Decarbonising European Shipping

Faïg Abbasov

TRANSPORT & ENVIRONMENT

T&E:

26 Countries

61 Members

5 National experts

Founding member of CSC

CLEAN SHIPPING COALITION

AirClim
Air Pollution & Climate Secretariat

BELLONA

CLEANAIR TASK FORCE

Carbon Market Watch

eia
environmental investigation agency

NABU

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SEAS AT RISK

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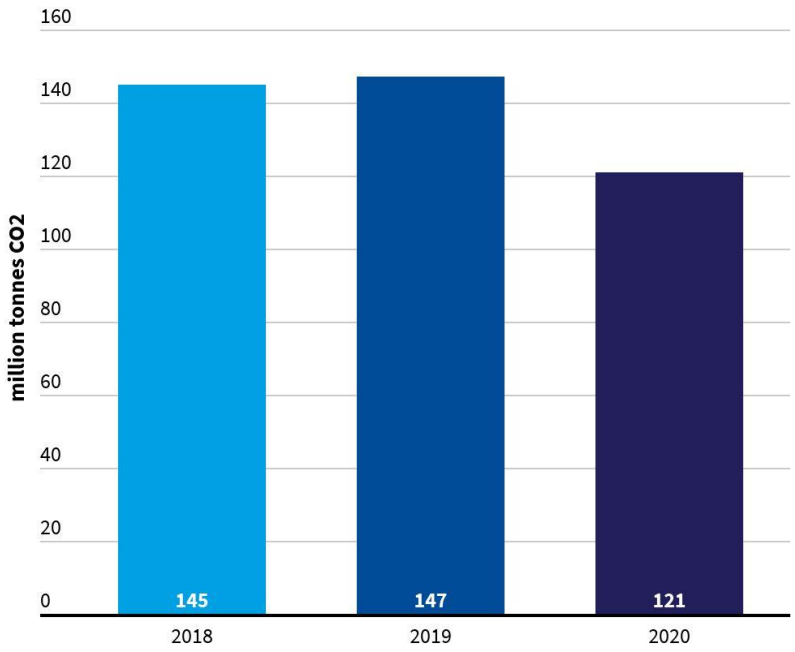
Key structure [temporary]

- State of the play
  - 2018, 2019, 2020 MRV emissions
  - Top emitters
  - Scope of emissions (fleet and company level)
- Our modelling results
  - Energy efficiency, SSE and e-fuels
  - Different fuels: e-fuel costs, bio-availability, LNG-limits
  - How much e-fuels would we need by 2030?
- Current FuelEU situation
  - Explain goal-based
  - Rational choice and price
  - The impact on LNG/bio of the current draft
  - Multiplier
- Recommendations

EU shipping emissions under MRV

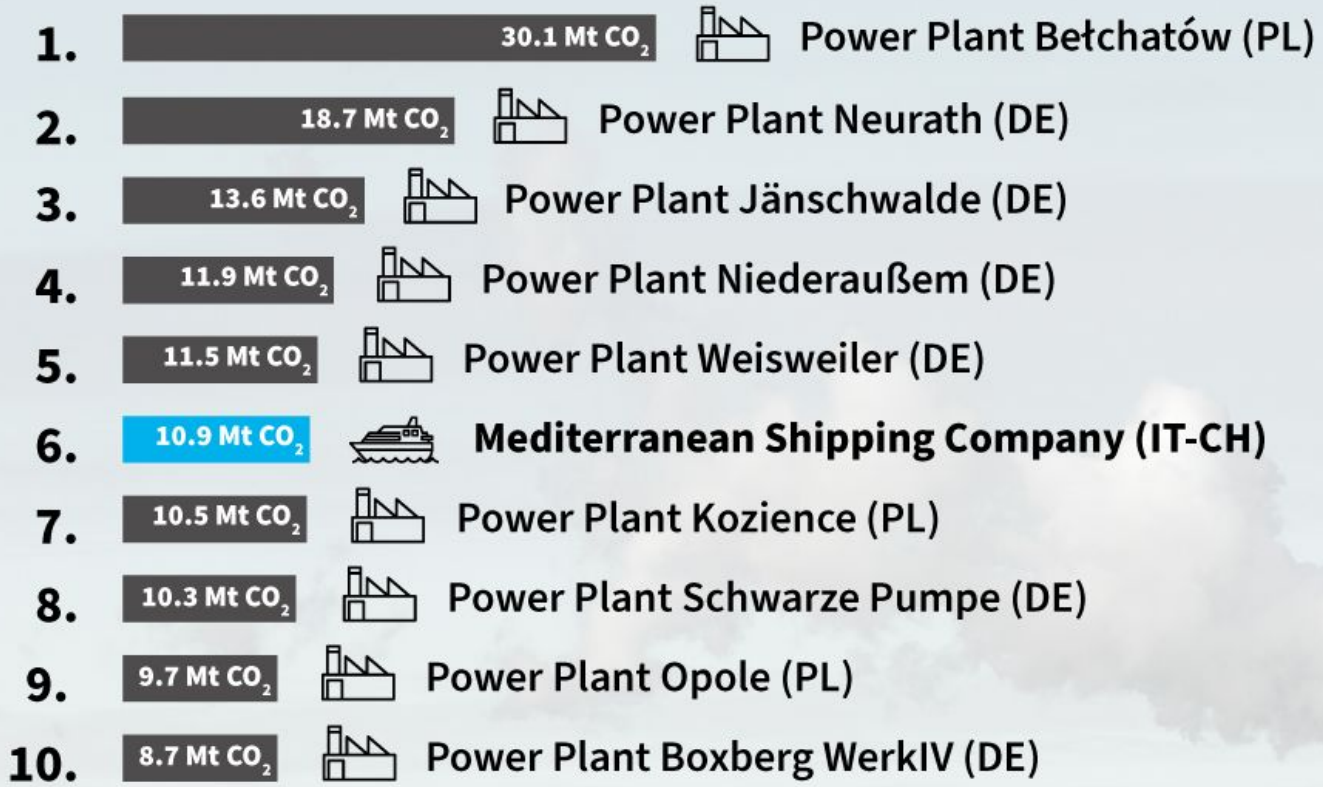


Note: data extracted from Thetis MRV using v258 for 2018, v182 for 2019 and v5 for 2020. 2020 emissions a likely be revised upward. About 10 Mt CO2 drop in 2020 is attributable to cruise and ferry passenger ships.

18% reduction in 2020 due to COVID-19 *

**preliminary*

Shipping giant climbs to 6th in 2020 EU top 10 polluters



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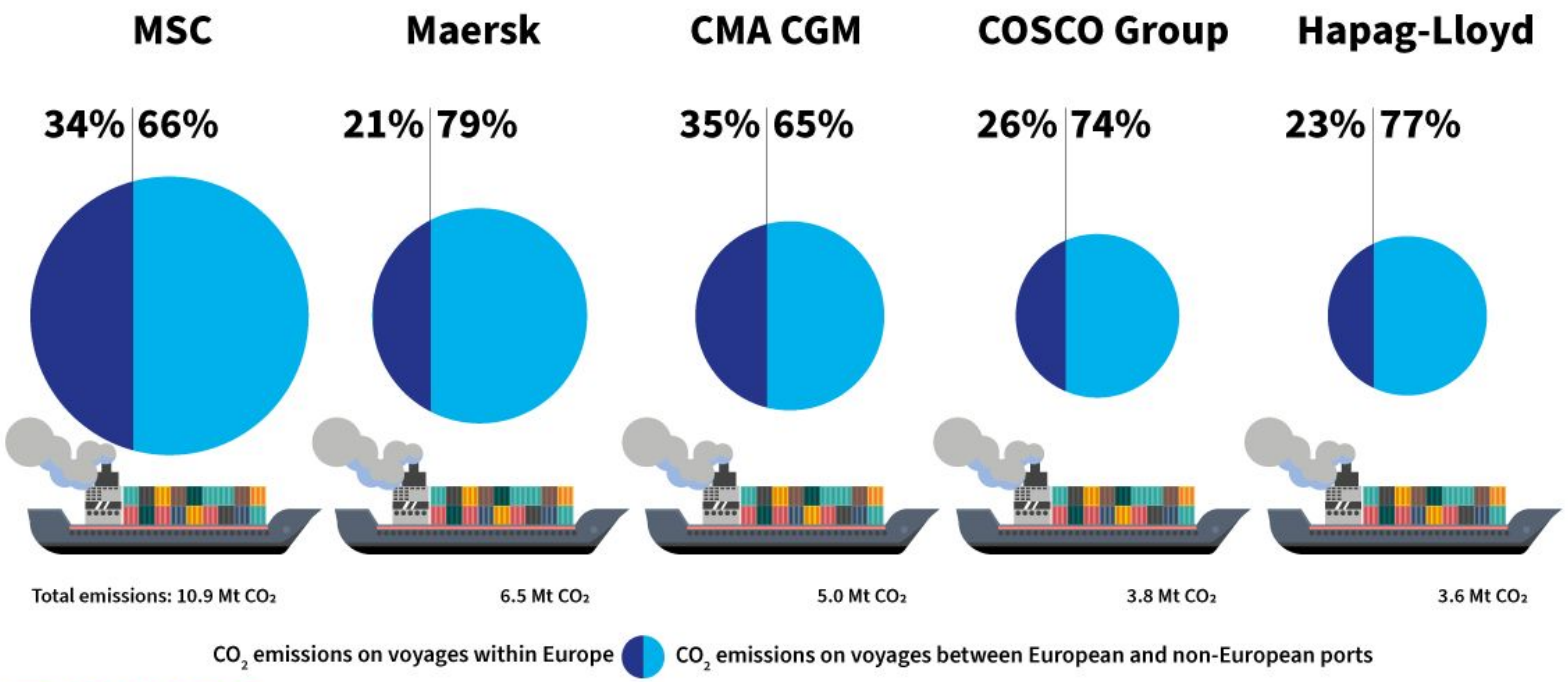
Source: Estimates by T&E based on the EU shipping MRV (2020 - v5), EU ETS emissions (2020) and Alphaliner containership database (2020).

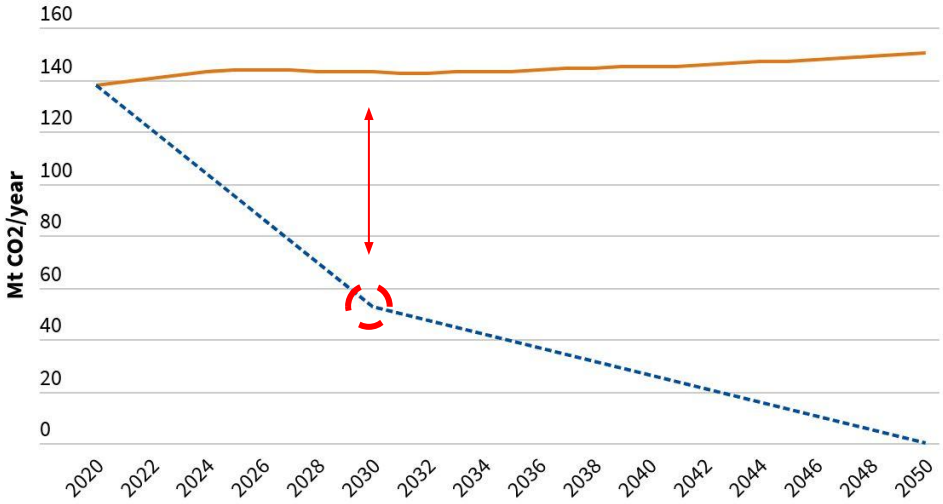
Majority of emissions fall on extra-EU voyages



Source: Transport & Environment (2021)

T&E Roadmap for decarbonising European shipping

"Fair share" decarbonisation of EU shipping



BAU "Fair share" decarbonisation trajectory: -55% 2030 target (vs 1990) & -100% by 2050

Note: "Fair share" trajectory envisages a -55% 2030 target (vs 1990) & -100% by 2050, compatible with the EU's overall climate goals. "Fair share" assumes that shipping's share in the overall EU emissions/ decarbonisation remains constant.

