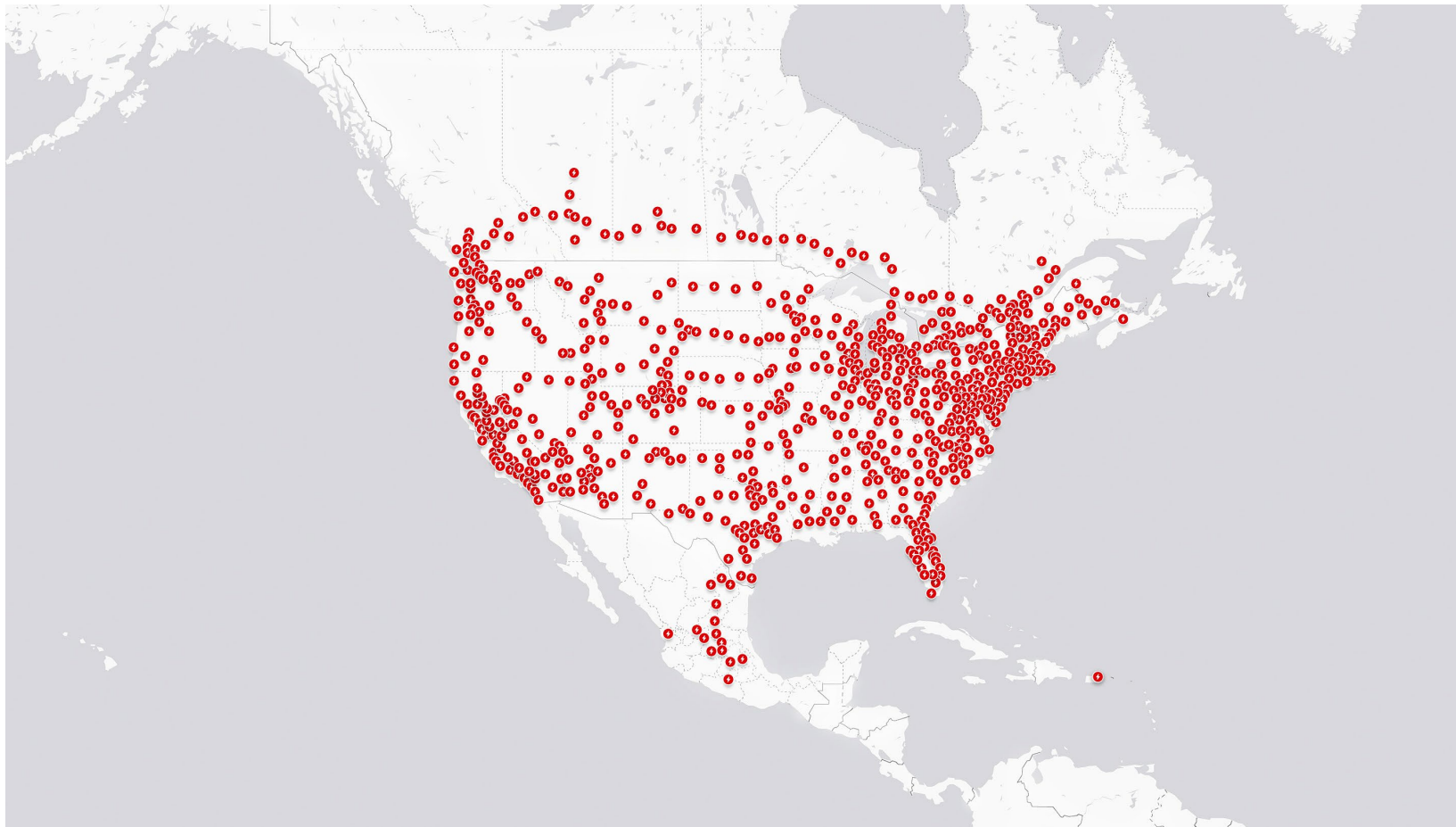


propeller thrust,
without wind propulsion

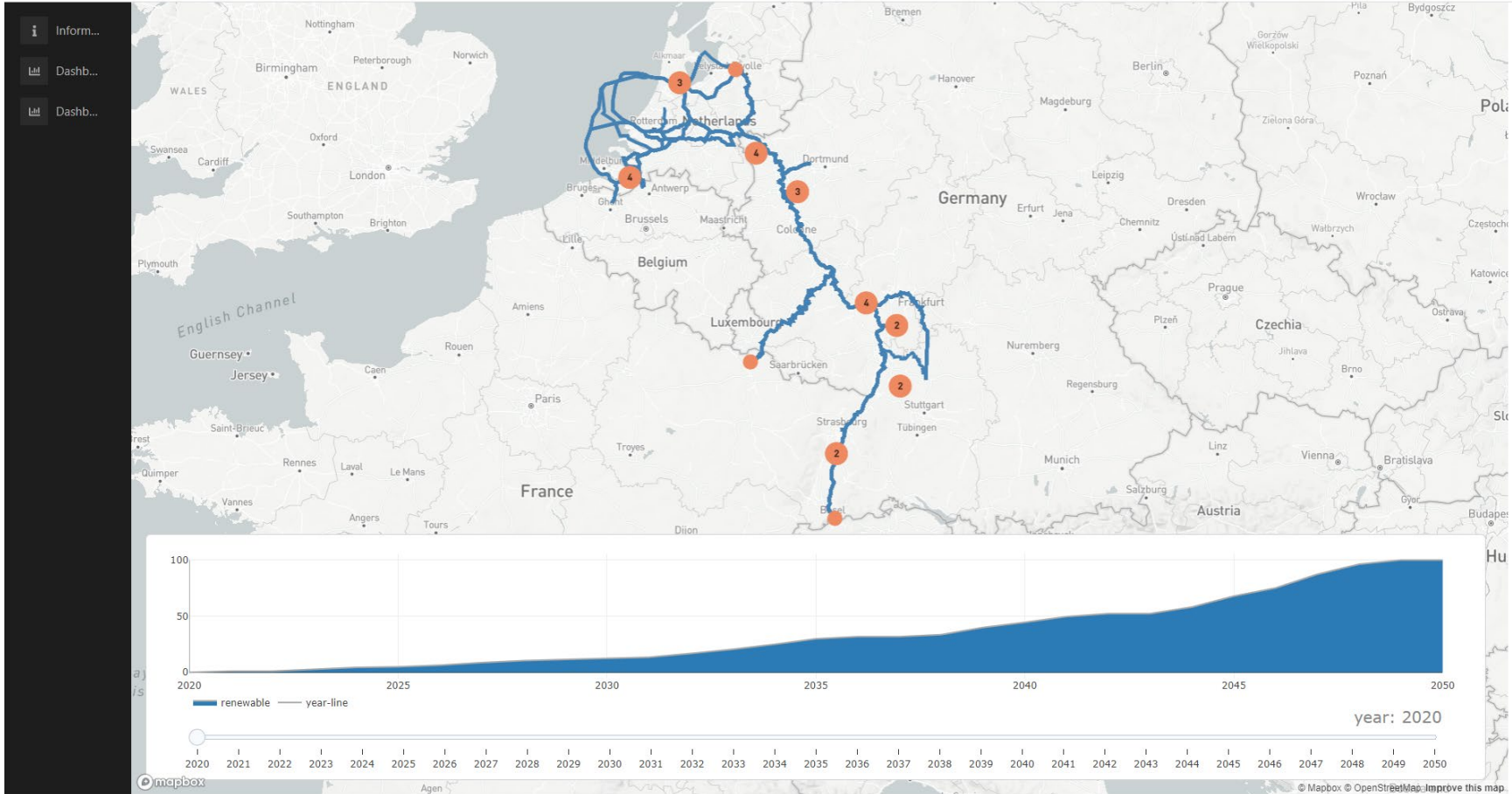
propeller thrust,
with wind propulsion

Reduction in thrust
with even more
wind propulsion

- On the influence of infrastructures



on the influence of alternative power sources, infrastructures and operations





A.P. Moller - Maersk engages in strategic partnerships across the globe to scale green methanol production by 2025

10 March 2022

Decarbonisation

Sustainability

Shipping Instruction

All the Way

Share



“Maersk has set an ambitious end-to-end net-zero goal for 2040 and the availability of green methanol at scale is critical to our fleet’s transition to sustainable energy. Partnerships across ecosystems and geographies are essential for the scale-up needed in order to make meaningful progress on this agenda already in this decade,” said **Berit Hinnemann**, Head of Green Fuels Sourcing, A.P. Moller – Maersk.

The cooperation is the seventh strategic green methanol partnership the company signed with companies across the globe earlier this year in its quest to boost global production capacity.



