Planet Earth is under attack !


Interreg
North Sea Region
DUAL Ports
European Regional Development Fund
EUROPEAN UNION
ZESTAs.
Zero Emission Ship Technology Association
Market Ready Solutions
Emissions Reductions Today

Zero Vision

By combining cutting edge innovations we can achieve zero emissions vessels today

Zero Ships

SELF FUELING **ZES 1**

ZESTAs.

Design Goals

- Zero Pollution, to air or ocean.
- Ultra low noise profile
- Healthy working environment
- Safe and secure vessel
- No disadvantage when compared to conventional vessels
- High resale and market value in the future green economy
- Economically advanced Vessel where the fuel cost is added directly to the bottom line as profit.

Design features : a holistic approach

- GEPS roll damping energy device
- Active routing for weather and current
- Regenerative propulsors/ generator turbines
- High efficiency steering
- Air Cavity Hull
- Refined Hull design
- Low dynamic drag
- Photo Voltaic power generation
- Hydrogen Fuel Cells
- Hydrogen generation
- Wave propulsion
- Passive fin propulsion
- Wind power

Technologies and Development

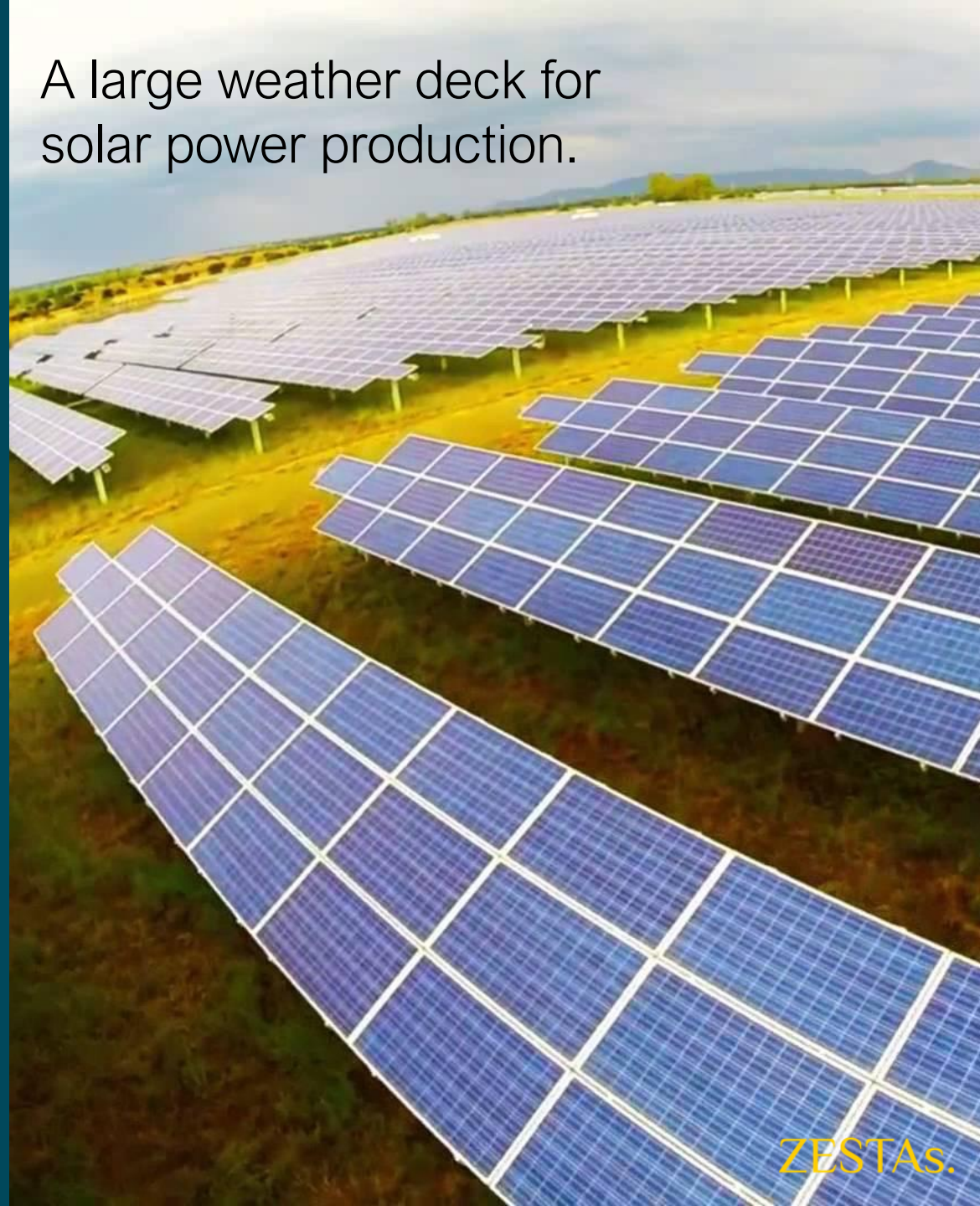
Technology	Conventional Use	Marinized	TRL
Solar power	NO	Yes	9
Lithium ion batteries	Yes	Yes	9
Hydrogen Fuel Cells	NO	Yes	9
Wind Propulsion	No	Yes	9
Passive Foil	Yes	Yes	9
Wave Propulsion	No	Yes	9
Re-gen Propulsion	No	Yes	9
Roll damping energy take-in	No	Yes	7
Hydrogen Electrolysis	No	Yes	9

Photo Voltaic Solar Generation

Solar power for Navigational and house loads

Solar power is fed to the Lithium Ion batteries to power;

- emergency systems,
- backups for steering navigation and lights,
- house loads
- power to the Flettner rotors.



Hydrogen Fuel Cells

- Marinized Hydrogen Fuel Cells have been available since the 1980's
- MW Hydrogen Fuel Cells have been available since 2011
- Serialized MW Marinized Hydrogen Fuel Cells are available now.