EU shipping would need to slash 90Mt CO_2 by 2030.

Scenarios and input main assumptions

SCENARIO 1
No energy efficiency/
High e-fuel penetration

- **2025+** | All new vessels co-combust 70:30 ratio of Nh3-diesel
- **2030-2040** | Old vessels progressively retrofitted for 50:50 Nh3-diesel co-combustion
- **2040-2050** | Remaining fossil diesel eliminated from the fleet via mono-fuel technologies or Nh3 co-combustion with e-diesel/biofuel/hydrogen
- New vessels improve their energy efficiency as *larger* new vessel with better EEDI enter the fleet
- **ZE berth standard** | Cruise, Ro-Ro, Ro-pax (2025+), container, oil tanker, ref-bulk (2030+), others (2035+)

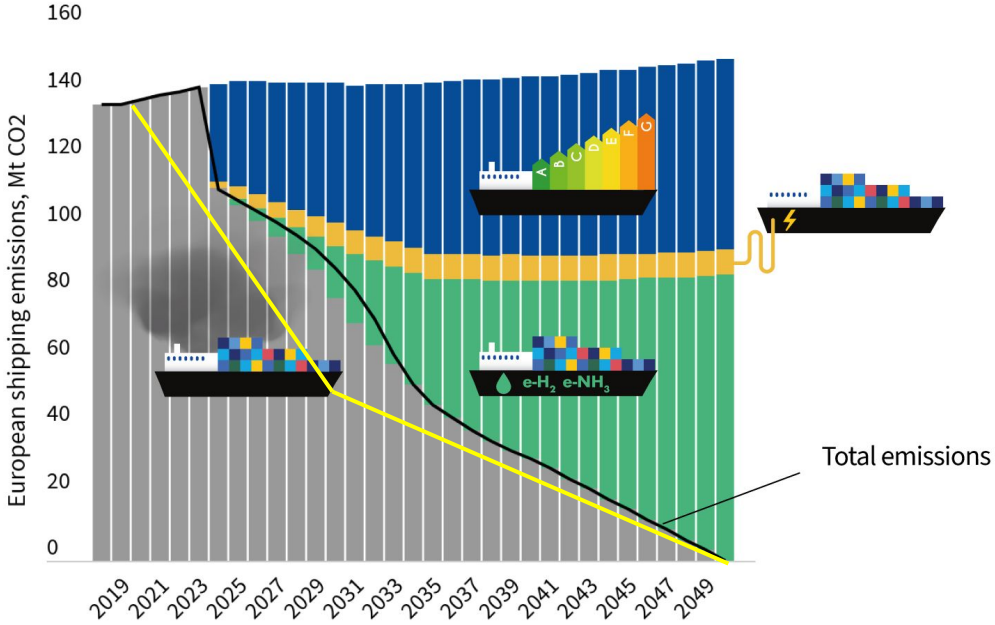
SCENARIO 2
High energy efficiency/
High e-fuel penetration

- **2025+** | All new vessels co-combust 70:30 ratio of Nh3-diesel
- **2030-2040** | Old vessels progressively retrofitted for 50:50 Nh3-diesel co-combustion
- **2040-2050** | Remaining fossil diesel eliminated from the fleet via mono-fuel technologies or Nh3 co-combustion with e-diesel/biofuel/hydrogen
- All vessels improve their technical (wind-assist, hull-lubrication, etc.) and operational (slow steaming) efficiency and carry out regular vessel maintenance.

SCENARIO 3
Low energy efficiency/
Low e-fuel penetration

- **Half the fuel penetration of Scenario 1**
- **Half the energy efficiency penetration of Scenario 2** (but includes ZE berth from 2025+ & 2030+)

Up to a 1/3 of EU ship CO2 can be cut with energy efficiency

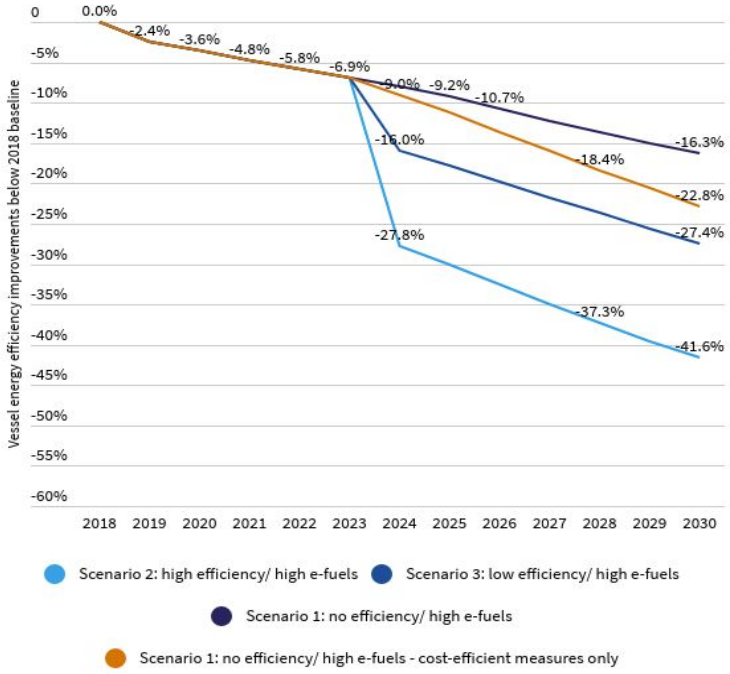


Emissions from fossil fuel only ships · E-ammonia and e-hydrogen ready ships · Port electrification · Energy efficiency measures

Trajectory compatible with EU's 2030-2050 objectives

Source: Transport & Environment

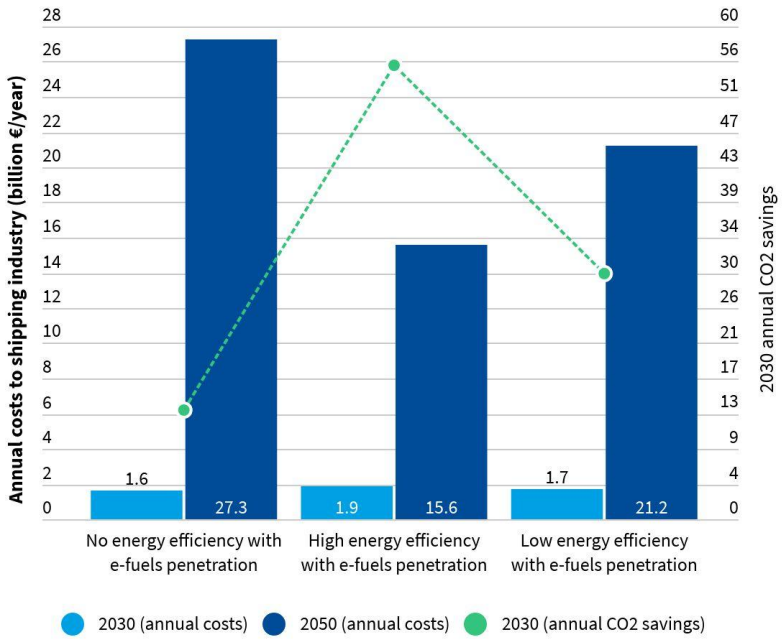
Improvements in vessel energy efficiency



Note: Vessel energy efficiency are expressed as: for RoRo/Ro-pax - kWh/GT-nm; for passenger (cruise) ships - kWh/pax-nm; for container ships - kWh/cargo_tonne-nm; for all other ship types - kWh/DWT-nm; Passenger (cruise) ships use different units and are thus not included in the graph above.
T&E analysis based on EU MRV and IMO 4th GHG Study.

Fleet-wide energy efficiency can improve by 41% between 2018 and 2030.

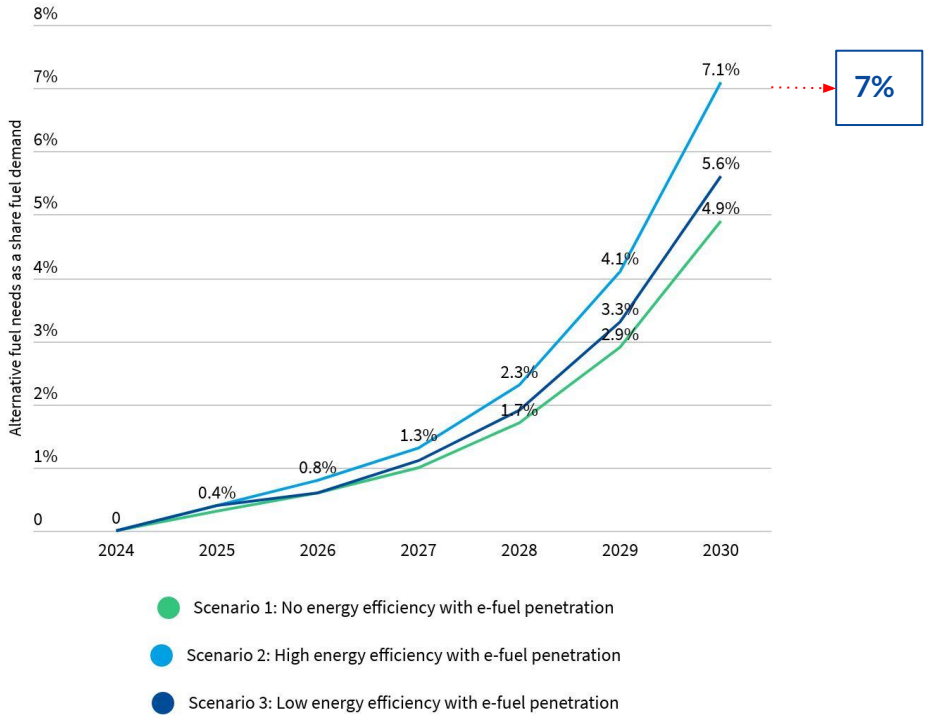
Cost-effectiveness of EU ship CO_2 abatement



Note: T& analysis based on MAC curves of the 4th IMO GHG study. For e-fuels, we assumed ships use green **e-ammonia** with production costs of €501/tonne in 2030 and €429/tonne in 2050 (Ricardo EAE, 2020). Energy efficiency includes, inter alia, wind-assist and slow steaming. Analysis excludes ship machinery and infrastructure costs.

Higher energy efficiency would save the industry about €12 billion/yr in transport costs in 2050.

