Introduction to HyWindships conceptual designs

Konstantinos Fakiolas, Naval Architect CEO, WASP Expert

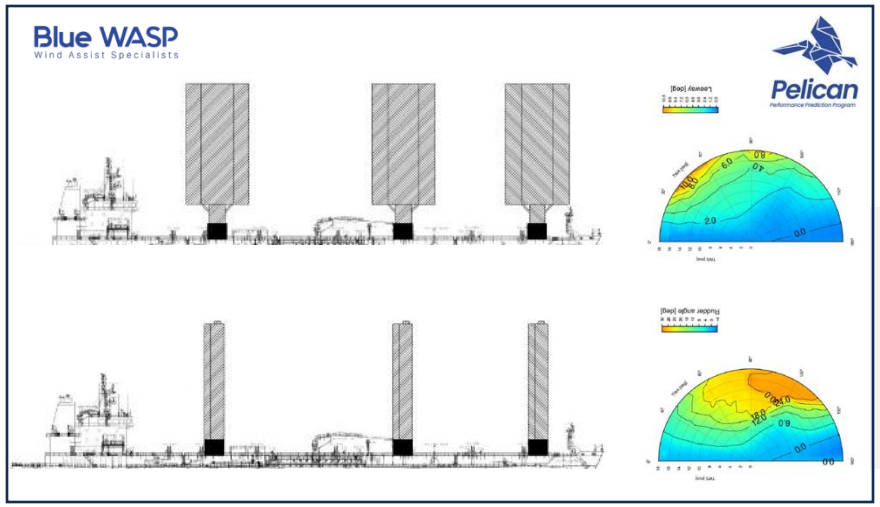
Enabling Zero Emissions Today, through hybrid H_2/Wind powered ships

Specializing in Wind propulsion since 2014

2014: First full WASP project development experiences on real ships
i.e. Rotor Sails, Airborne Kite, Suction Sail installations,

2019-2025: Funding & research Member of the **WiSP, WiSP2, WiSP3** project
an International JPD involving Owners, Class, Research Institutes,

2025: Hands-on experience in **over 100+** WASP ship project applications
(from feasibility to real installations) → all type of WASP systems



Authors of the **1st global Shipping Industry Guide** for Wind-assist ship integration.
https://www.finoceanltd.com/wind-assisted-propulsion/

Providing guidelines, checklists, research-based and real project based feedback to Ship Owners, Operators and Designers for WASP projects.

Complete Project development for WASP applications:

- Independent holistic Performance prediction platform (PELICAN),
- In-house optimal Ship Integration methodologies,
- Investment project management
- Advanced & specialized Engineering & studies
- Post delivery performance optimization