2016, 2 MW PEMFC POWER PLANT – PORT OF YINGKOU, CHINA

2011, 80 PASSENGER PEMFC PROPELLED ROUND TRIP BOAT – AMSTERDAM CANALS

2019, 40 kW PEMFC POWER UNIT, MARIN - WAGENINGEN, THE NETHERLANDS

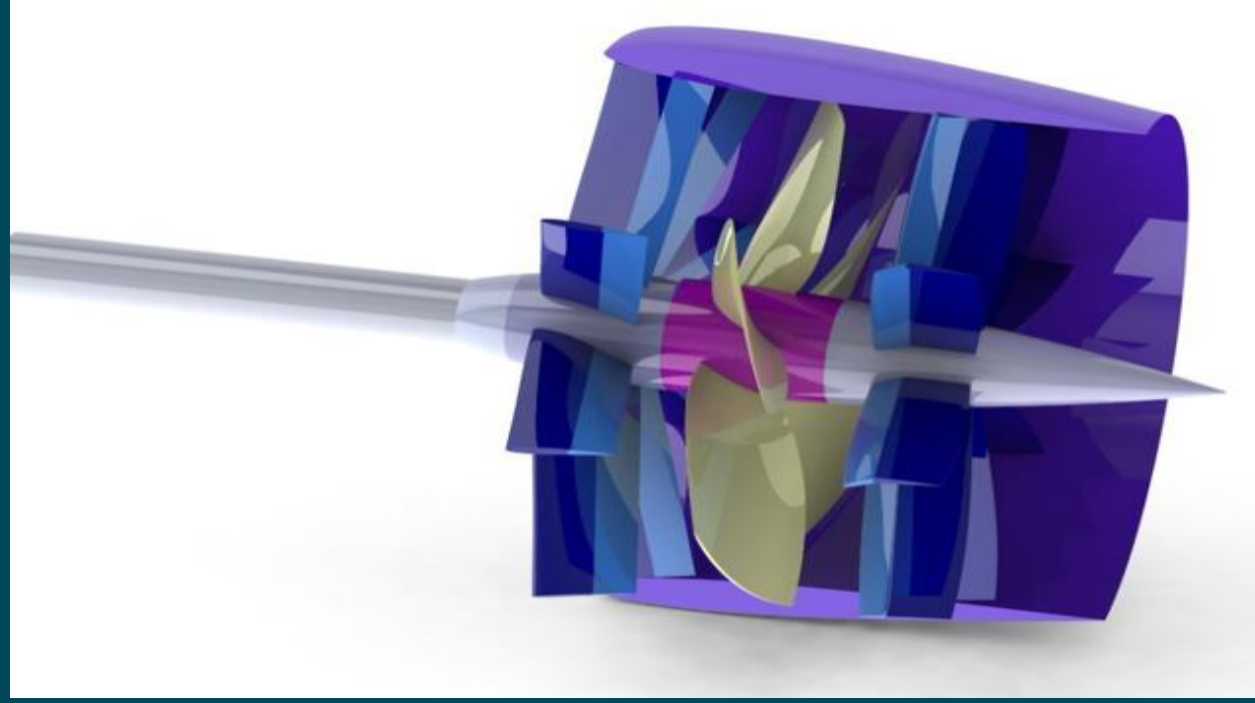
Regenerative Propulsion

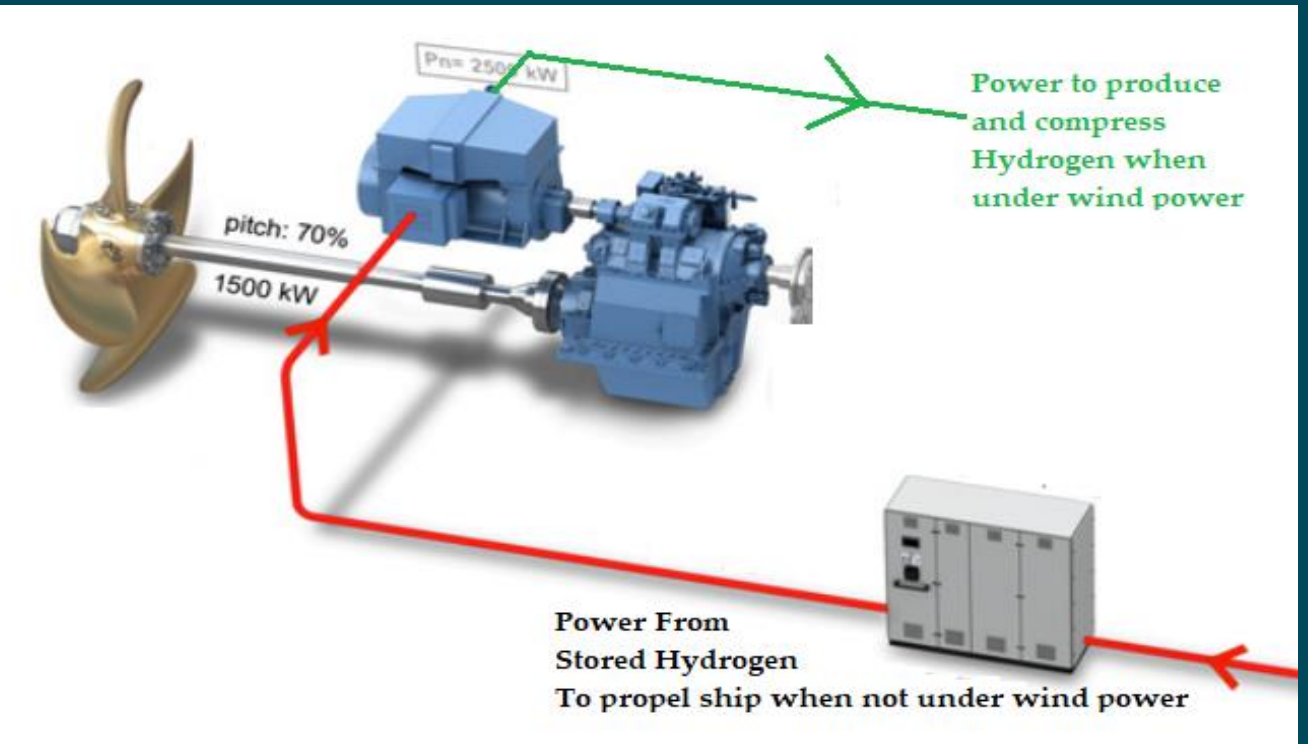
Electrical power is generated from trailed turbines