Green fuels uptake pathways for European shipping



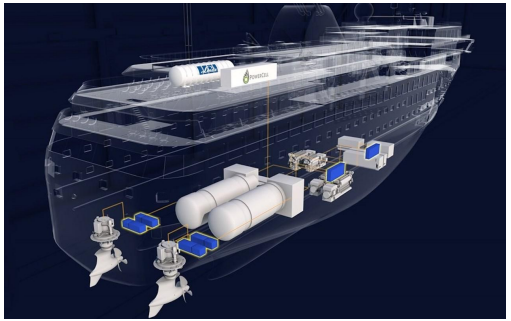
E-fuels such as e-ammonia can reach up to 7% of EU shipping's energy demand by 2030, if coupled with efficiency measures.

What are the realistic & sustainable technologies?

Battery-electric

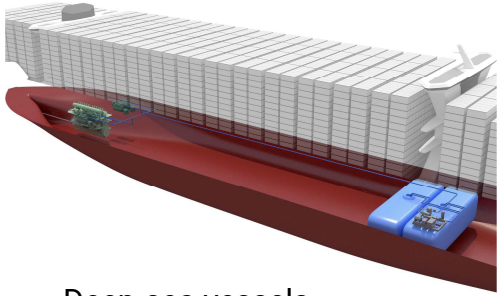
Inland barges & short-sea ferries; power supply at berth

Hydrogen fuel-cells/ICE



Inland & short-sea ferries, tomorrow larger vessels

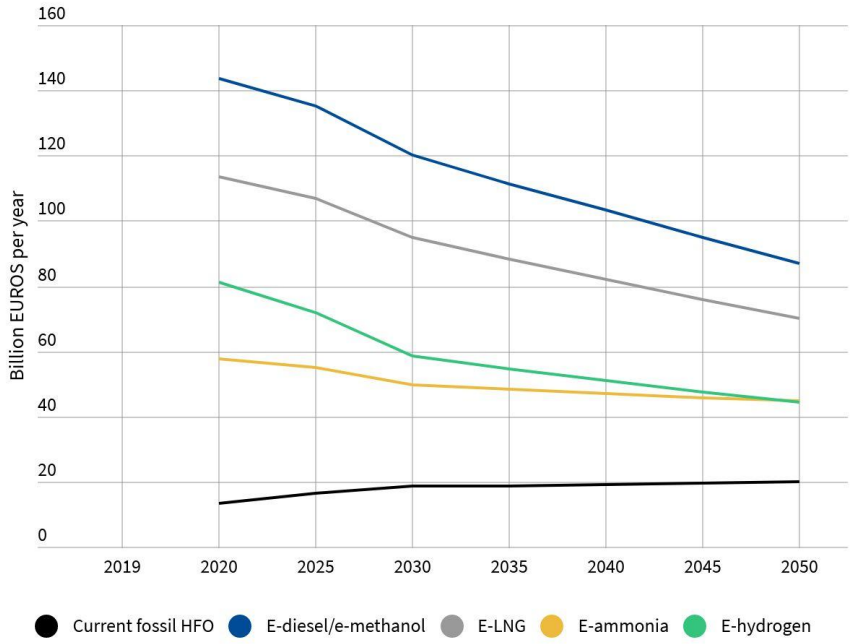
Green ammonia



Deep-sea vessels, typically containerships

How much would e-fuels cost to EU shipping?

(Ricardo EAE e-fuel cost estimations)



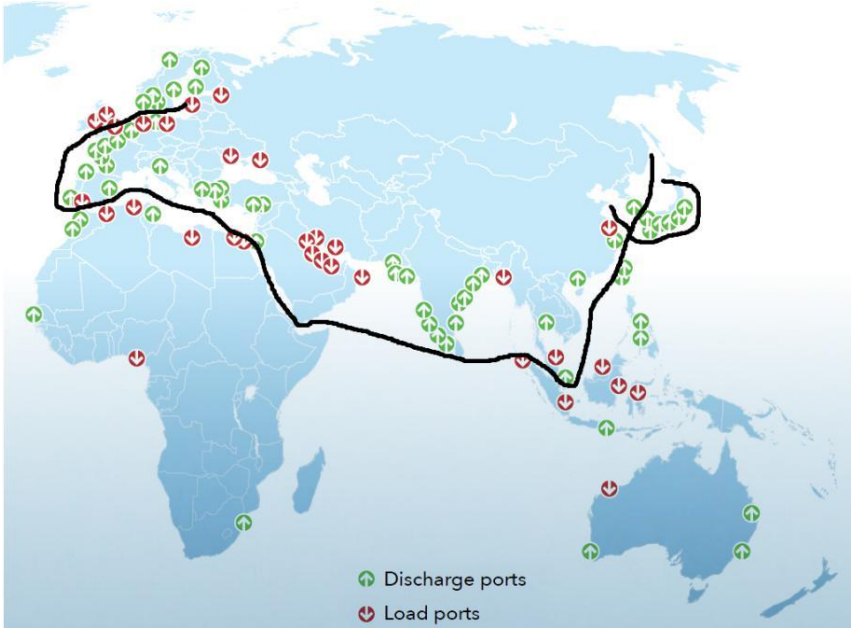
Source: T&E estimations based on fuel consumption projections for EU shipping (full MRV scope) and cost of e-fuel production with high DAC from Ricardo EAE, 2020.

e-Ammonia & e-Hydrogen cheapest e-fuels to decarbonise maritime transport

What do the shipyards say?

Dalian Shipbuilding Industry (China) - *world's largest shipyard*

- Ammonia - *The Closest Alternative to an Ideal Fuel*
- Even the largest vessels can be powered - 23 000 TEU
- Enough autonomy for a single trip from S. Korea to Poland
- Multiple refueling can be realised along the route - already existing ammonia discharge/loading ports



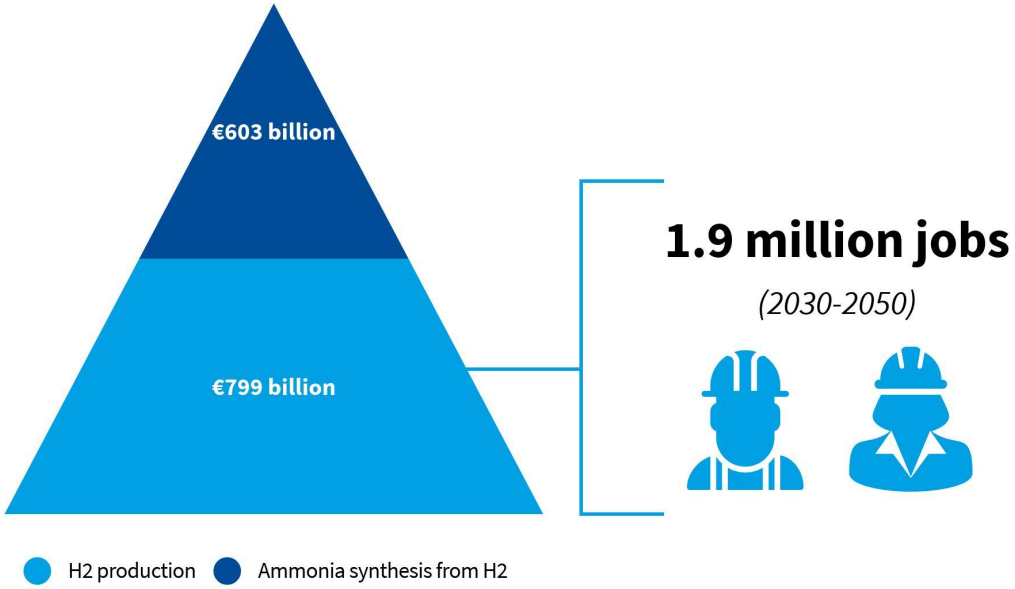
Daewoo Shipbuilding & Marine Engineering (S. Korea)

- Ready to commercialise 23 000 TEU container ship by 2025

Hyundai Mipo & Samsung Heavy Industries (S. Korea)

- Ready to commercialise 50000-125000 DWT tankers by 2024/2025

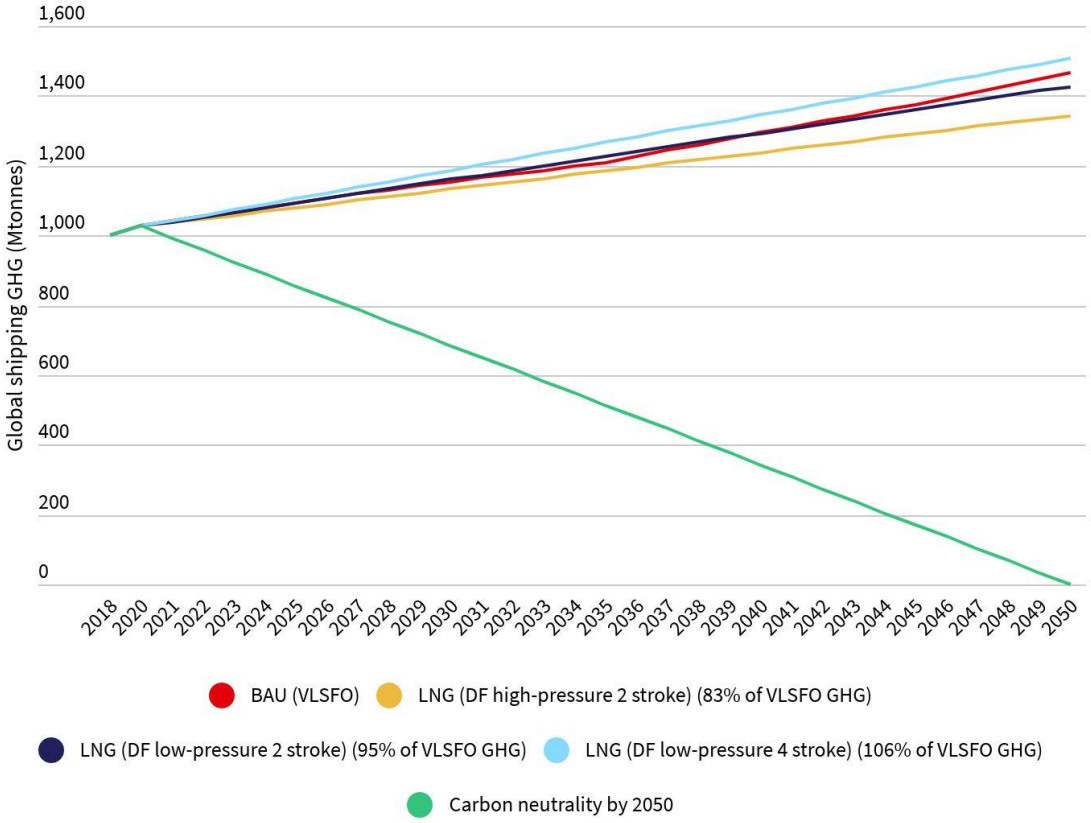
Investment needs in H2 production for ships & new Jobs



Note: T&E estimations based on UMAS (2020), *Aggregate investment for the decarbonisation of the shipping industry* and European Commission (2020), *Hydrogen generation in Europe: Overview of costs and key benefits*. Analysis includes only CAPEX needs for H2 production and excludes electricity generation & ammonia synthesis.