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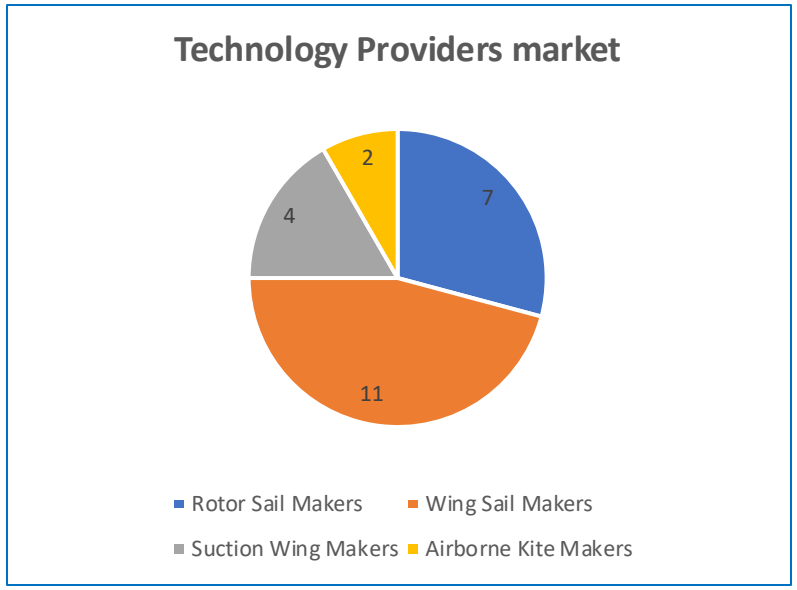
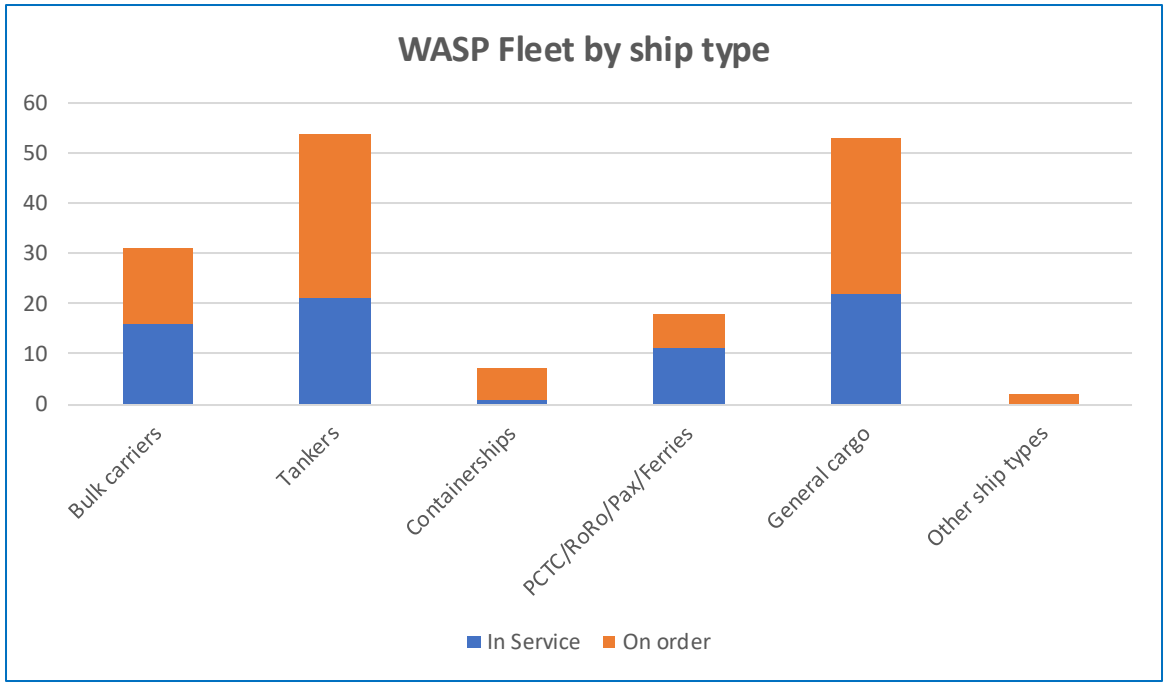
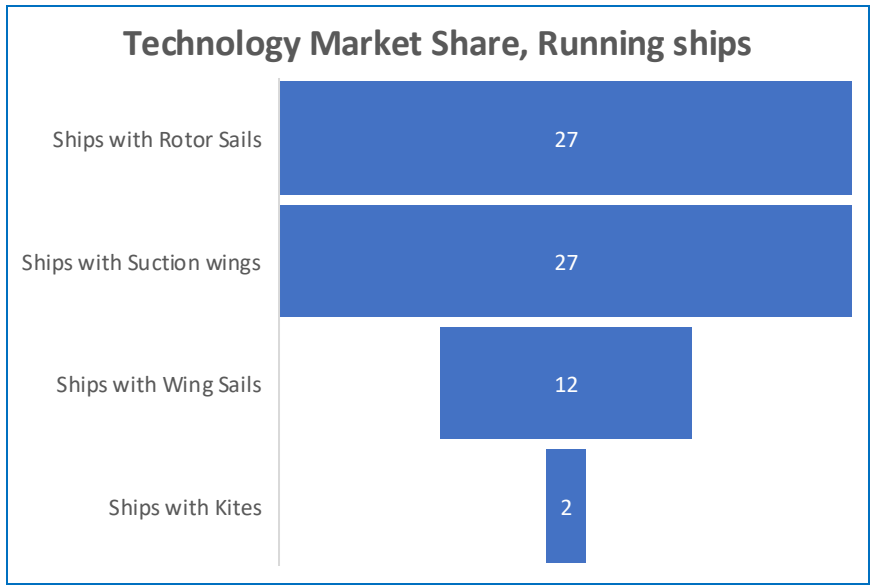
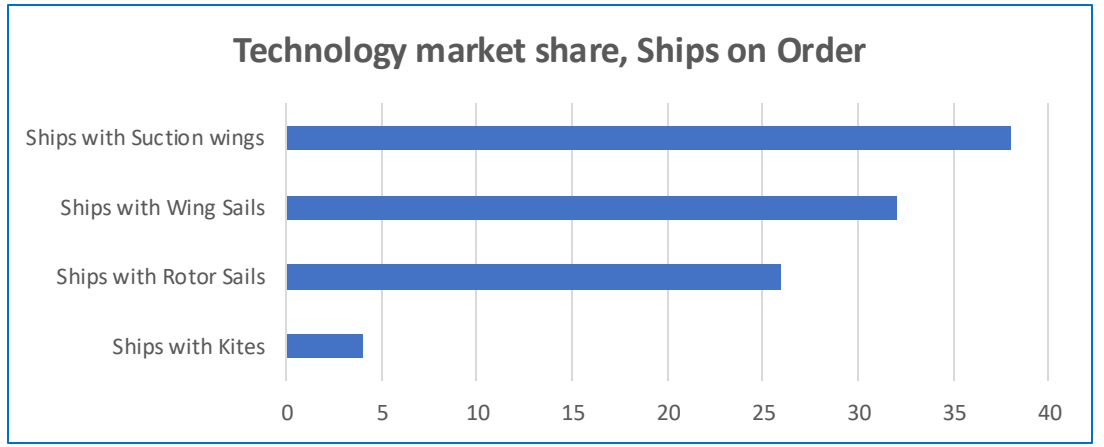
Wind-Assisted Ship propulsion by numbers *(as of September 2025)*