1st go to – Battery

2nd go to - Electrolysis

Recycling of water allows Hydrogen system efficiencies of 40%





Propulser is used as a turbine when under sail to take energy into the ships energy system

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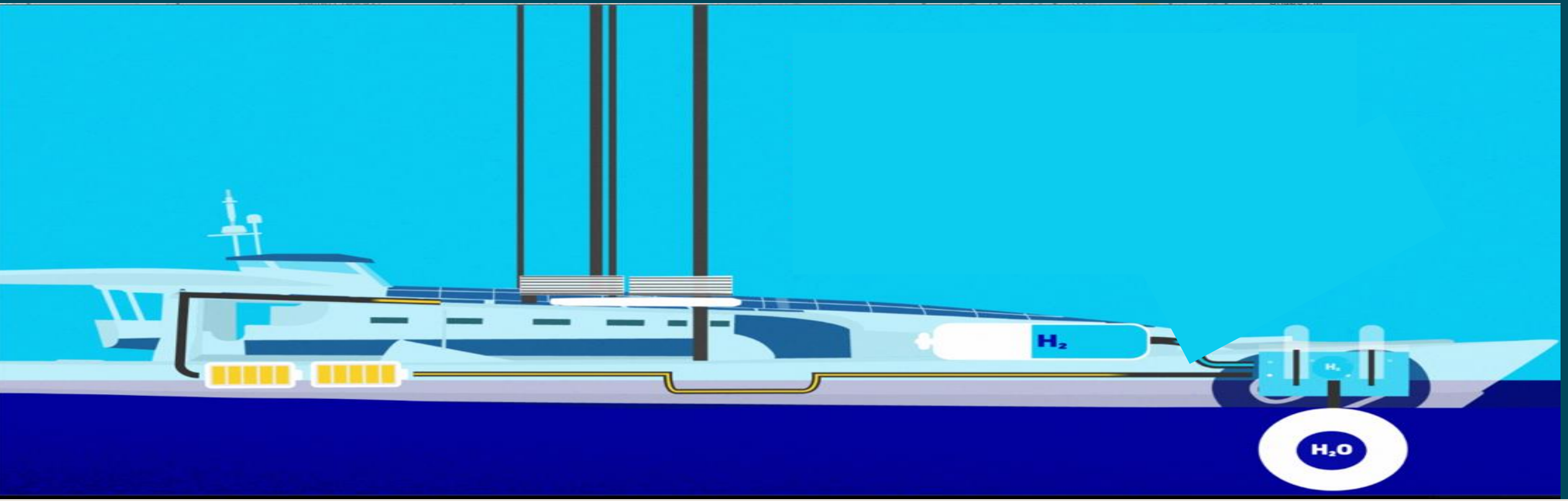
Energy Observer
uses solar and wind energy to produce hydrogen.

Global efficiency - 42%



40+ years Hydrogen production At sea

/ Maritime ‘sea proven’ systems

Mission & safety-critical systems

- In service for 40+ years
- System engineering using advanced technology to deploy safe, reliable, high performance equipment
  - O_2 generators (PEM Electrolysers)
  - H_2 generators (PEM Electrolysers)
  - CO_2 removal and management
  - VOC removal
- Developing new technologies for safer CO_2 management and energy storage using H_2



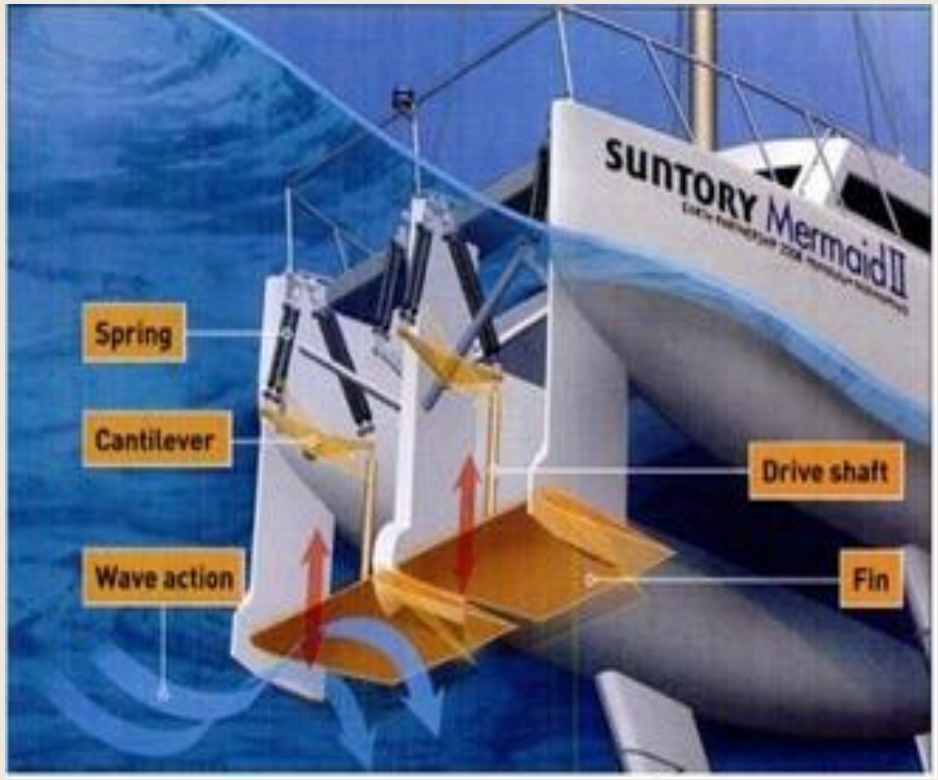
tpgroup

Wave Propulsion System

Wave propulsion in an environment made of waves

Active propulsion

passive foils built into the ships bows



Demonstrations on

- fishing vessels
- offshore vessels
- commercial ships
- CFD analysis to supports real world experience.