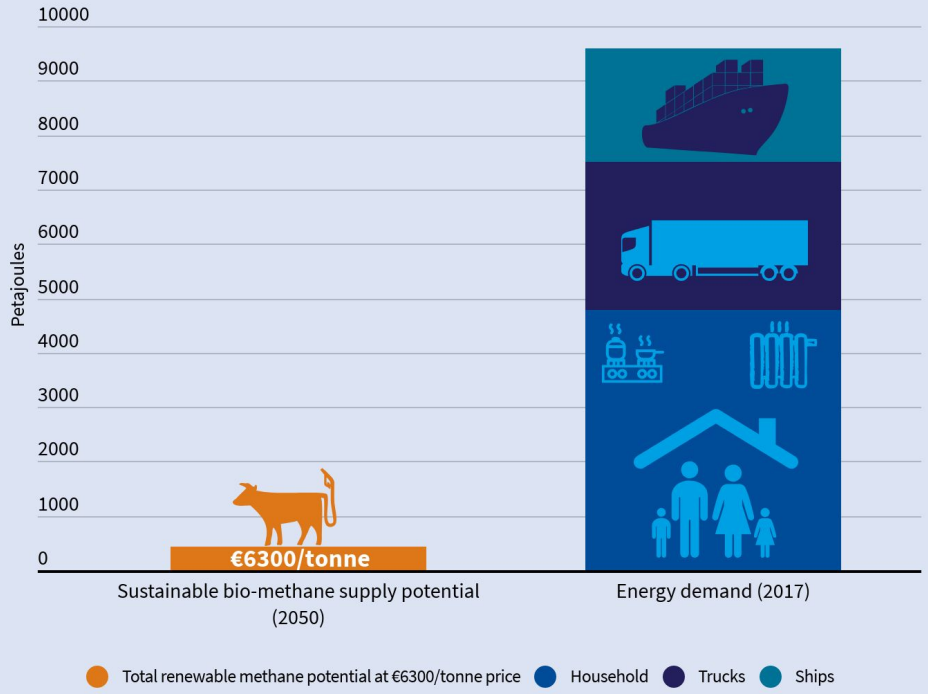
Economic Recovery via Technological Transition

What if half of global fleet were to switch to LNG by 2050? Here is why it is a dead-end fuel.



How can LNG be a transitional fuel if emissions go in the opposite direction?

EU 2050 bio-methane potential not even enough for households



Notes: The chart is conservative as it compares 2050 supply with 2017 demand. This supply would only be feasible at a retail price of €6300/t (excluding taxes), which is more than 10 times higher than the current LNG prices. Energy demand for households is limited to natural gas demand only.

Sources: ICCT (2018), Eurostat (2017), UNFCCC (2017).

Recap - Key findings

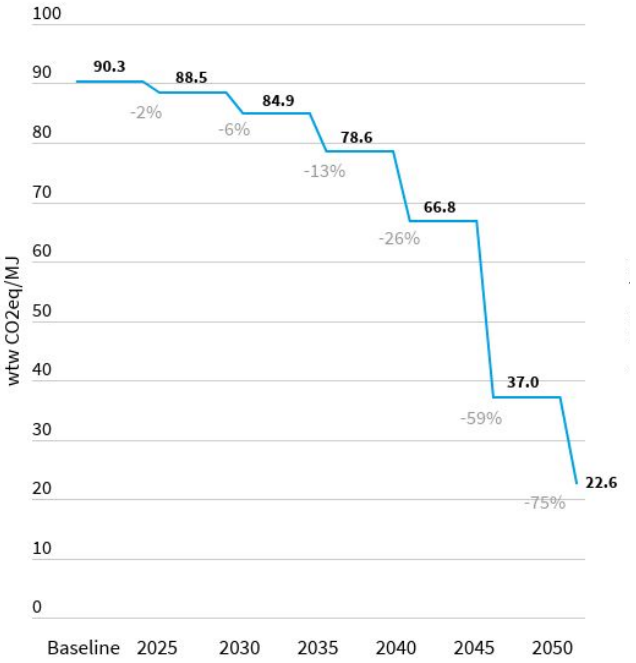
1. EU shipping needs to slash **90Mt CO_2** in 2030 to meet -55% below 1990.
2. Almost **half** of it (46%) could be met by high energy efficiency alone (about 42Mt).
3. For 2050 carbon neutrality, **zero emission** vessels needs to be deployed from **2025**, while existing vessels need to be retrofitted to run on green hydrogen(-based fuels) from 2030 on.
4. But without energy efficiency, even that would leave a 60Mt/yr **CO_2 gap** towards 2030 target.
5. Combined energy efficiency & ammonia uptake would:
   a. be **3x more cost-effective** than fuels-alone approach to abate each tonne of CO_2 by 2030 .
   b. **save** industry **€2 billion/year** in 2030 and **€12 billion/year** in 2050
   c. require **3 times less** alternative fuels by 2030 than fuels-alone approach.

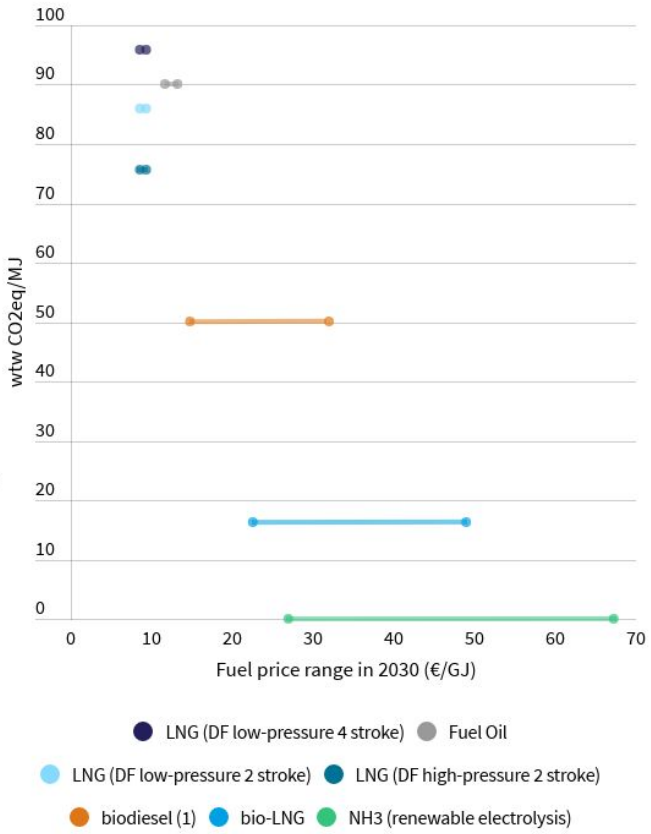
European Commission

FuelEU Maritime regulation

(forthcoming)

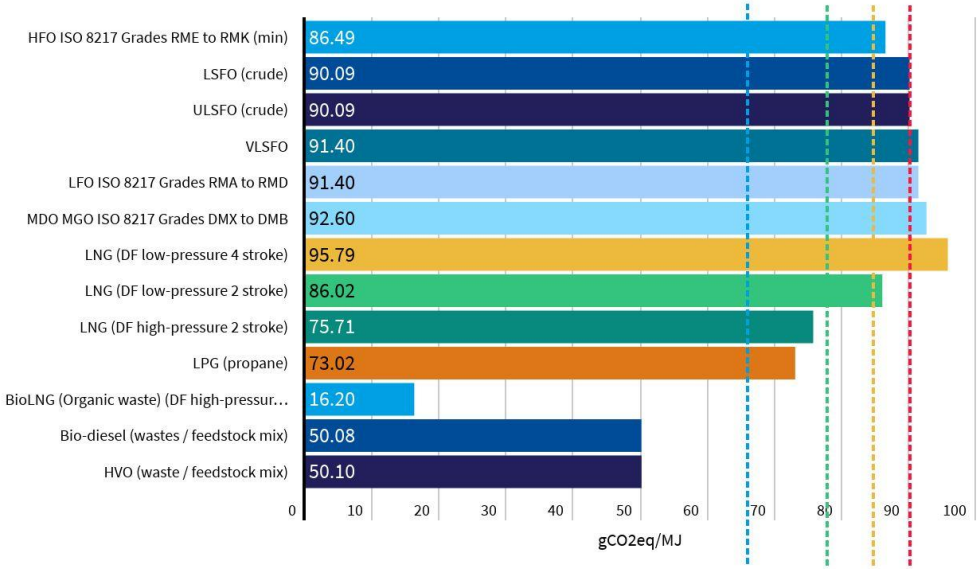
Goal-based targets in FuelEU Maritime regulation





Note: The baseline for well-to-wake emissions of CO2 equivalent per energy is calculated from the Port of Rotterdam fuel sales in 2020. Sources of fuel price in *Table 1* of the Annex.

Well-to-Wake carbon intensity of marine fuels

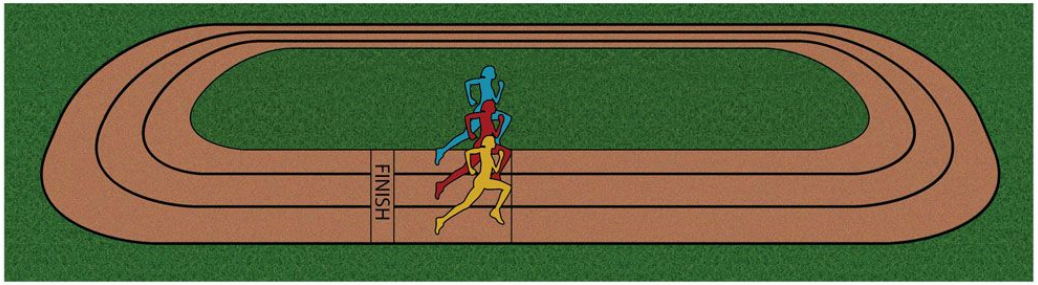


Note: T&E compilation based on the draft FuelEU Maritime Regulation. Baseline was estimated by T&E using 2020 Rotterdam fuel sales data as a proxy. Analysis assumes CH4 GWP of 36 as per IPCC 5AR; however, if GWP 28 were chosen, WtW intensity of LNG in low-pressure DF 2 stroke engines would be **83.26 gCO2eq/MJ.**