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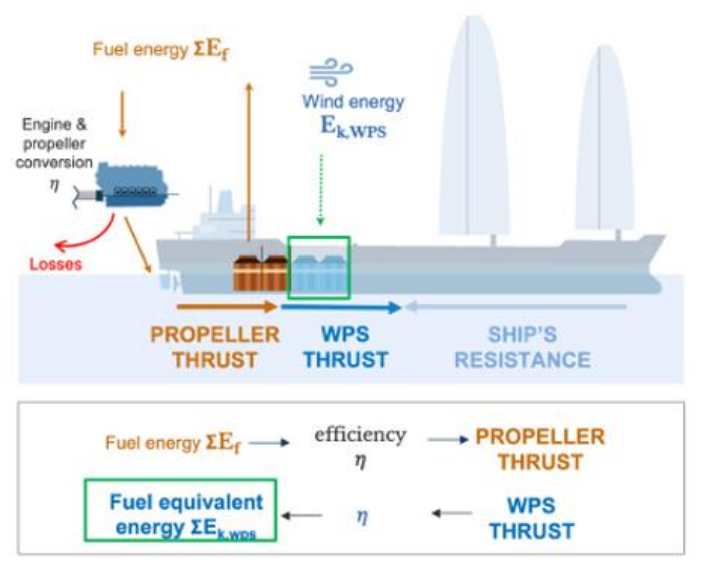
The pathway to Zero: It can only be 'Windy'

Within the **2024 LCA Guidelines** (MEPC.391(81), Appendix 1) Wind is recognized as a **Fuel Pathway** (pathway **128**):

MEPC 81/16/Add.1
Annex 10, page 48

Order	Group	Fuel type	Feedstock structure		Conversion/Production process		Fuel Pathway Code
			Feedstock Type	Nature/Carbon Source	Process Type	Energy used in the process	
127	Electricity	Electricity		Renewable	Dedicated Photovoltaic and/or Wind and/or other	Renewable electricity	Electricity_renewable
128	Wind propulsion						



Submission of MEPC 82/7/9 proposes below Formula for an improved GFI score:

$$GFI_{attained} = \frac{\sum_{j=1}^{N} GHG_{WtW,j} \times M_j \times LCV_j}{\sum_{j=1}^{N} M_j \times LCV_j + \sum_{k=1}^{K} E_k}$$

$$E_{k,WPS} = \frac{P_{B,WPS} \times Time}{\eta_E}$$

- WASP is an 'emission-less' energy source E_k
- GFI score is improved due to a reduced fuel mass M_j and due to the addition of the E_k factor.