Japanese Naval architect Kenichi Horie sailed his catamaran from Hawaii to his home in Japan using wave power alone.

Permanent wave foils are fitted in a bank of three below the bows

2 degree Rocker is built into her keel to promote vertical motion

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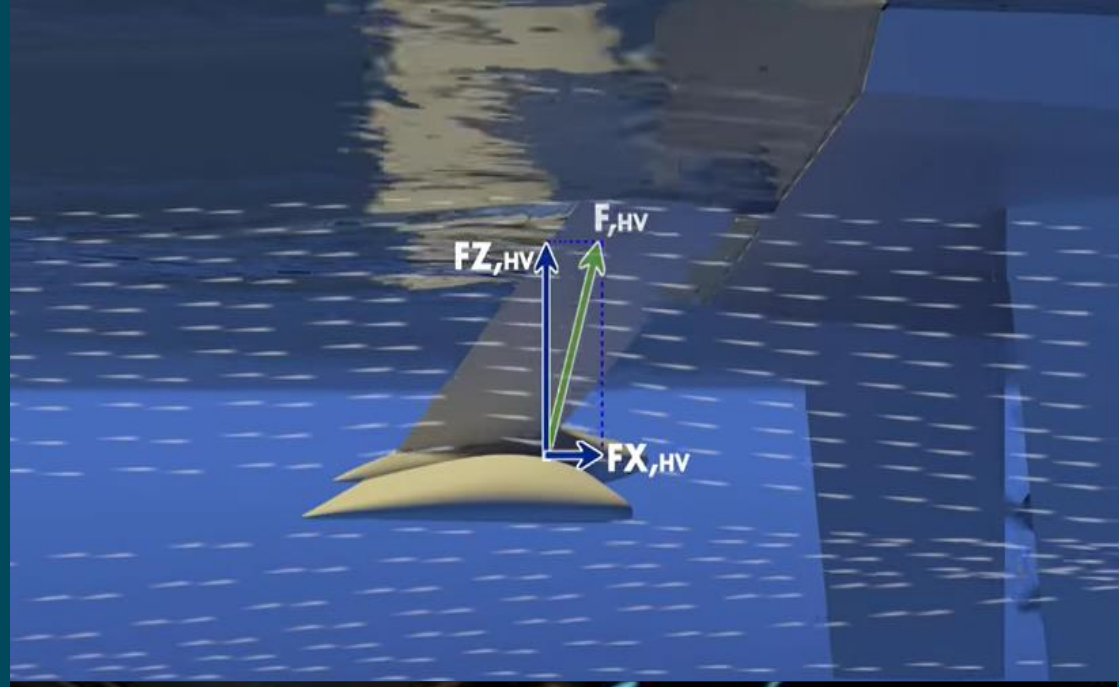
Passive Foil Propulsion

Capturing forward thrust from lift at the stren

- positioned behind the rudders
- take advantage of the aft and upward direction of the water flow direction to
- generate a forward thrust vector.
- making use of wasted energy from wash
- has reduced power requirement on medium speed vessels by 15%.
- equally effective under electrical drive or wind power.
- reduces stern waves reducing damage to the shore environment



Wind Propulsion - Retractable Flettner Rotor Sail

The regenerative power sail system is key

- operational capacity
- mission duration
- range at sea

Retractable Rotors -Stored below weather deck

- eliminate drag
- cargo handling
- air draft

Over powered to ensure hydrogen production

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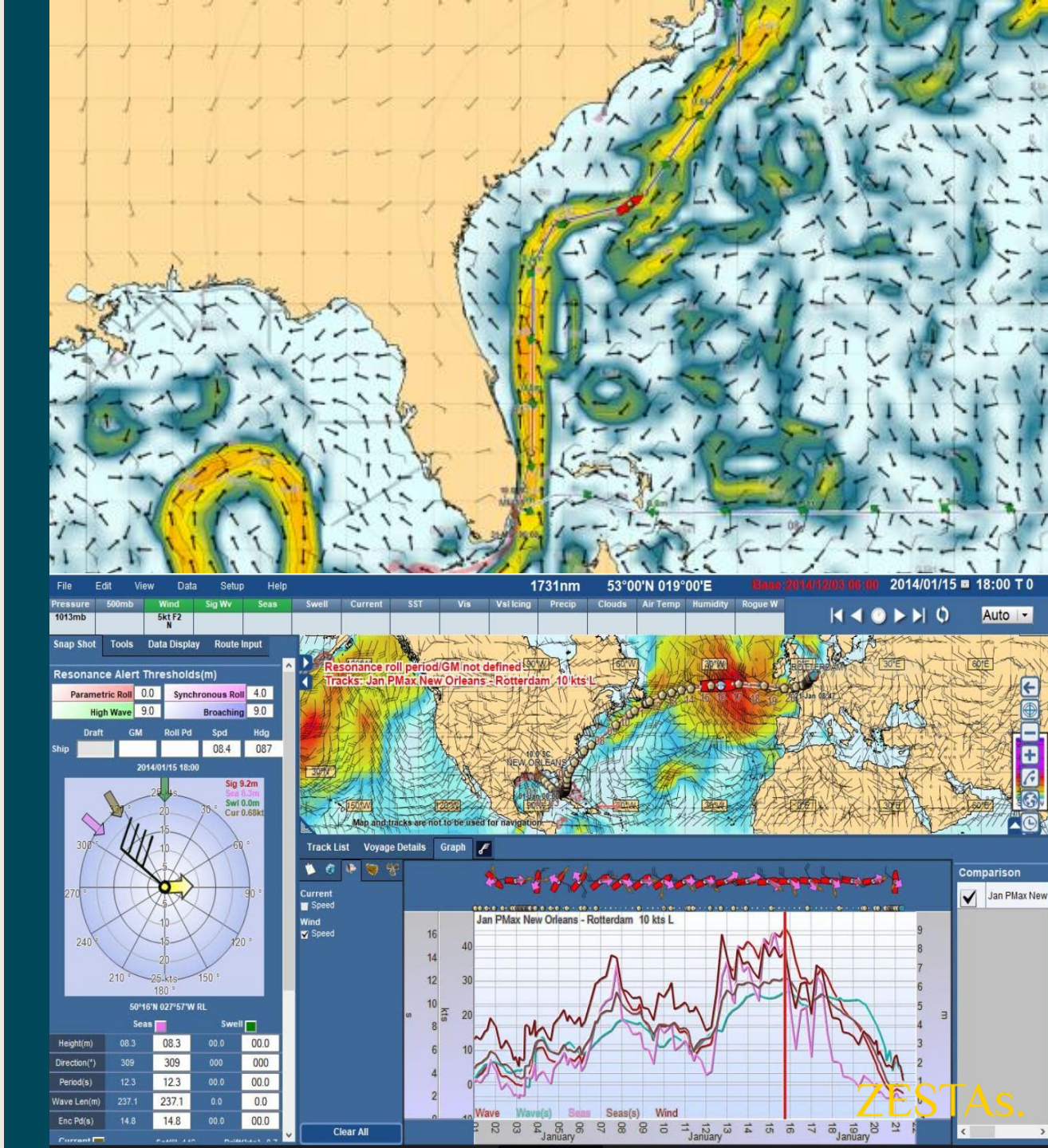
Weather and Current Routing