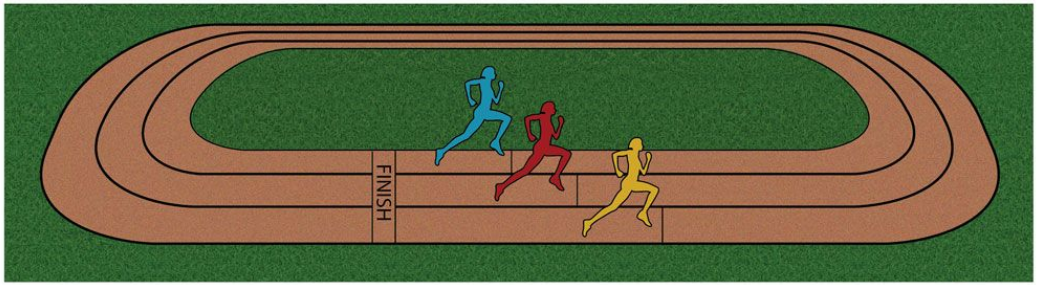
Fossil LNG compliant until **2039**

Advanced (UCO) biodiesel until **2044**

Simply goal-based approach provide equality but not equity

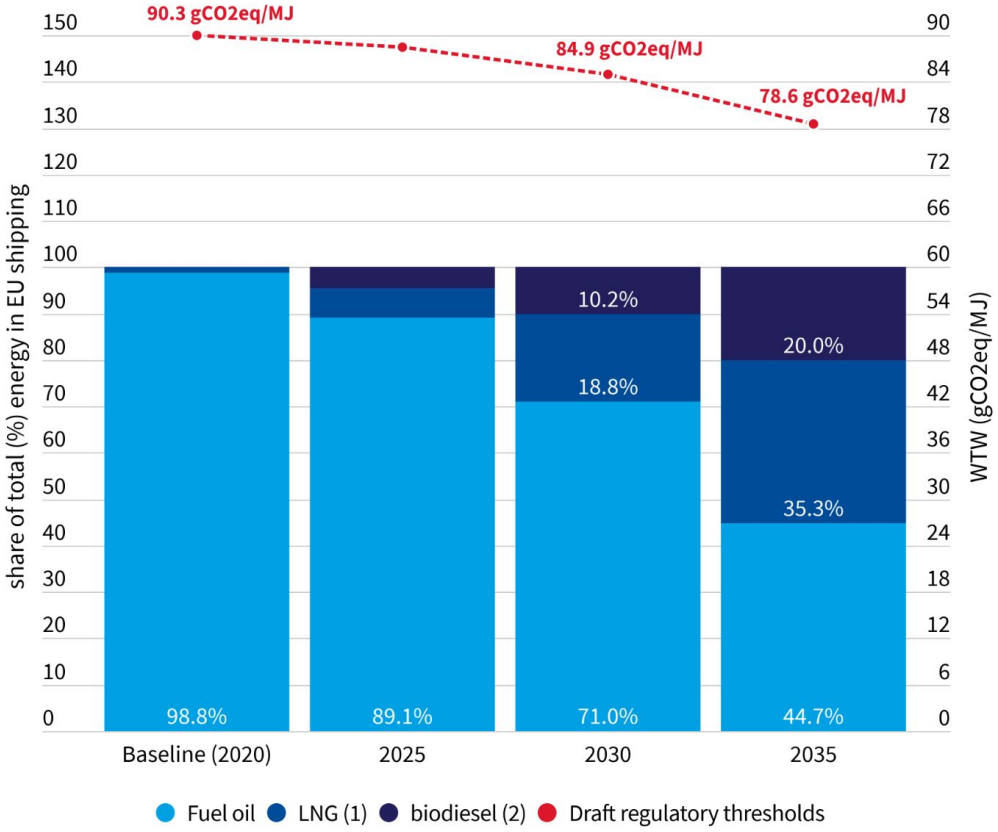


EQUALITY



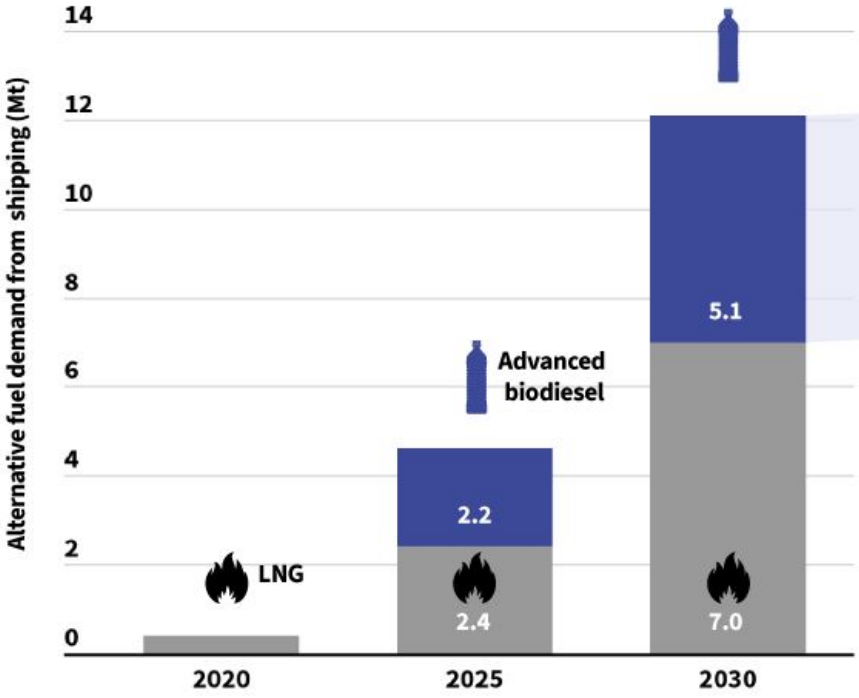
EQUITY

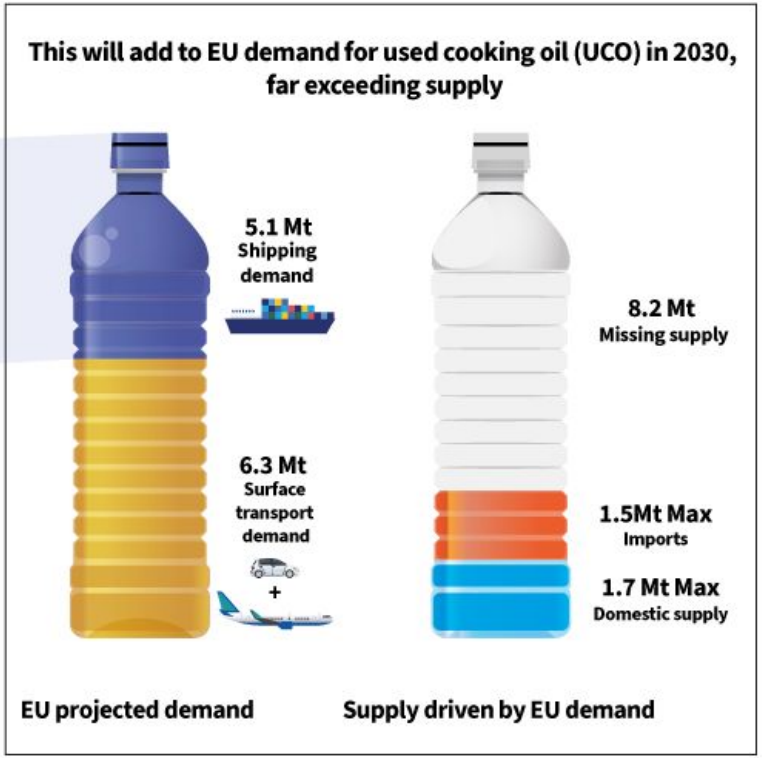
Disaster Pathway: draft FuelEU maritime will mostly drive fossil LNG and biodiesel



With no safeguards, FuelEU target will drive fossil LNG and biodiesel in shipping, instead of green e-fuels

The draft FuelEU will incentivise fossil LNG and dubious biodiesel imports





Source: Oilworld (2020), CE Delft (2021) and T&E (2021)

With constrained waste-based feedstock, most biofuels supply for ships will come from unsustainable crop-based bio

DEFORESTATION

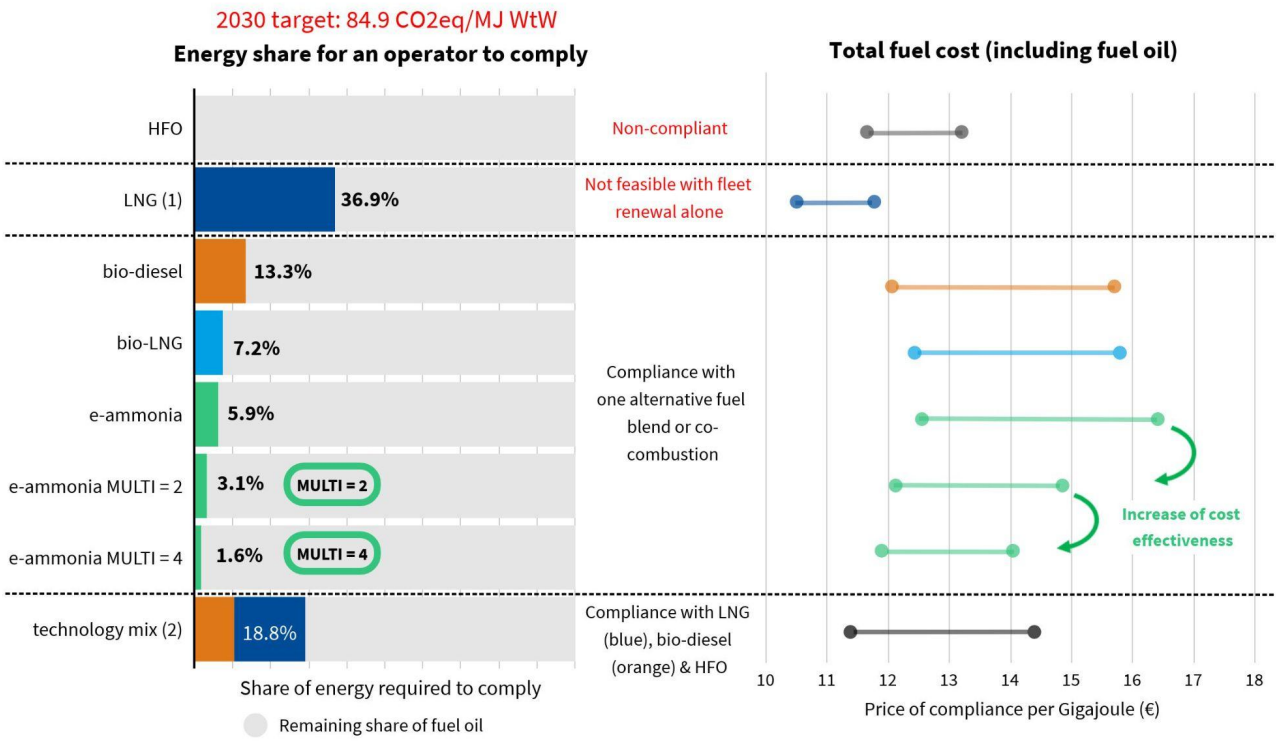
Table 5 Biomass feedstock consumption by type (in Mtonnes)

Feedstock consumption	PO1		PO2		PO3	
Mtonnes	**2030**	**2050**	**2030**	**2050**	**2030**	**2050**
Part A						
Perennial crops	0.0	6.3	0.0	7.7	0.0	6.9
Annual crops	0.3	33.6	0.3	40.8	0.3	36.4
Forestry products	3.1	14.4	3.2	18.4	3.1	15.9
Forestry residues	1.4	11.7	1.5	14.7	1.5	12.8
Wood waste	1.8	6.7	1.8	8.0	1.8	7.2
Agricultural residues	1.5	15.4	1.5	18.6	1.5	16.8
Manure	1.2	2.8	1.2	3.3	1.2	3.0
Part B						
Non-agricultural oils	0.80	1.4	0.83	1.8	0.82	1.6

Source: PRIMES Biomass model, E3Modelling

Estimation of biomass feedstock consumption for 2030-2050 under various policy options in European Commission's impact assessment for FuelEU Maritime

Compliance costs - multipliers can boost cost-effectiveness of e-fuels for operators in 2030