- $P_{B,WPS}$ = Break Propulsion power demand reduction, as delivered from WASP
- η_E = main engine efficiency
- **Time** = operational time of WASP in action (per compliance period)

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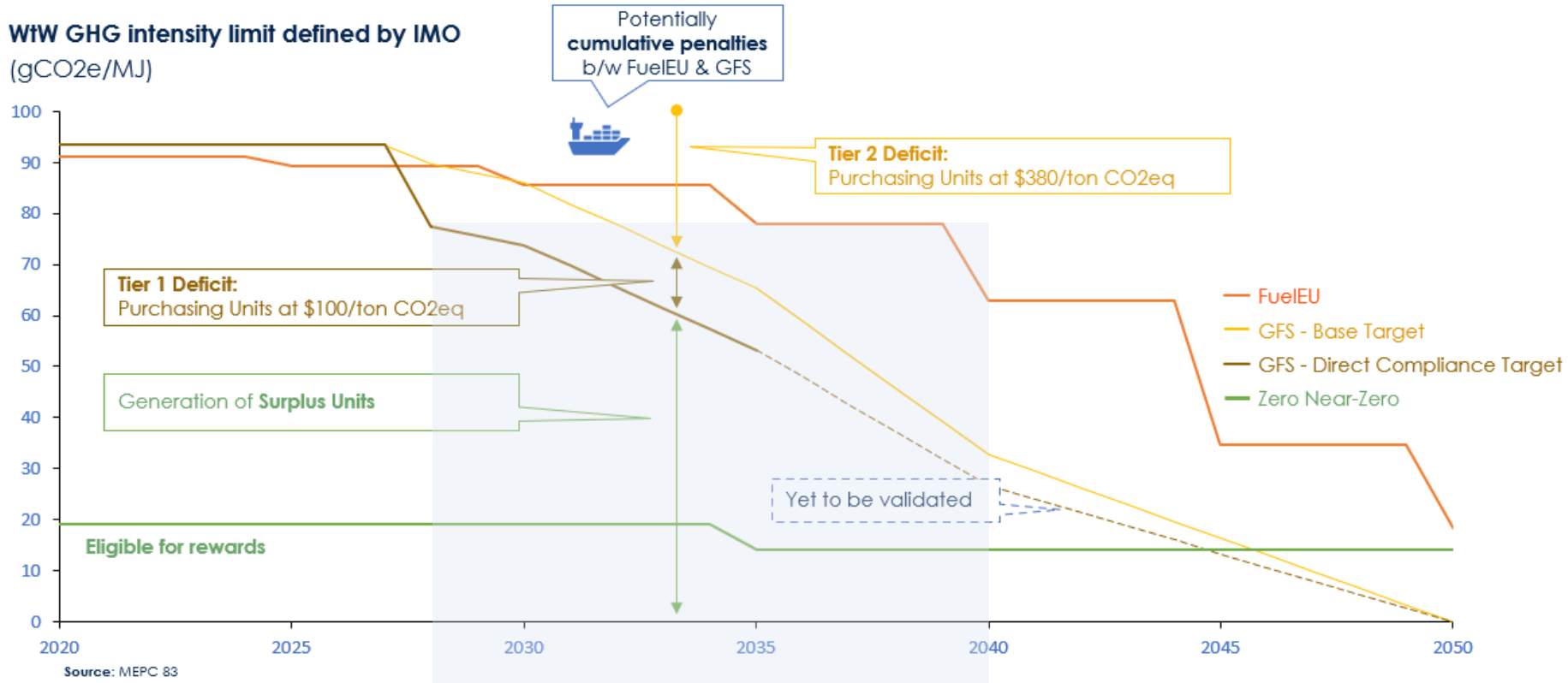

How to:

Enable EARLY Zero Emission compliance + **Restrict the ship's Capex** + **Earn from Surplus Units** =

Emit ZERO + Payback the Investment fast ?