- Reduces energy requirement
- Primary Renewabless
- Currents as active propulsion



Air Cavity Friction Reduction

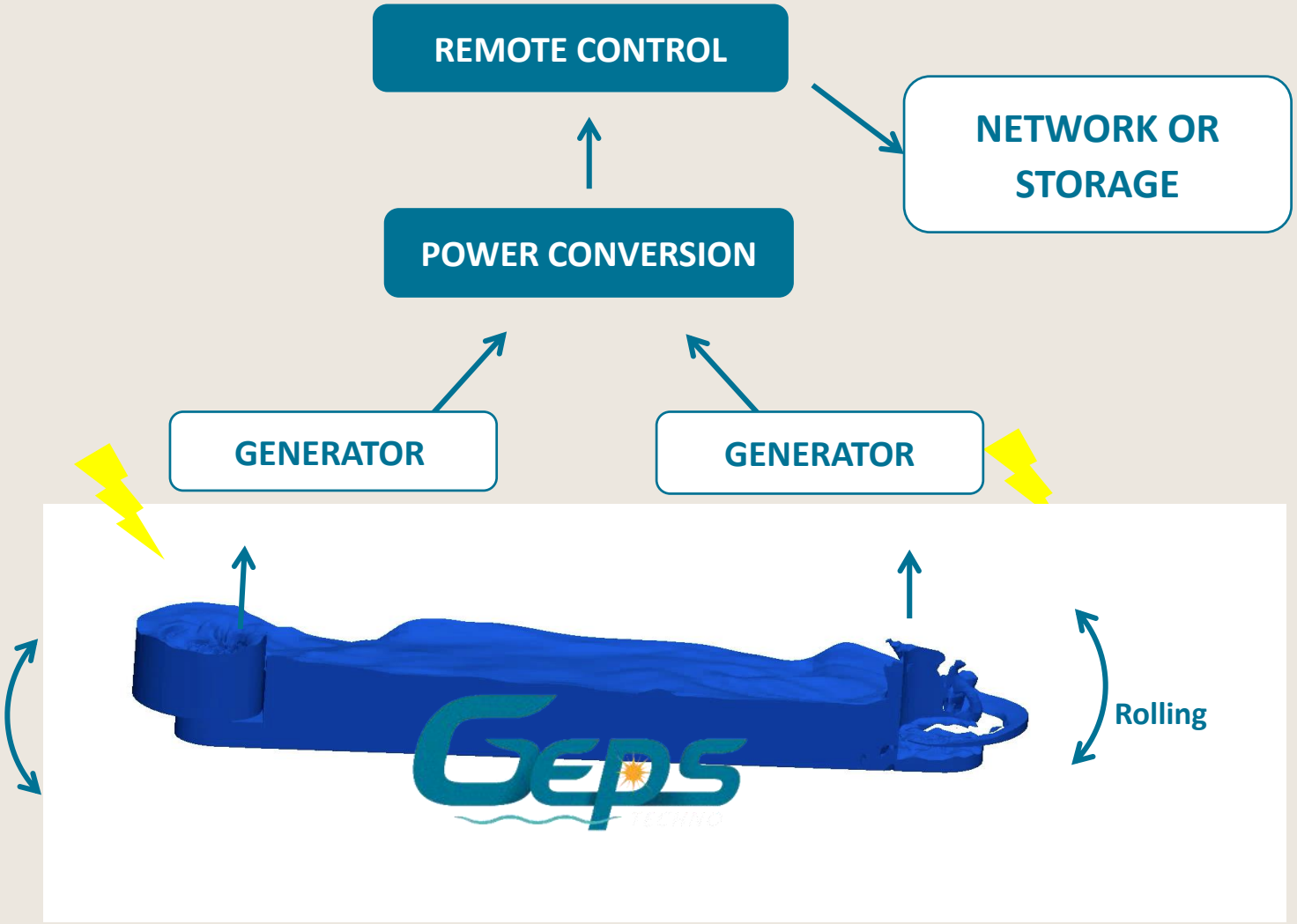
Contact between the hull and the ocean is reduced with the inverted swimming pool

hull shape -

- Simple flat surface to apply an air cavity system
- Long channels are used for the same effect.
- Air trapped below the hull adds buoyancy when the vessel is laden,
- Air can be released when she is in ballast

The ships hull is designed with a slimmer less resistant shape adding to overall efficiency