Note: This graph shows how multipliers can incentivize e-fuels by boosting their cost effectiveness for compliance per operator. This simplistic approach only includes fuel costs - carbon mark-up is excluded. Price range based on the difference between conservative and optimistic cost assumptions. See Table 1 for sources.
(1) LNG (DF high-pressure 2 stroke) ay 75.71 gCO2e/MJ well-to-wake (WtW). We calculate the maximum share from LNG could be 18.8% from a fleet turn-over model.
(2) LNG and biofuel from Climate Disaster Scenario. See Figure 2 for LNG technology mix, resulting in 83.62 gCO2e/MJ WtW

E-fuels needs a multiplier of at least 5 to be cost-competitive

T&E FuelEU Maritime recommendations

Min. share 50% e-fuels to achieve target and/or **multiplier of 5** to boost e-fuels' cost-effectiveness	Credit exchange mechanism with **excess credit sales** (pooling) to ships with e-fuels only to incentivise their uptake;	**Exclude fossil LNG and first gen. biofuels** from the scope; **apply RED II** sustainability criteria to all advanced fuels
Regulation with **dissuasive fines** (cfr car CO2, DE REDII) - **NO "pay-to-comply"**	**Beyond intra EU** (ideally full MRV scope)	**EU industrial policy (CfDs)** to support uptake of zero-emission vessels

Faïg Abbasov

Shipping Programme Director

Transport & Environment

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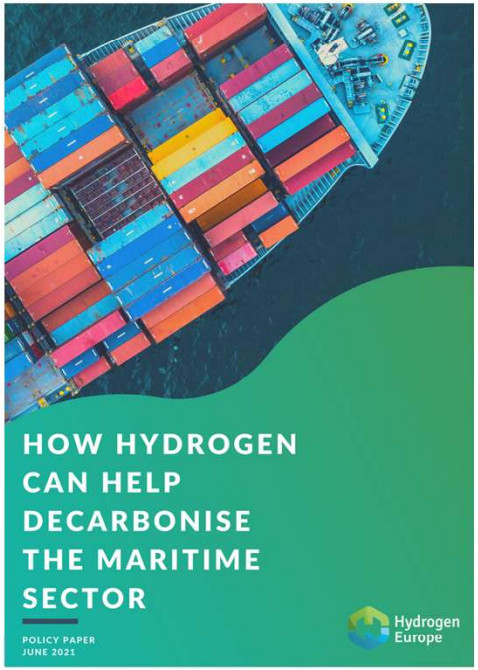
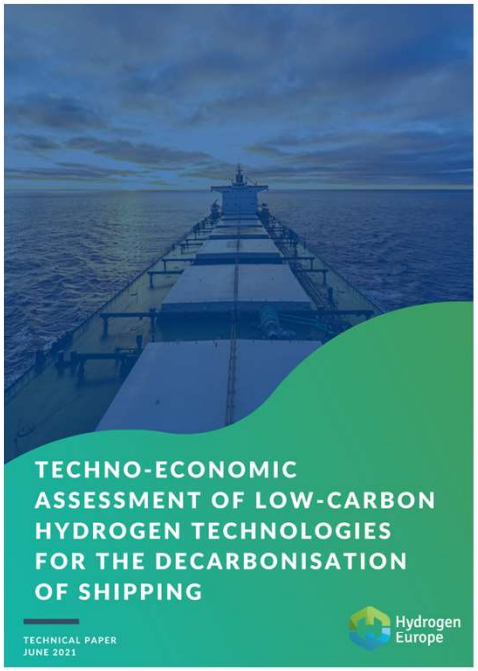
Hydrogen Europe

HOW HYDROGEN CAN HELP DECARBONISE THE MARITIME SECTOR

Jorgo Chatzimarkakis, Secretary General





Hydrogen Europe

OUR VISION

Where we stand

Around half of all operating ships are more than 15 years old.

For smaller cargo ships, the average is 40 years, and it's even higher for inland ship

Need to act now!

Before 2030

All European new-build short sea ships and inland vessels can be build to have zero emissions.

The greatest potential in the very short term lies in **inland vessels and vessels active in ports.**

By 2030

Many small ships will be running on hydrogen or e-fuels. Hydrogen and hydrogen-based fuels can already provide auxiliary power to larger ships.

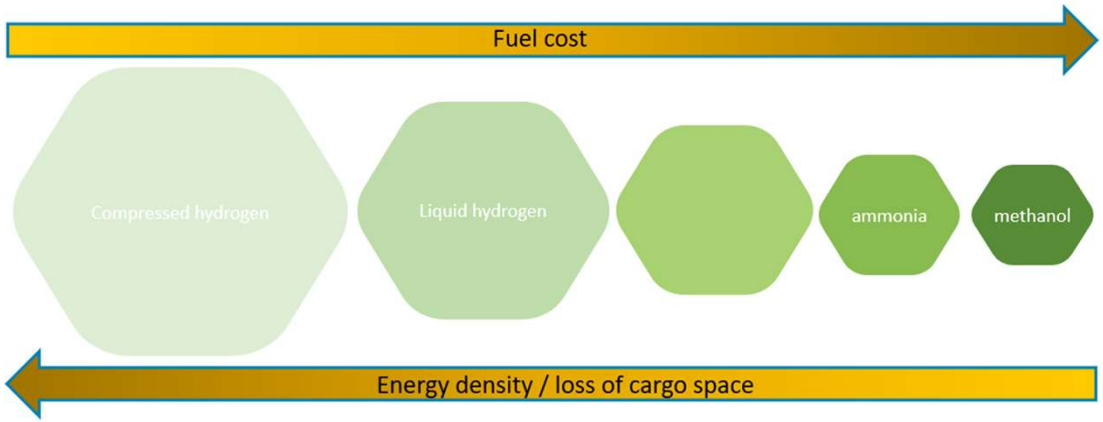
By 2050

The **majority of ships** with many of them fully autonomous **will run on alternative fuels** such as hydrogen and hydrogen-based fuels.

Hydrogen Europe

THE ROLE OF HYDROGEN

- Hydrogen can be used in multiple ways: fuel cells or via combustion in ICEs.
- Pure H2 is the cheapest fuel. However, other fuels that are made from H2 have a better volumetric energy density.
- For short distance ships and inland vessels, pure hydrogen is a convenient option and the cheapest one.
- For large ships, **ammonia is the cheapest synthetic fuel.**

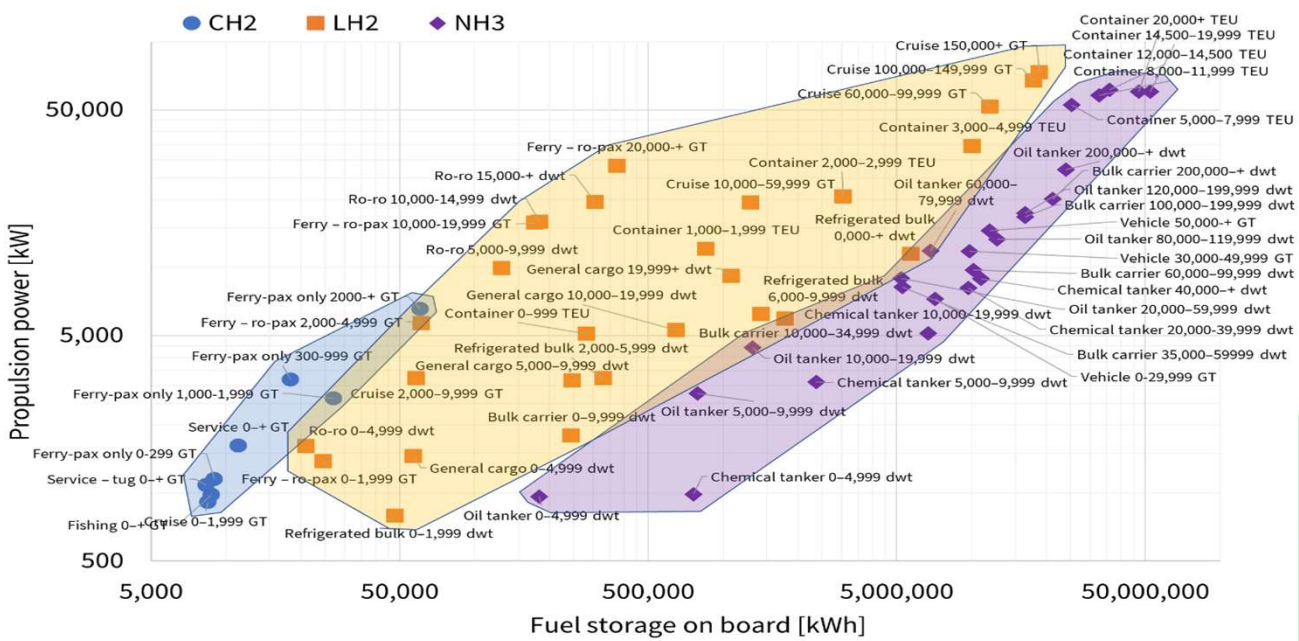


Fuel trade-off dilemma: the higher the energy density of a fuel, the higher its cost!

Hydrogen Europe

THE ROLE OF HYDROGEN

- Alternative fuels (except biofuels) are based on hydrogen.
- Each type of vessel has its own most convenient option (Up to the shipowners to choose)



Hydrogen Europe

Techno-economic assessment of low-carbon hydrogen technologies for the decarbonization of shipping