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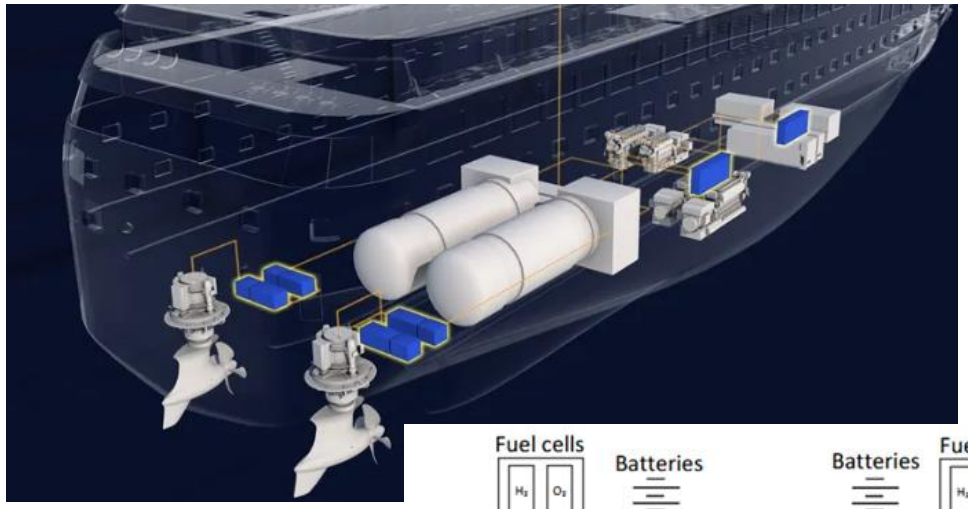
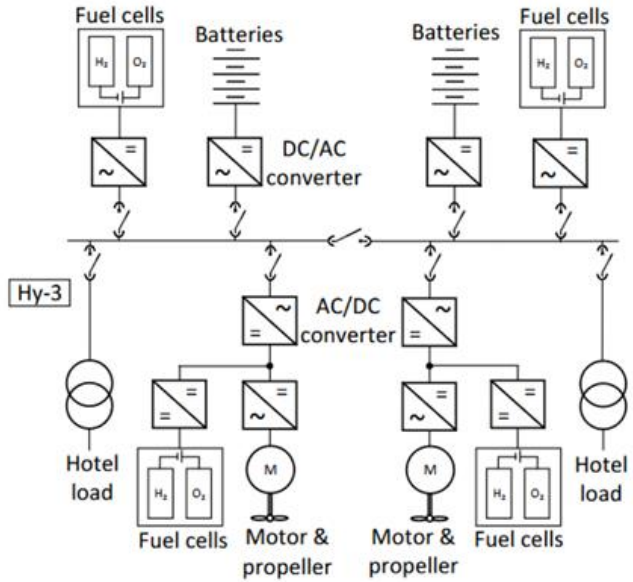
The HyWindship: Zero emissions hybrid power for propulsion



Source: Havyard



Source: Haxhiu 2022

Ship Integration challenges for a sole H_2 fuel cell propulsion system:

- Demanding space requirements (Batteries, Fuel cell modules),
- Increase of equipment weight (affecting cargo payload),
- Require cryogenic LH_2 or CH_2 fuel tank (extra weight & volume) – able to handle boil-off gas,
- Demanding & costly H_2 fuel supply system