GSIRE®: Power Producing Roll Damping Tank



CASE STUDY FPSO
300m LOA / 60m B

- Around 1% of total displacement
- Dimension : full beam

- Improving stabilization
- Power estimated >300 KW per tank

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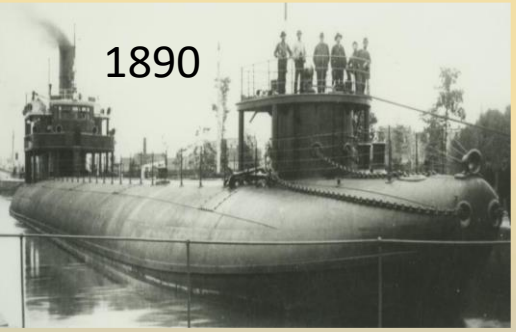
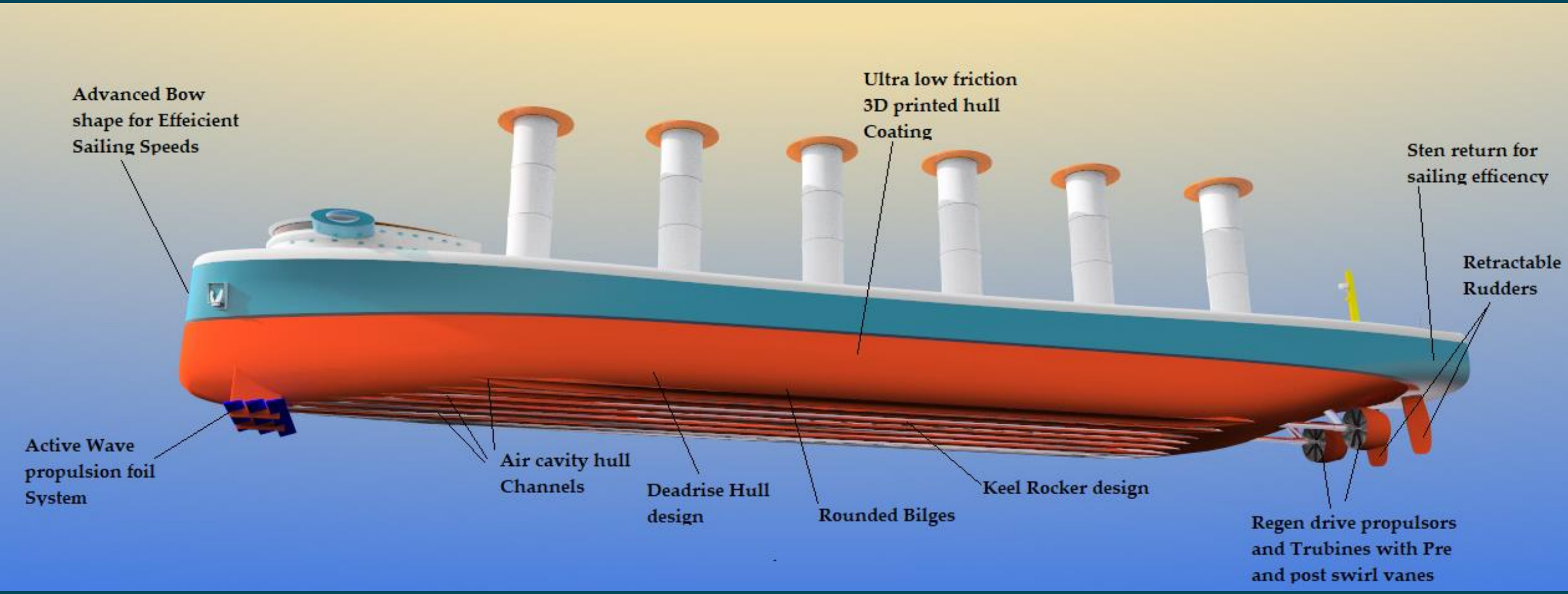
Dynamic Friction Reduction by design



Below the Waterline



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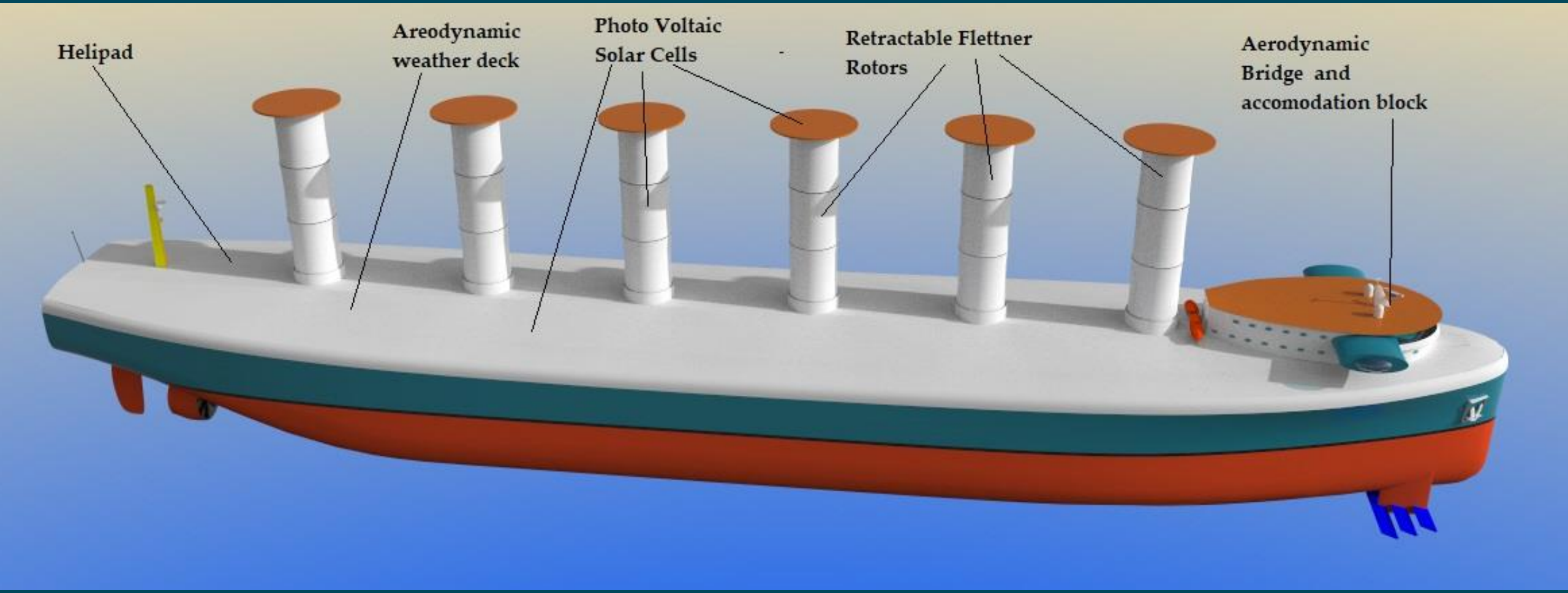
Above the Waterline