Climate Change

Climate Solutions

Transport Fuels



2 minute read · November 3, 2022 2:31 PM GMT+1 · Last Updated 2 days ago



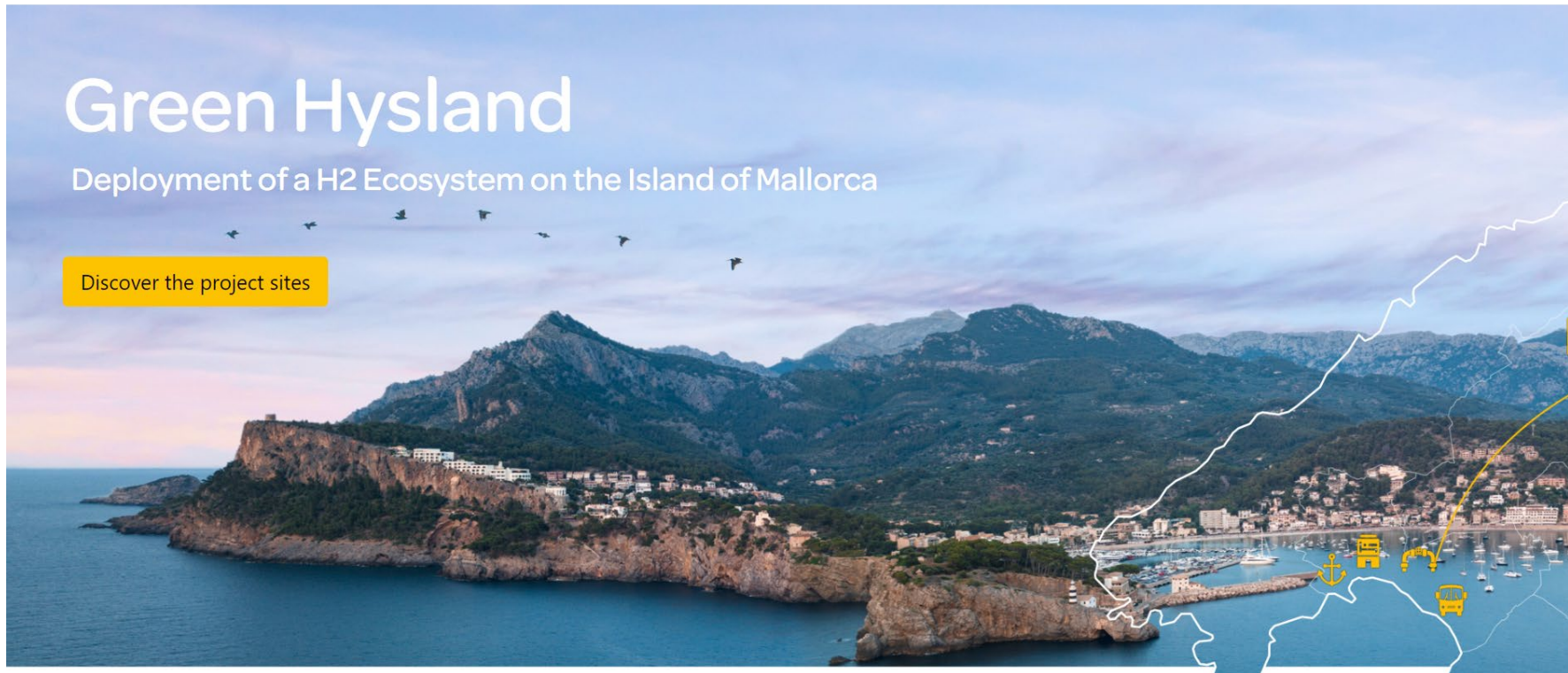
Maersk agrees on project with Spain to make e-methanol for its fleet

Reuters

Green Hysland

Deployment of a H2 Ecosystem on the Island of Mallorca

Discover the project sites



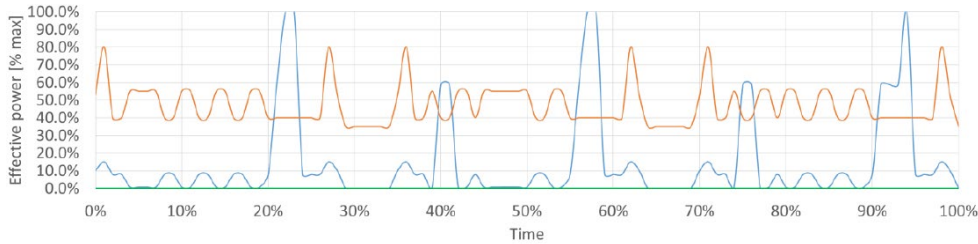
COUNTRIES CONTRIBUTION TO TOTAL FOSSIL FUEL PRODUCTION

With data gathered from The U.S. Energy Information Administration (EIA), The Central Intelligence Agency (CIA), The Ente Nazionale Idrocarburi, (ENI) and British Petroleum (BP), our map changes the area of each country to show their individual contribution to total fossil fuel production.