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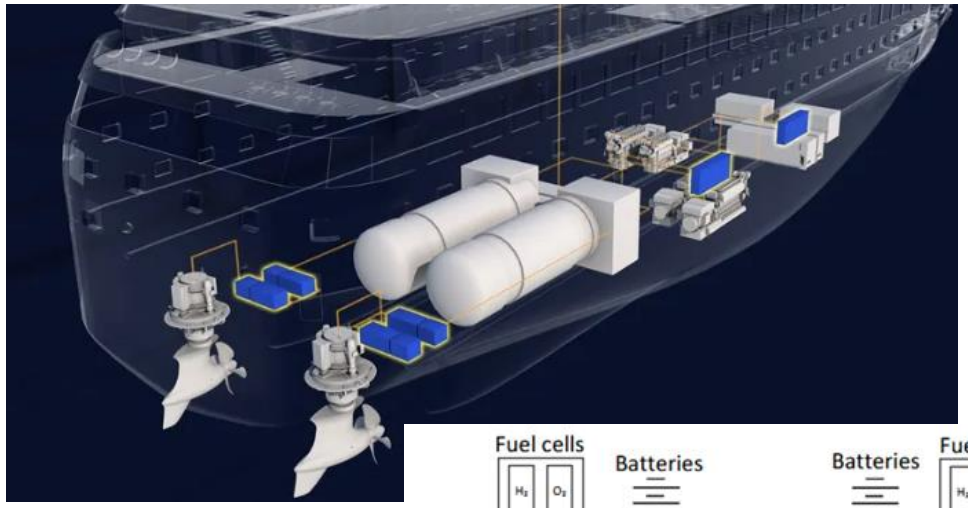
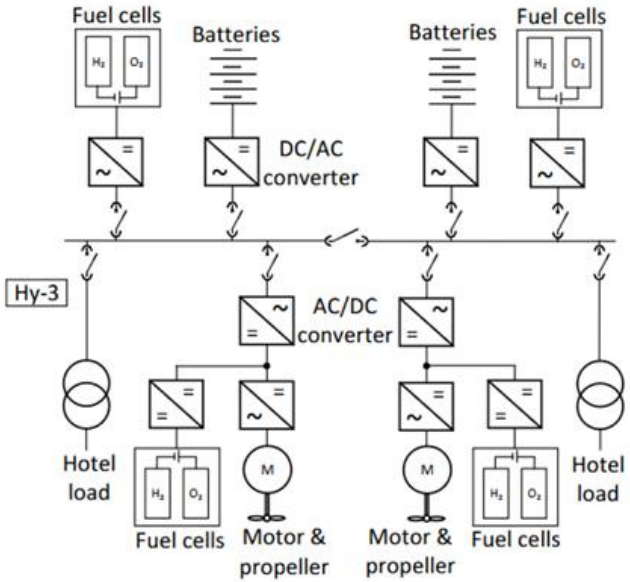


Source: Havyard

Source: Egil Ulvan Rederi



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What if we Add a **Zero Emission, Zero bunkering**, High energy density propulsion thrust generation source:

THE WINDS!

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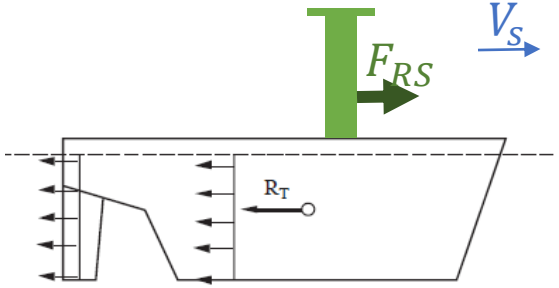
The HyWindship: Getting propulsion power from Winds

- Wind energy used for direct **Main engine Power Replacement**.
- The best metric is **% kW savings** per route and on yearly average.