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Port Oostende
energy port

HYDROGEN use in ports and connected areas

To design a hydrogen re-fuelling system suitable for refuelling a hydrogen ferry. Read more.

HEAT using renewable rest-energy from wind, solar and sea-based power systems to supply a local heating system.

Read more.

SEA POWER - demonstrating the potential of wave energy to supply energy to ports and hydrogen production facilities, and developing a wave energy converter.

Read more.

WAVE - and tidal energy generation to supply clean power and optimize the use of surplus energy

Read more.

SEDIMENTS - developing an innovative and sustainable concept for the removal of pollutants in the ports sediments

Read more.

SAIL - creating a wind cargo platform

Analyze the socio economic impact of the centralization of shipping and the importance of small ports to local economies. Read more.

SAIL CARGO TEST - testing the adaptation of a sail vessel to innovatively transport cargo with wind propulsion and hydrogen generation.

Read more.

SOIL - renewed use of soil in port and area development.

Enviromental assessment, investment, technology and management. Read more.

SURFACE - testing new technologies to reduce and absorb green house gasses through asphalt and pavement in port development.

Read more.

LNG - Liquefied natural gas as a multifunctional part of REPs

Multifunctional LNG installation for companies/logistics and local community. Read more.

LED - lighting in port areas

Install, manage and monitor a new intelligent and innovative lightingsystem on the new developed harbour area. Read more.

SMART SECURITY - testing an LED-based smart signalization system to increase the efficiency and security of port operations.

Read more.

LOW CARBON Harbour Plan

Making the three ports of Zwolle, Meppel and Kampen more carbon neutral. Read more.

GREEN OFFICER - implementing sustainability management

Implementing and coordinating sustainable management of ports. Read more.

DOCKLAND - lead by Port of Oostende

Development of a new green port strategy by the introduction of industrial co-siting. Read more.

Check out our latest

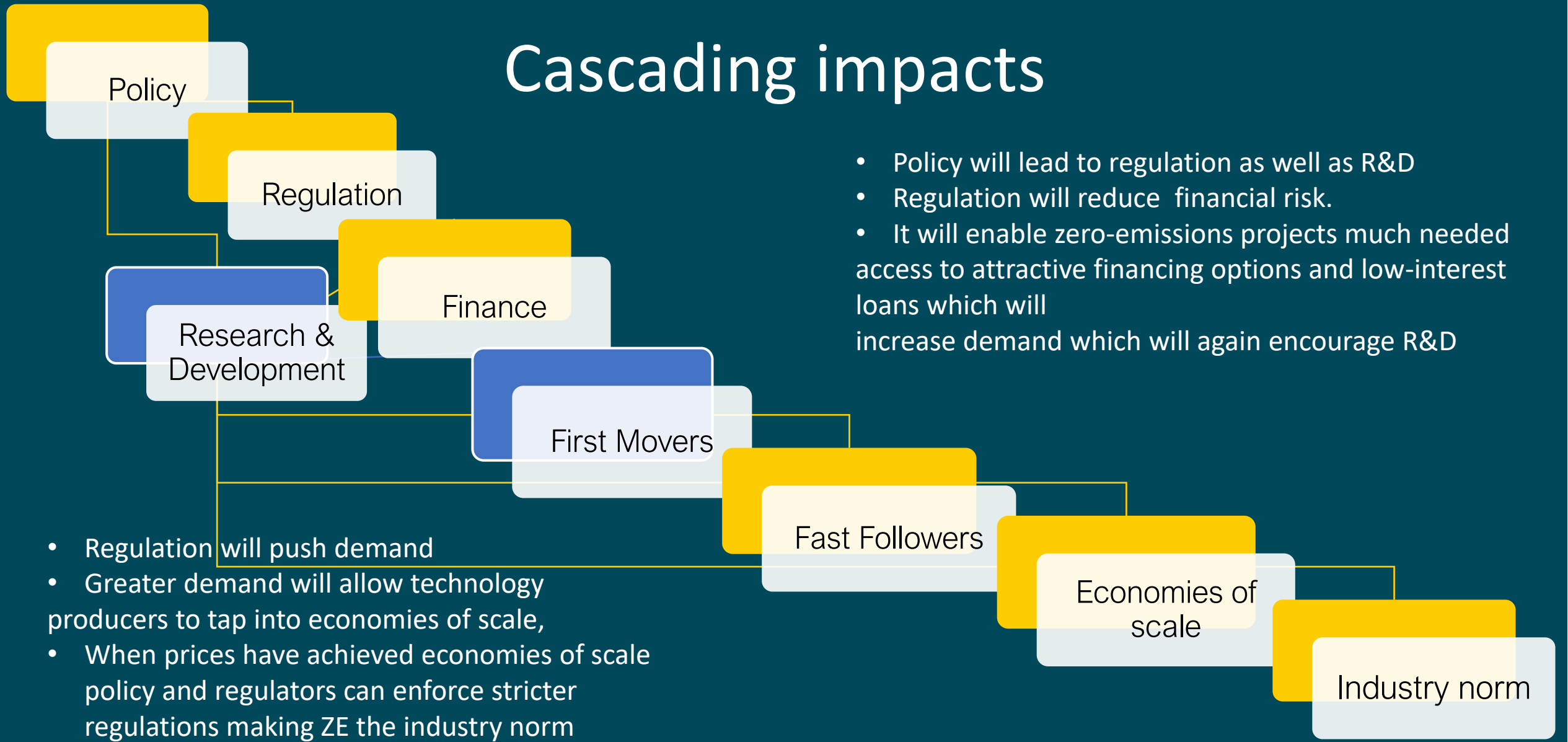
NEWS

&

EVENTS

The biggest barrier is Policy and Regulation

Cascading impacts



- Policy will lead to regulation as well as R&D
- Regulation will reduce financial risk.
- It will enable zero-emissions projects much needed access to attractive financing options and low-interest loans which will

increase demand which will again encourage R&D

- Regulation will push demand
- Greater demand will allow technology producers to tap into economies of scale,
- When prices have achieved economies of scale policy and regulators can enforce stricter regulations making ZE the industry norm