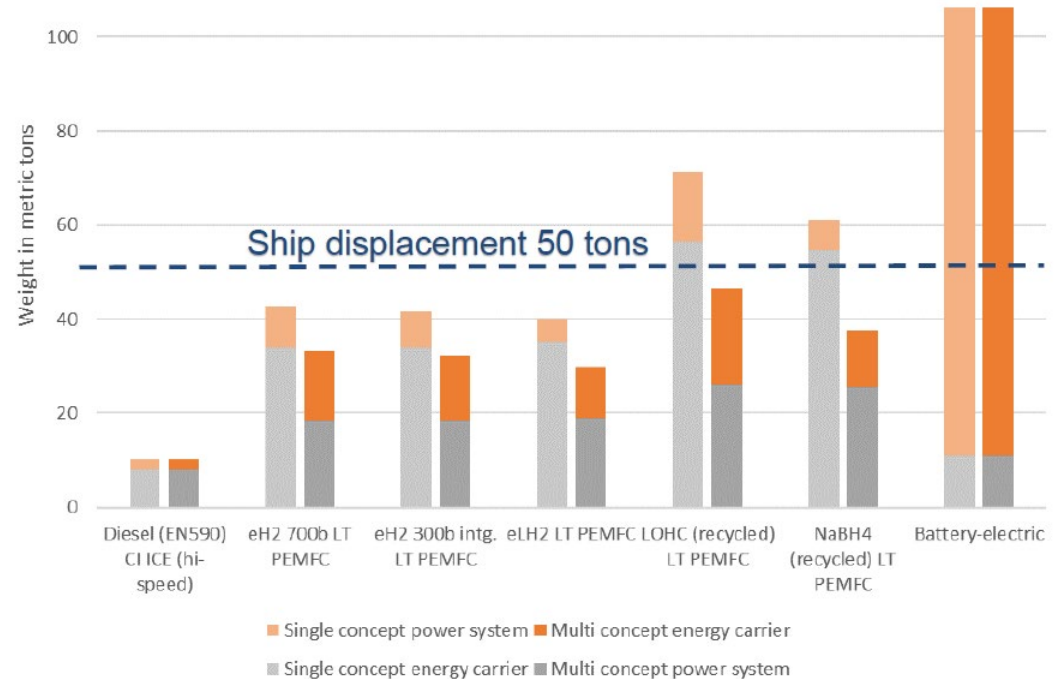


How will be
this map in
2050?