$$P_{ME} = \frac{R_T \cdot V_s - F_{WASP} \cdot V_s}{\eta_T}$$

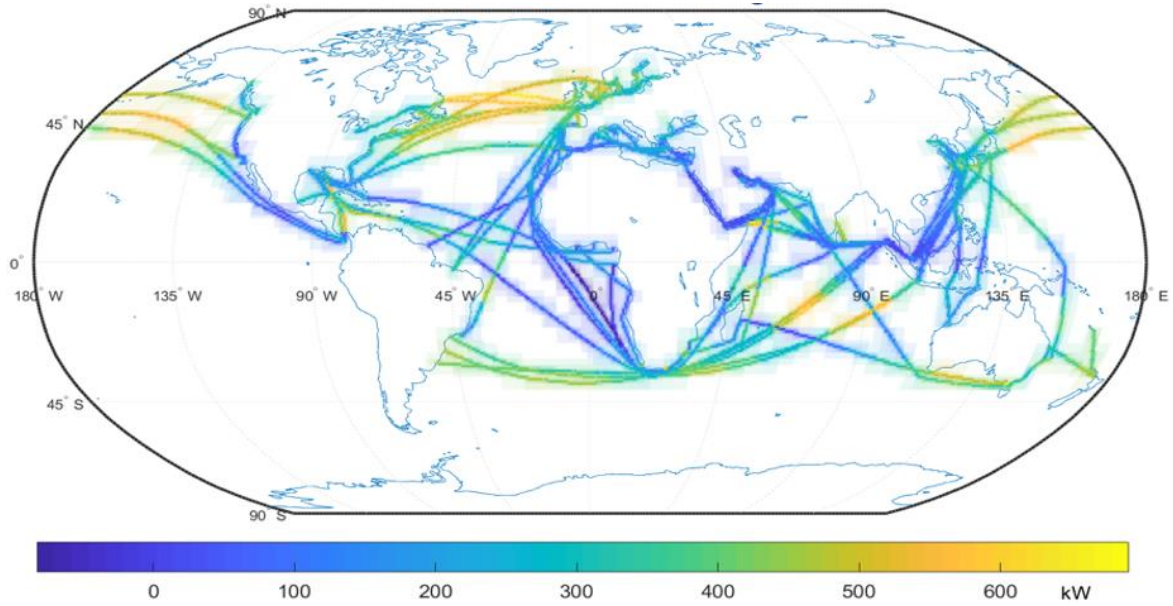
Wind Propulsor contribution



Source: Anemoi, Blund4Blue, BarTech

Power delivery range of
0.3 – 2.5 kW/m²
Basis Sail performance

Route propulsion power performance for a 30m Rotor Sail, ship speed 15 knots



Courtesy of Norsepower

- Wind energy harvested Power savings will vary depending on the **route topology** and **seasonality**.
- Routes away from the Equator, closer to the Poles are becoming more favorable (i.e. Transatlantic, Transpacific, Brazil-Singapore, etc).
- **Wind Routing** (course & speed adjustments) can enhance wind energy harvesting by further 10-25%, on average per route.

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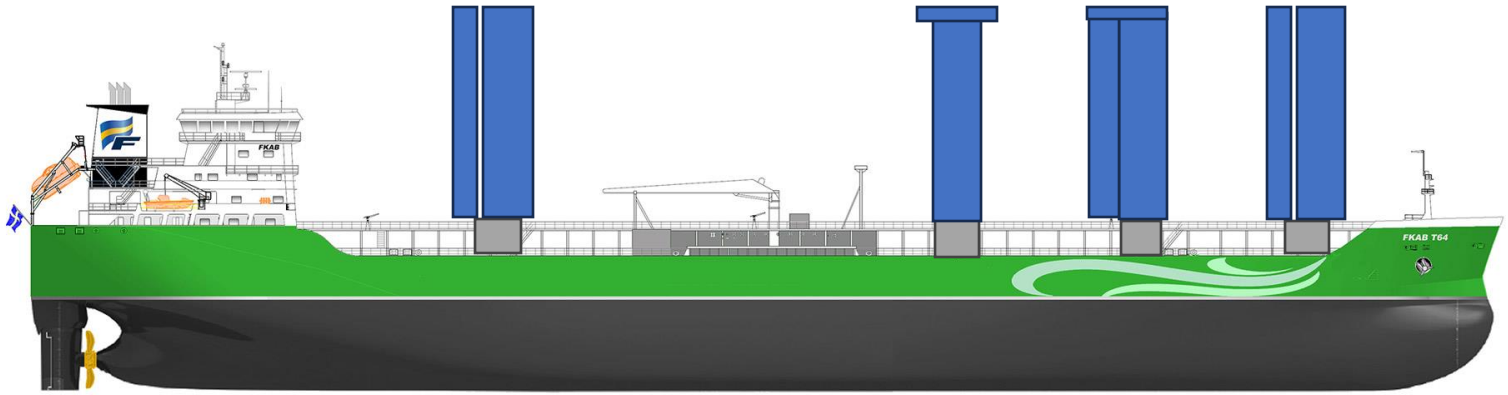
The HyWindship: Developing HyWind Chemical/Product Tanker series



Project in collaboration with FKAB Ship design

First version: a 22 000- 24 000 DWT capacity, same Length / drafts

Hull & Appendages optimized for Service speeds of 12-12.5 knots

Propulsion power demand ≈ 3700 kW
@12 knots, laden condition

50 %
H_2 Fuel cell powered*

50 %
Wind powered *

*average power delivery

Configuration of **8 x** Mechanical Sails

all possible technologies:
i.e Wing Sails, Rotor Sails, Suction Sails

Avg. service propulsion Power: ≈ 230 kW/Sail
(global routes basis)