CONTENTS

Hydrogen Europe

THE ROLE OF PORTS

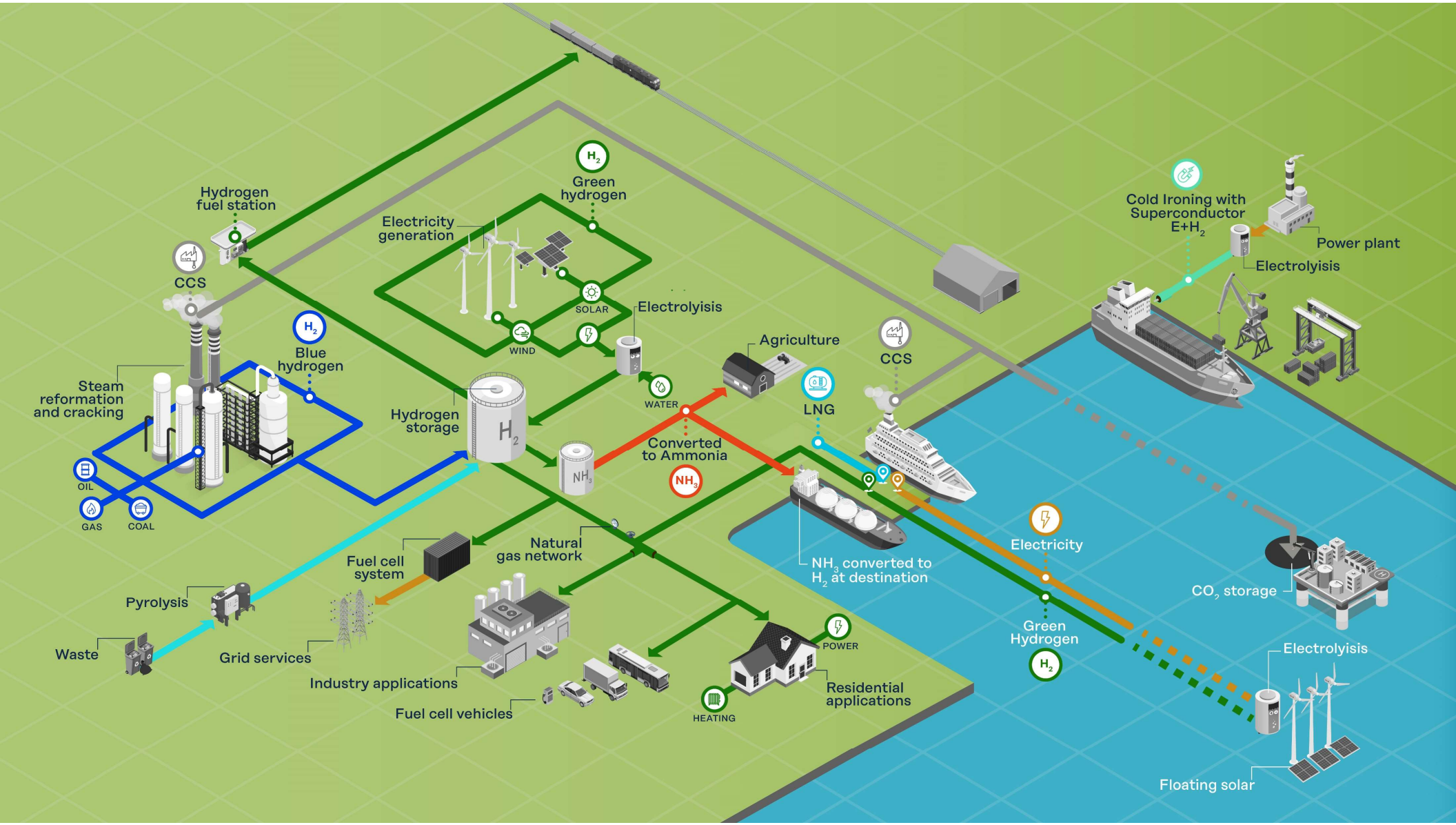
The pace to decarbonize very much depends on <u>how fast ports</u> will be able to <u>store sufficient amounts of green hydrogen</u>

Ports will become H2 hubs or "H2 Valleys" where hydrogen can be produced or imported, stored and distributed for use in different applications such as:

- H2 for trucks and rail
- H2 for inland waterways (for inland ports)
- H2 for onshore power
- H2 for the decarbonisation of terminal and cargo handling
- H2 for the industrial hinterland (refineries, chemicals…)

The revision of the directive on alternative fuels infrastructure will play a crucial role in this regard

Hydrogen Europe


Hydrogen fuel station
CCS
Steam reformation and cracking
OIL
GAS
COAL
Blue hydrogen
Green hydrogen
Electricity generation
SOLAR
WIND
Electrolysis
WATER
Hydrogen storage
Converted to Ammonia
Agriculture
LNG
CCS
Cold Ironing with Superconductor E+H2
Power plant
Electrolysis
Fuel cell system
Natural gas network
Pyrolysis
Waste
Grid services
Industry applications
Fuel cell vehicles
HEATING
POWER
Residential applications
NH3 converted to H2 at destination
Electricity
Green Hydrogen
CO2 storage
Electrolysis
Floating solar

ReFuel EU Maritime

Aim is to trigger the uptake of low carbon fuels in the maritime sector.

It will have direct implications for alternative fuel infrastructure and must therefore be well-aligned with existing legislation also under review.

Through the FuelEU Maritime initiative specific targets regarding the share of hydrogen and hydrogen-based-fuels by 2030 in the total fuel demand for maritime sector will need to be set.

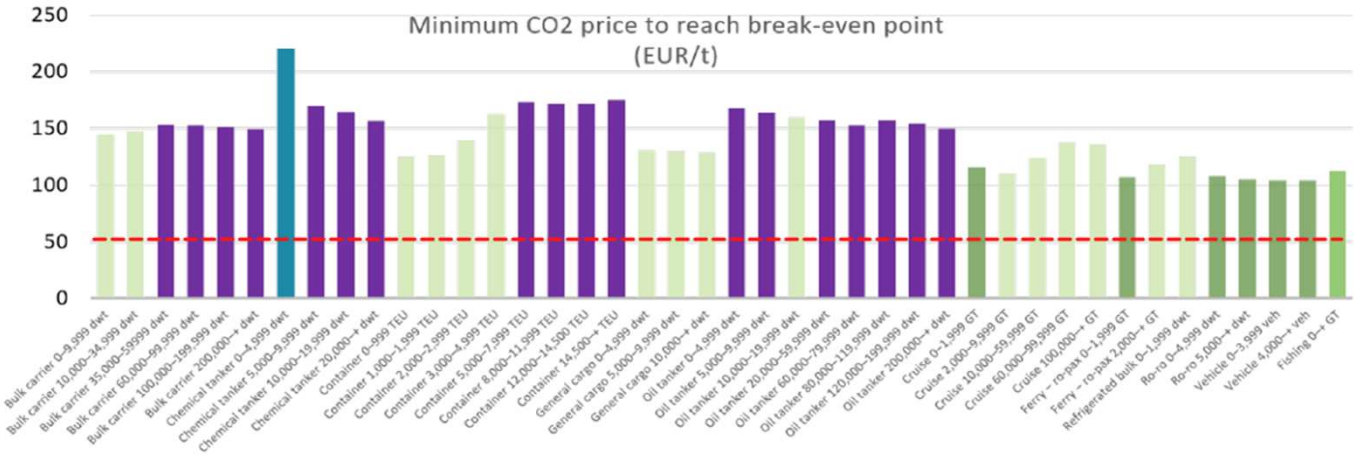
A recent T&E study shows that 7% of e-fuels by 2030 would kickstart the decarbonization of EU shipping.

The policy initiatives are all connected one way or another. Although there is no silver bullet to decarbonise the maritime sector, we cannot afford to have a patchwork of legislations and regulations. We need a European regulatory framework with clear and ambitious obligations for the use of hydrogen and hydrogen-based fuels by 2025 and 2030 in the maritime sector.

Hydrogen Europe

KEY POLICY RECCOMENDATIONS

Putting a price on carbon emissions of shipping through the EU ETS **would be a welcome step in establishing a regulatory framework for the decarbonization of this sector, provided that the auctioning revenues flow back to the maritime sector** through the Ocean Fund which can act as an important driver for necessary investments in sustainable fuels, innovation and retrofitting.



Hydrogen Europe

other POLICY RECCOMENDATIONS

Future-proof fuels

Solutions, (…) need to be sought among **technologies that can be both sustainable and scalable.**

RED II

(…) **the Commission should provide certainty for ports on how to deal with green hydrogen imports.**

AFID

(…) rapid expansion of hydrogen refueling stations. **The deployment of infrastructure must occur alongside the deployment of ships.**

TEN-T / TEN-E

Synergies between TEN-T and TEN-E should be further explored. **When their corridors are aligned geographically, the HRS network should be strengthened.**

Europe's diversity offers enormous strength if it can be harnessed and strategically guided, but European policy, research and development are presently fragmented both within and across the different countries.

Hydrogen Europe

Hydrogen Europe

HYDROGEN EUROPE SECRETARIAT

Avenue de la Toison d'Or 56-60
BE-1060 Brussels
secretariat@hydrogeneurope.eu
+32 (0) 2 540 87 75
www.hydrogeneurope.eu

THANK YOU FOR YOUR ATTENTION!

How to kick-start the deployment of zero-emission vessels

Online presentation at "How to decarbonise shipping by 2050?"

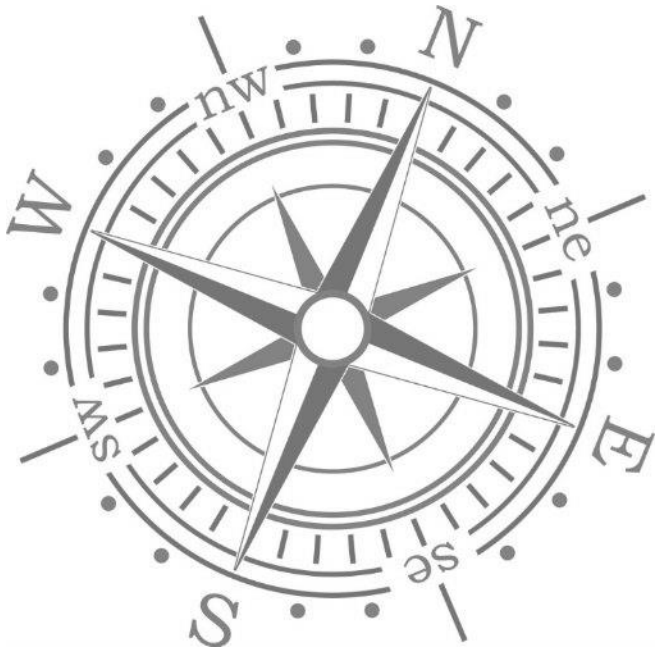
EU Parliament, Brussel

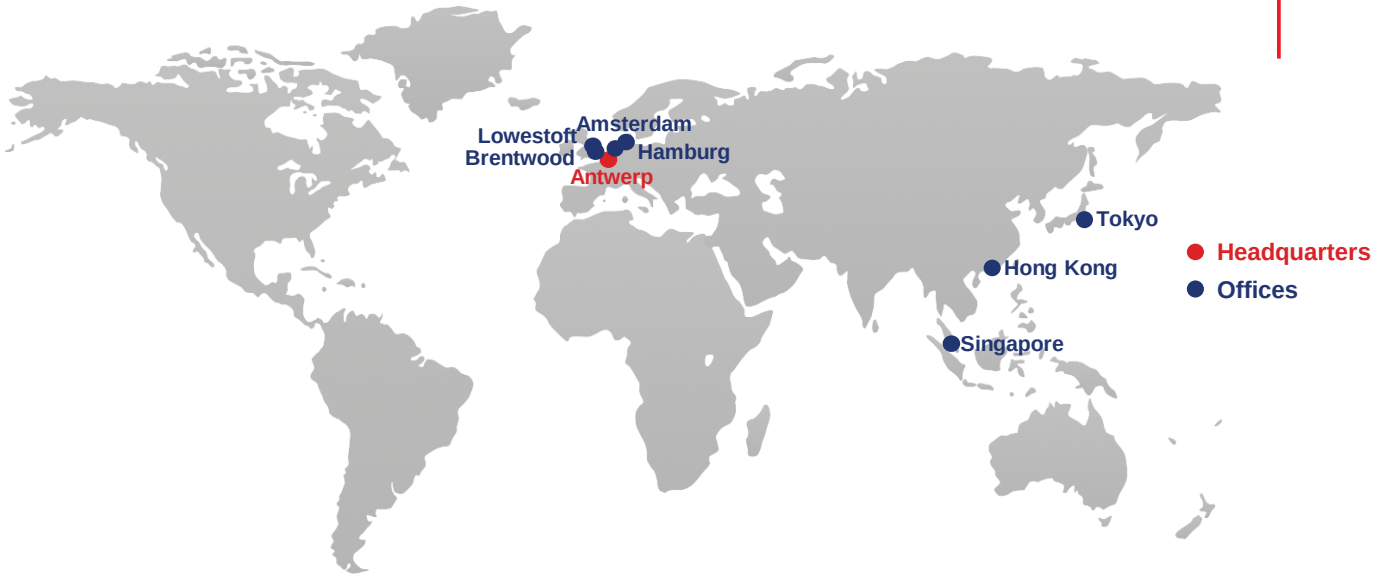
July 2021, Roy Campe, CTO CMB.TECH

CMB .TECH

Presentation Topics

1. Introduction CMB Group & CMB.TECH
2. Zero carbon pathway from CMB
3. Why ports can play a crucial role
4. Dual fuel combustion technology
5. Key takeaways
6. Q&A