- On the influence of operations



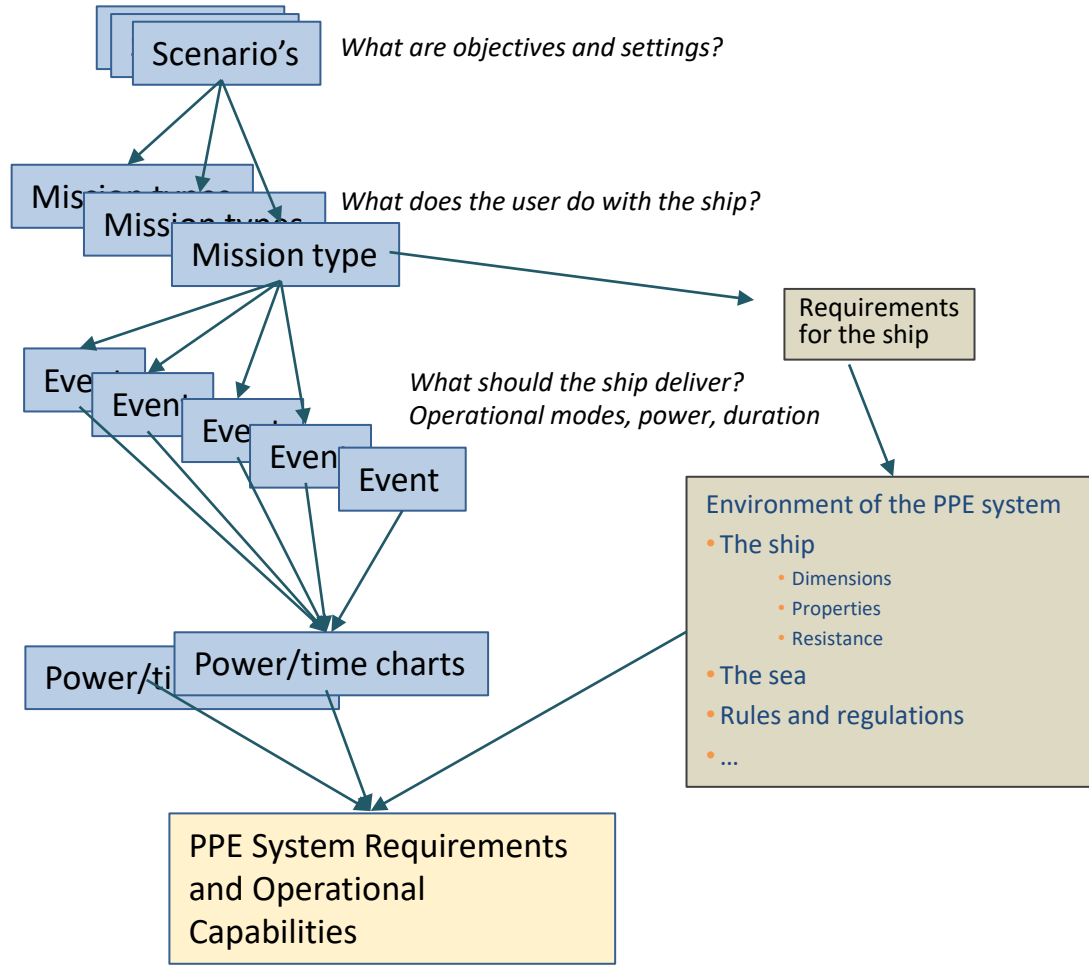
- Fast intervention ship

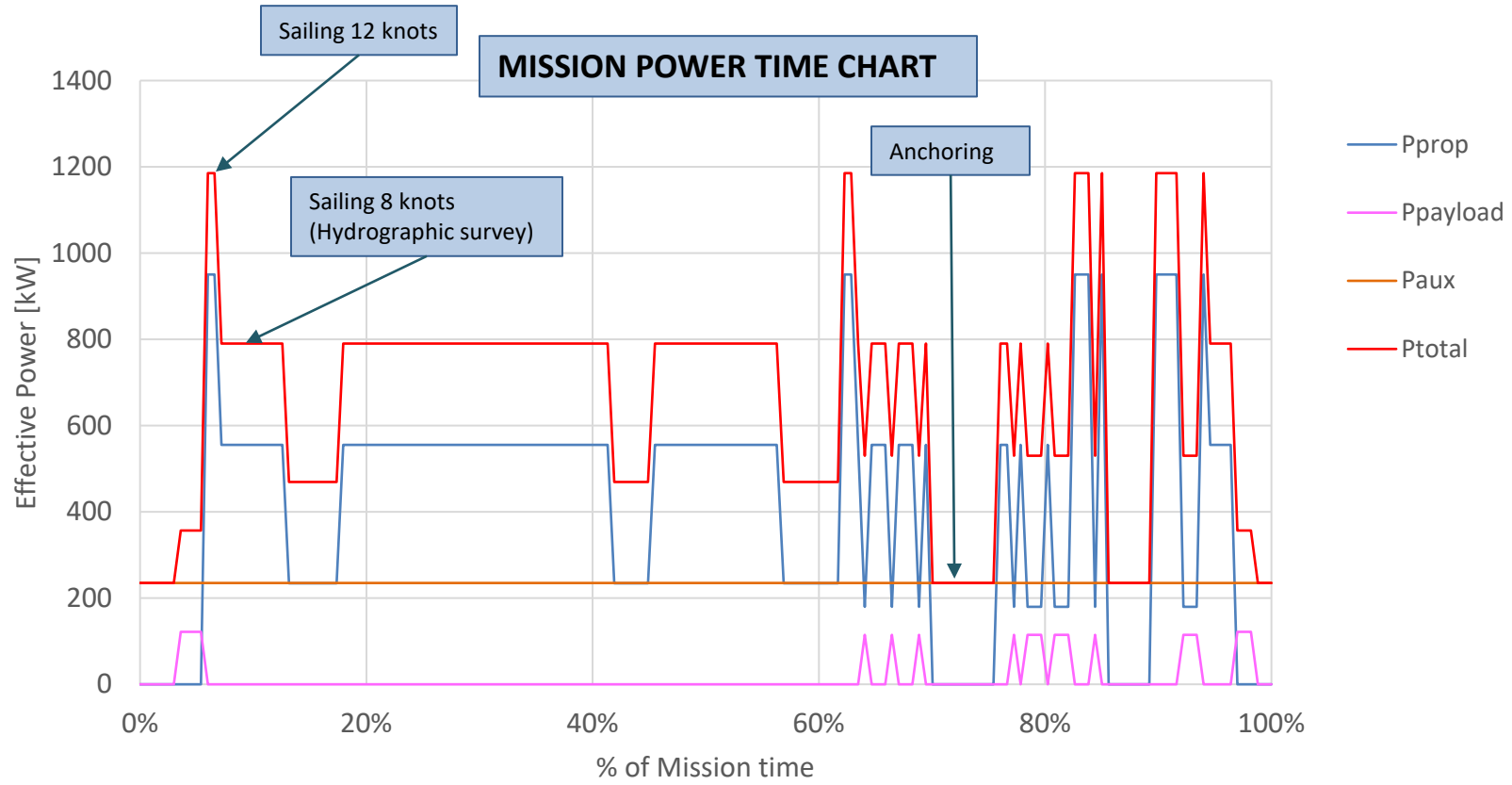