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“Hy-Seaways” the Workshop

Hydrogen Seaways or “**Hy-Seaways**” are shipping links between Hydrogen Hub Ports or “Hydrogen Valleys”.
A hydrogen seaway needs RE, Hydrogen infrastructure and hydrogen vessels that are built on a realistic business case. The two main arguments against hydrogen in shipping are price and on board storage. In many cases we can tackle both problems with one solution, reducing on board energy requirements thorough the addition of wind propulsion.

On the 18th and the 19thof March 2020, The Zero Emissions Ship Technology Association (ZESTAs) and Oostende Port, within the framework of the **Interreg VB North Sea Dual Ports** will organize the **Hy-Seaways workshop in Oostende (Belgium**).
The aim of the workshop is to bring together a diversity of innovators and thought leaders, who are active in the implementation of hydrogen and wind propulsion technology (WPT) to vision pathways to their uptake.
identify barriers pinpoint development opportunities,
defining actionable solutions that will lead to a clear trajectory of hydrogen and hydrogen wind-ship uptake in the North Sea and international shipping.
The outcomes of the workshop will be action items that will support zero emissions business cases, new partnerships on the voyage to zero, as well as, an action roadmap that will shape the backbone of a Zero Emissions Shipping seminar to be organized during the COP26 in Glasgow (Scotland) during November 2020.

Funded by: DUAL PORTS Interreg VB North Sea Region program European cooperation project
Hosted by: The Port of Oostende

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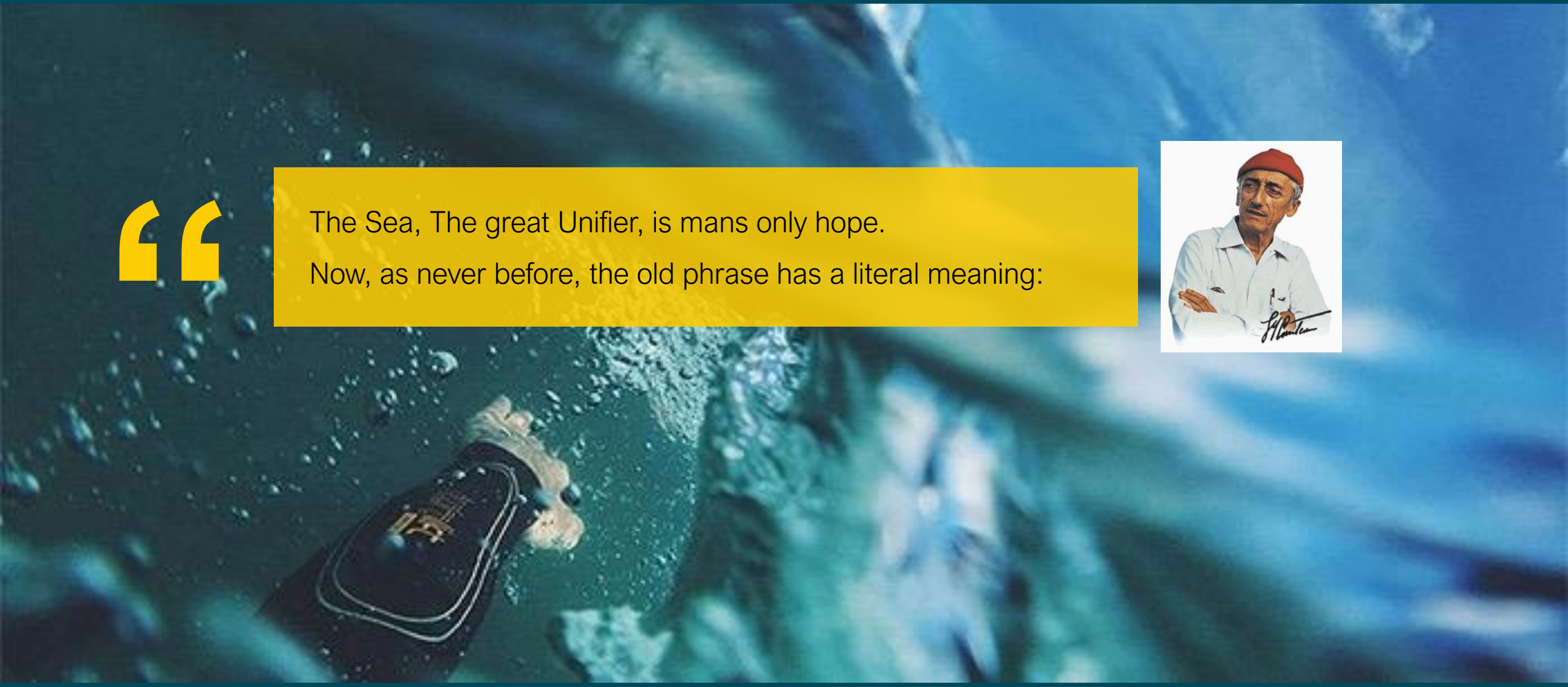
We are all in the same boat. Lets pull together !



> The Sea, The great Unifier, is mans only hope.
>
> Now, as never before, the old phrase has a literal meaning:

ZESTAs.

Navigating to a sustainable future together

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