Max Net propulsion power: ≈ 1 000 kW/Sail

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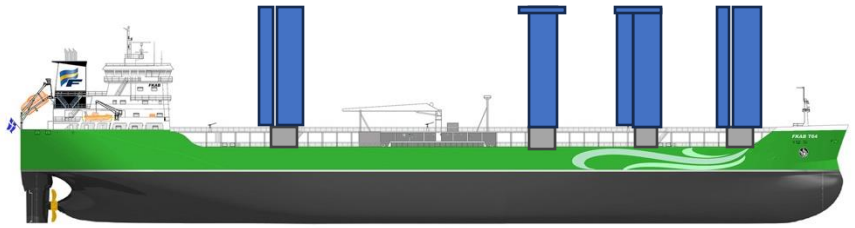

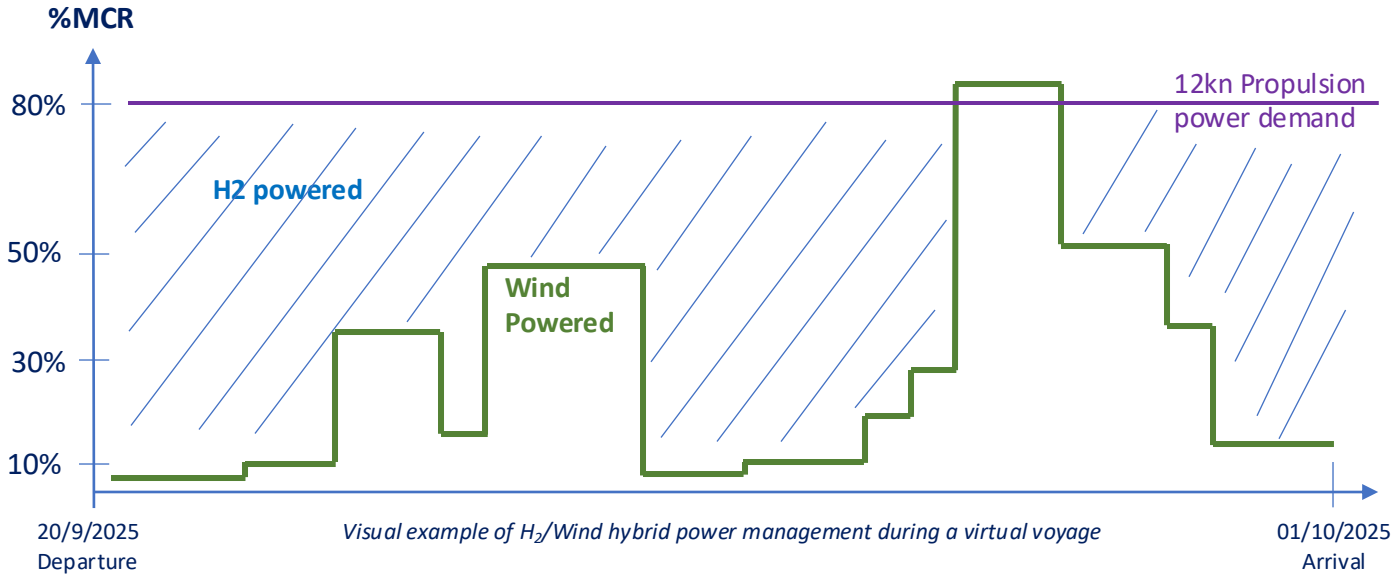

- Hybrid propulsion management (**H_2, Batteries, Winds**) through continuous speed & course adjustments to maximize wind power harvesting → 230 days annual voyage,
- Super slow steaming & min safe manoeuvring speed of 7-8 knots in headwinds/rough weather (H_2 power only),
- Slow steaming (8-11kn) in exploitable > BF 5 winds without H_2 consumption (Wind power only),
- Smart Sail arrangement deck integration, operationally functional,

Wind Propulsion plant (current) cost:
abt 5 000 $ / kW

Pays back in <u>less than 5 years</u> due to:

- 50% H_2 fuel cost savings (basis avg. 1 000 $ / tonH_2)
- H_2 bunkering costs (less frequent bunkering)
- Eligible for early (2028) ZNZ framework benefits

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