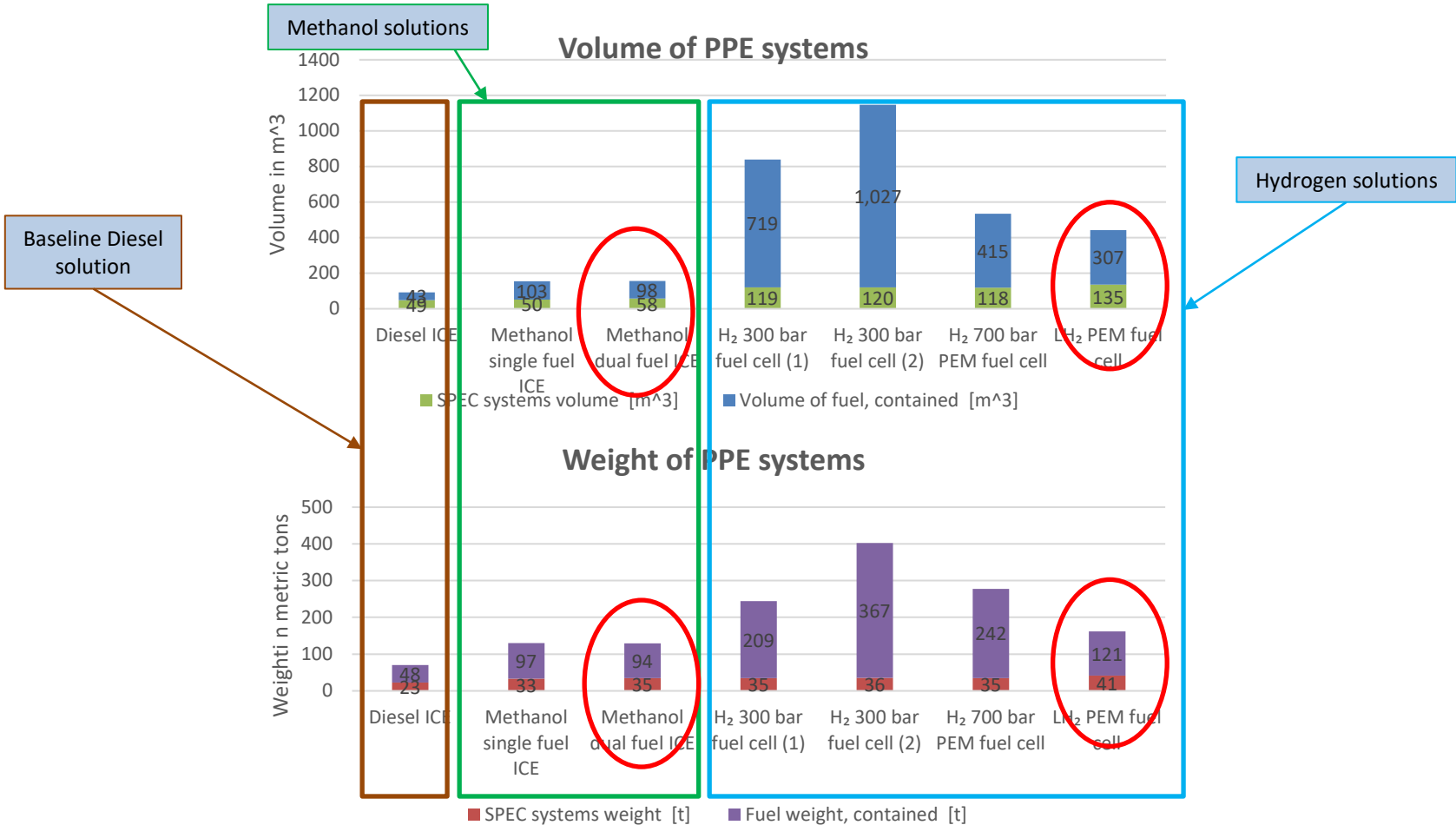
- Multi-purpose vessel (similar to current MPV50)
 - Buoy laying
 - Ecological surveys
 - Oil recovery
 - Search and rescue tasks
 - Etc.

- Multi-purpose vessel

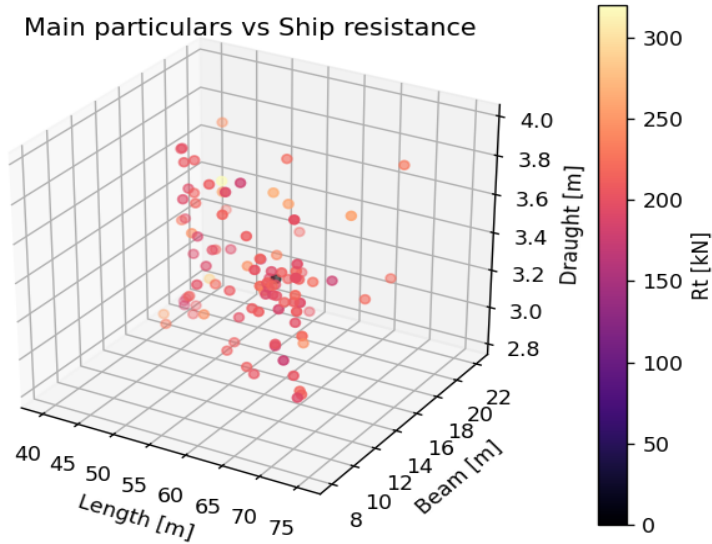




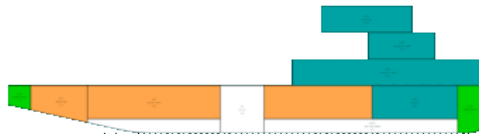
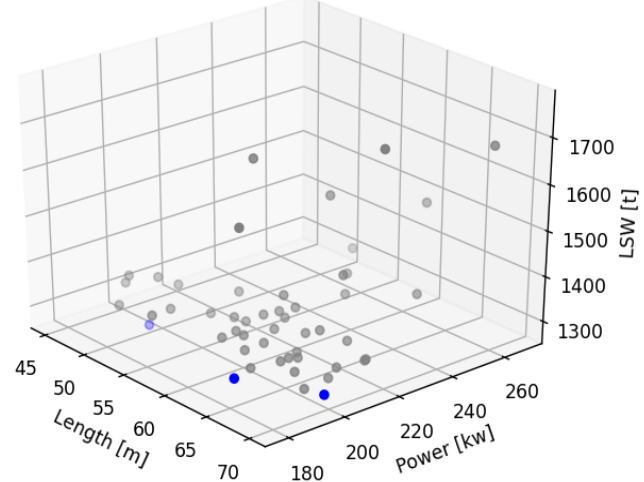




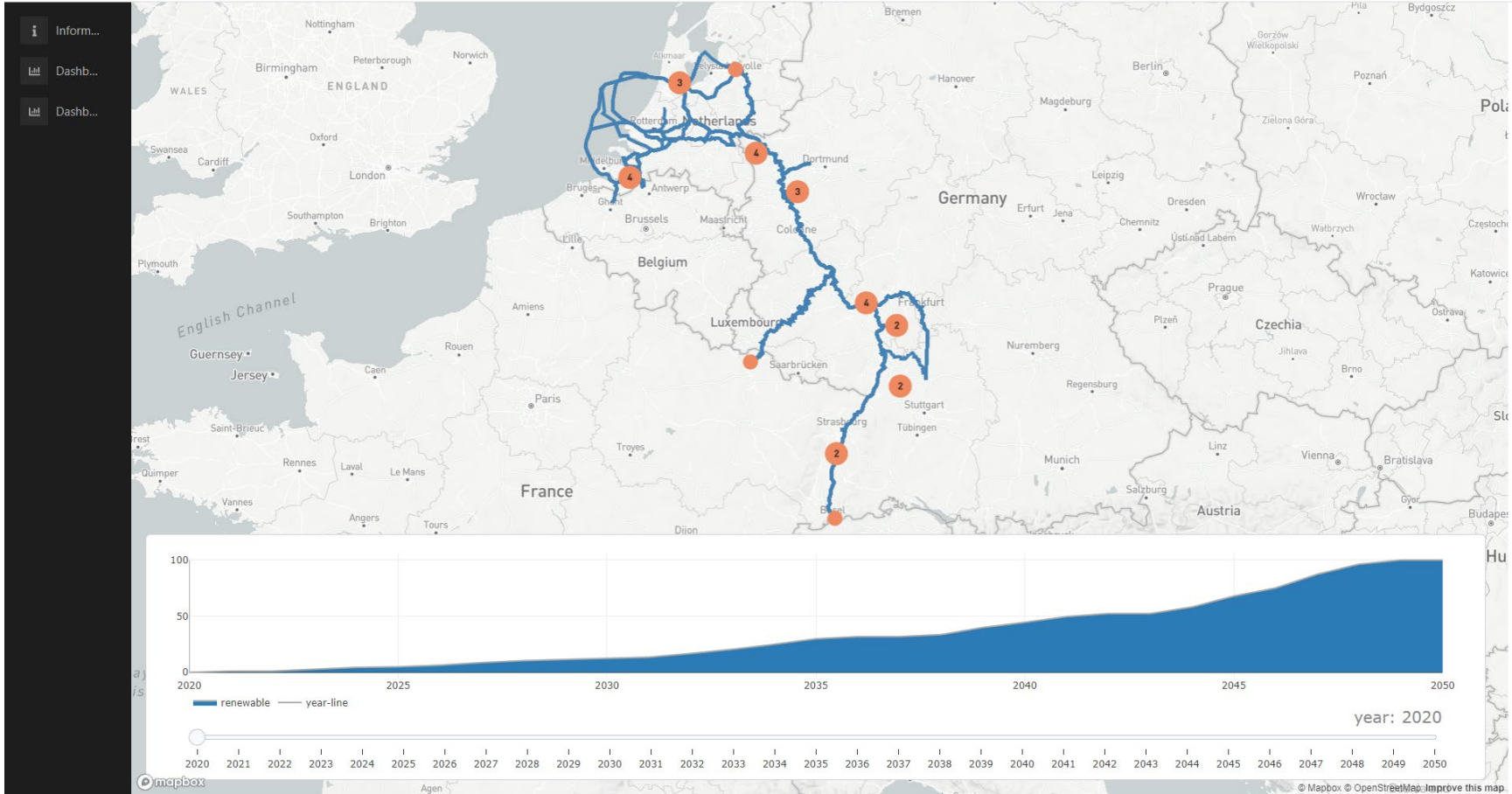
Main particulars vs Ship resistance



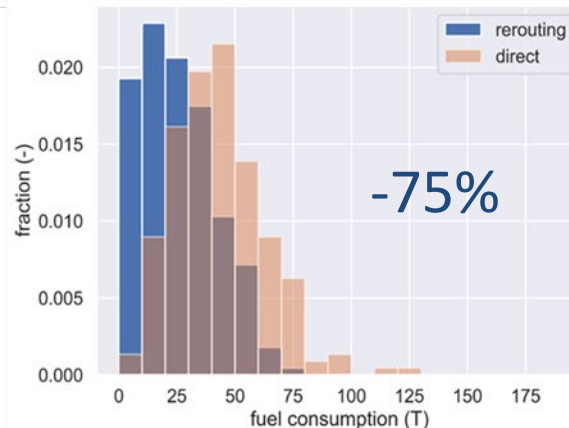
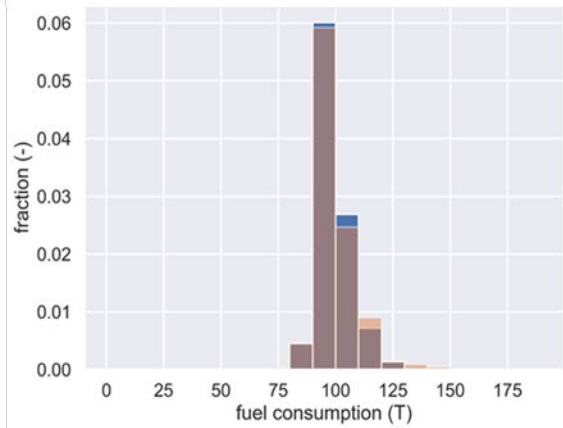
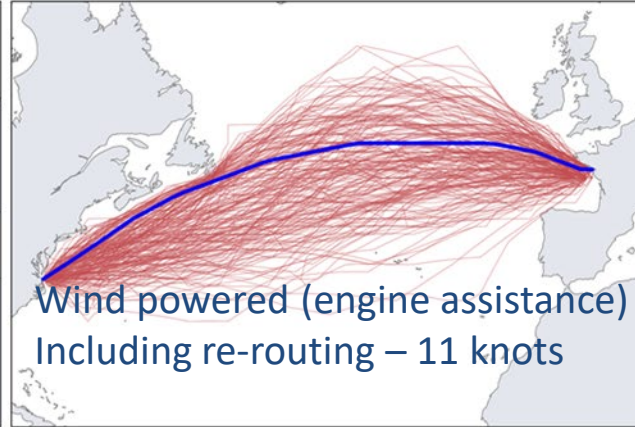
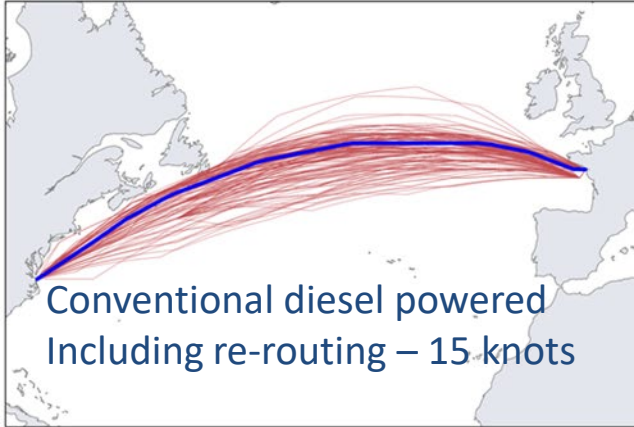
Pareto-frontier



on the influence of alternative power sources, infrastructures and operations



Scenario studies for alternative wind propulsion



Zero emission or carbon neutral waterborne activities are possible, if new ship designs integrate the following changes:

- Put sustainable performance first & start the design loop from an energy need and energy/power management perspective. This will drive the range of solutions
- Adapt displacement & payload to the constraints of the sustainable alternative energy carriers
- Reduce drastically energy use by adapting operations & mission profiles & logistics
- Use wind or solar as free and non-storable energy source onboard, in any case.
- In case the performance depends mainly on wind as primary source of energy, adapt the hull design and appendages accordingly, as well as the operational profile & logistics
- Work hand in hand with infrastructure & energy sector, as sustainable shipping will only be possible with a joint and simultaneous effort.

THANK YOU FOR YOUR ATTENTION!