CMB

BOCIMAR

DELPHIS

BOCHEM

CMB .TECH

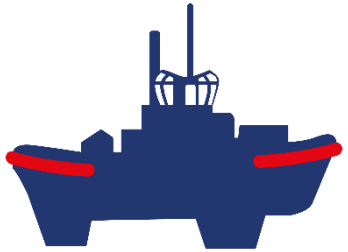
WINDCAT WORKBOATS

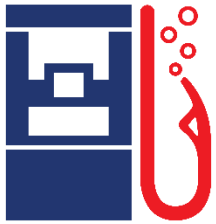
MCA MARITIME CAMPUS ANTWERP

CMB.TECH, the cleantech division of CMB

- The division's activities can be summarized in 4 focus areas:

ENGINEERING	INDUSTRY	MARINE	H2 INFRA
A fast growing highly skilled engineering team with >15y of experience with hydrogen systems	Design and retrofit of industrial applications to run on the clean fuel of hydrogen	Design, building and operation of a future proof fleet powered by hydrogen and ammonia	Technology and infrastructure to produce and distribute the clean fuels of the future





CMB has paved the pathway towards zero emission shipping with concrete and tangible projects

- In operation
- Construction phase
- Design phase

H_2 Powered (short distance)

NH_3 Powered (long distance)

HydroPhoenix (50TBP)

Coaster (3800dwt)

Hydrotug (65TBP)

Hydrocat (CTV)

Hydrobingo (80pax ferry)

Maritime Hydrogen Refuelling Station

Hydroville (16pax ferry)

Chemical Tanker (25k DWT)

Dry Bulk Carrier (205k DWT)

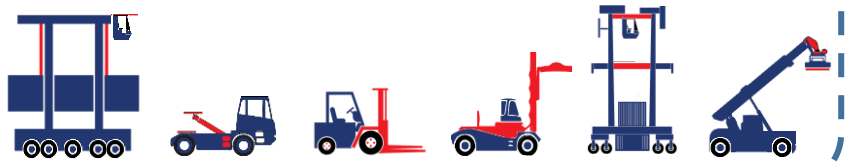
Container Vessel (6000 TEU)

CMB.TECH is also working on large scale production of green H_2 and NH_3 in Namibia

Ports will play a key role in kickstarting zero emission ships

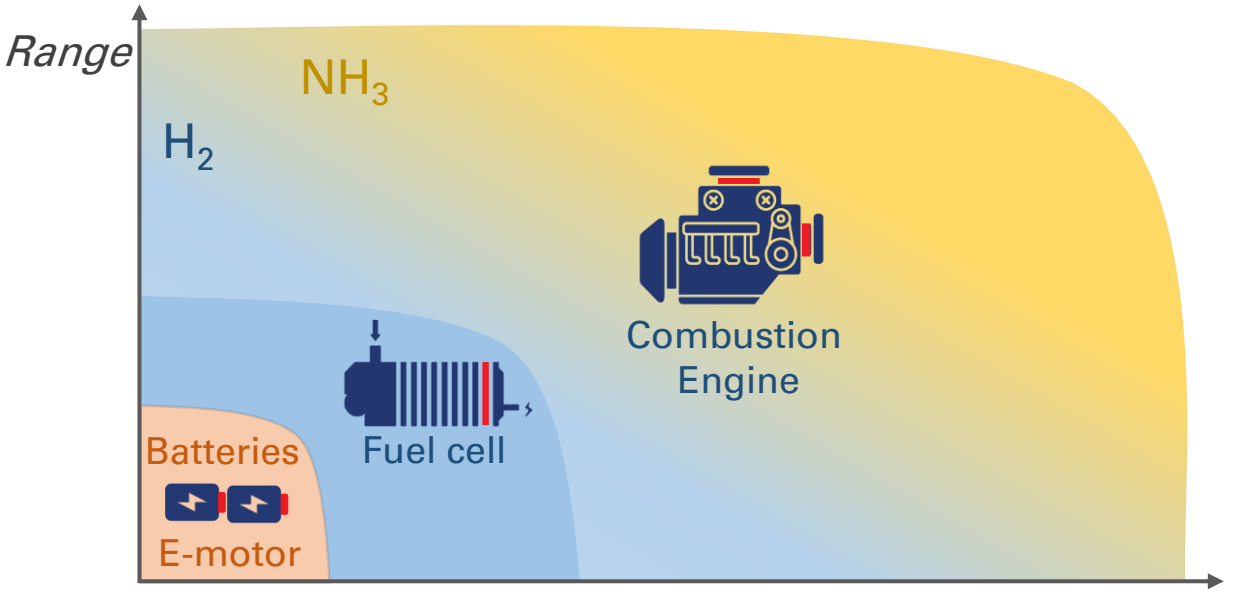
- Shipping is standardized, meaning what works for Antwerp will work in Rotterdam, Hamburg, Marseille, etc.
- By equipping 200 ports worldwide with H_2 technology, an unparalleled emission's saving can be established
- Europe can be key player developing the H_2 technology:
  - Port equipment: difficult to electrify (when vessel is in port, cargo operations do not allow long battery recharging)
  - Shore power solutions: CMB.TECH developed in the JV BeHydro hydrogen powered cold ironing genets and the concept of a power barge, to provide clean power to ships.
  - Power barge: can also be used to refuel barges or other ships: *"The station comes to the vessel, instead of the vessel sails towards the refuelling station."*
  - Port vessels: most port vessels can operate on compressed H_2 without the need for disruptive technology

Port Equipment is very suitable for H_2 technology



Combustion engines will have a major role for heavy industries such as shipping

- There is no golden bullet that can replace diesel, but batteries, hydrogen and ammonia will have a major role as future fuels:
  - Batteries for low power and short-range applications with high idling times
  - H_2 for local heavy-duty equipment where quick refuelling is required
  - NH_3, where H_2 storage does not offer a viable solution
- Fuel Cells (H_2 & NH_3)
  - Not proven in harsh conditions
  - Expensive & limited lifetime (degradation)
- Combustion engine (H_2 & NH_3)
  - Reliable
  - Affordable
  - Known technology
  - Dual fuel capability



Ships do not have that many choices to offer zero emission transport

- Batteries: ships require a large energy buffer, resulting in a battery size which is too large, too heavy and too expensive. There are no means to charge this battery during port call;
- Photo-Voltaic panels: the ship's surface is not big enough to even provide 10% of the required power;
- Wind energy: more interesting for slow sailing vessels. Deck space is challenging, but with a projected saving of 10-30% the IMO limit of 50% GHG reduction can not be reached;
- LNG: due to methane slip during production, storage & combustion, net GHG effect saving is far from any IMO target. The high investments required are not justified in this respect;
- Bio-fuel: not enough biomass available and the supply is very seasonable. Should only be used locally.
- Methanol: DAC technology will remain a costly and an energy consuming technology;
- E-fuels: H_2 and NH_3 are carbonless fuels, each with its own challenges but offer the best perspective.
- The wide variety of technologies is withholding many ship owners, shipyards, OEMs and technology providers to invest massively into H_2 and NH_3 technology which could create the boost required to achieve the emission targets.
- Investments should accelerate and focus mainly on Hydrogen and Ammonia:
  - H_2 for port/local vessels (tug, pilot vessel, patrol vessel, etc), inland water vessels (barge, ferry, etc) and short sea vessels (coaster, CTV, CSOV, feeder, etc)
  - NH_3 for deep sea going ships.

Key takeaways from a ship owner's perspective

- Hydrogen technology will be used by the early movers which will kickstart zero emission technology for local and short sea shipping.
- Dual fuel technology is key to allow the infrastructure to grow and mature.
- Combustion engines will play a key role in supplying an affordable and reliable platform for zero emission technology.
- Ammonia is regarded as the main clean fuel for deep sea shipping.
- Clean ammonia production is to be accelerated to allow the maritime sector to make the shift.
- Fossil fuel will remain cheaper, so regulatory incentives (reduced port fees, support for infrastructure) or a global carbon tax should provide an economic justification.
- Public tenders should enhance the selection of clean propulsion designs. Low emission cars/busses/ferries/ships should be ordered/chartered, despite the higher costs and unknowns.
- CMB.TECH believes that net-zero shipping is possible and necessary.

Q&A

Roy Campe
CTO CMB.TECH
roy.campe@cmb.be
+32 471 80 1959
www.cmb.tech



IWSA
International Windship Association




Decade of Wind Propulsion 2021-2030

Delivery | Optimisation | Facilitation

www.decadeofwindpropulsion.org

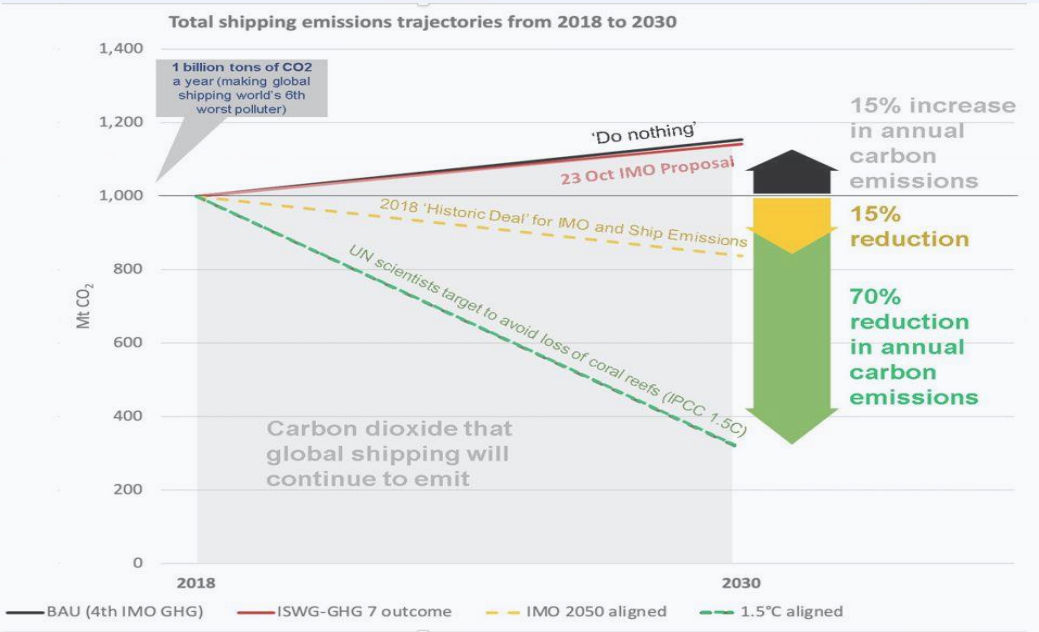



International Windship Association
Gavin Allwright, Secretary General
secretary@wind-ship.org
www.wind-ship.org

IWSA
International Windship Association

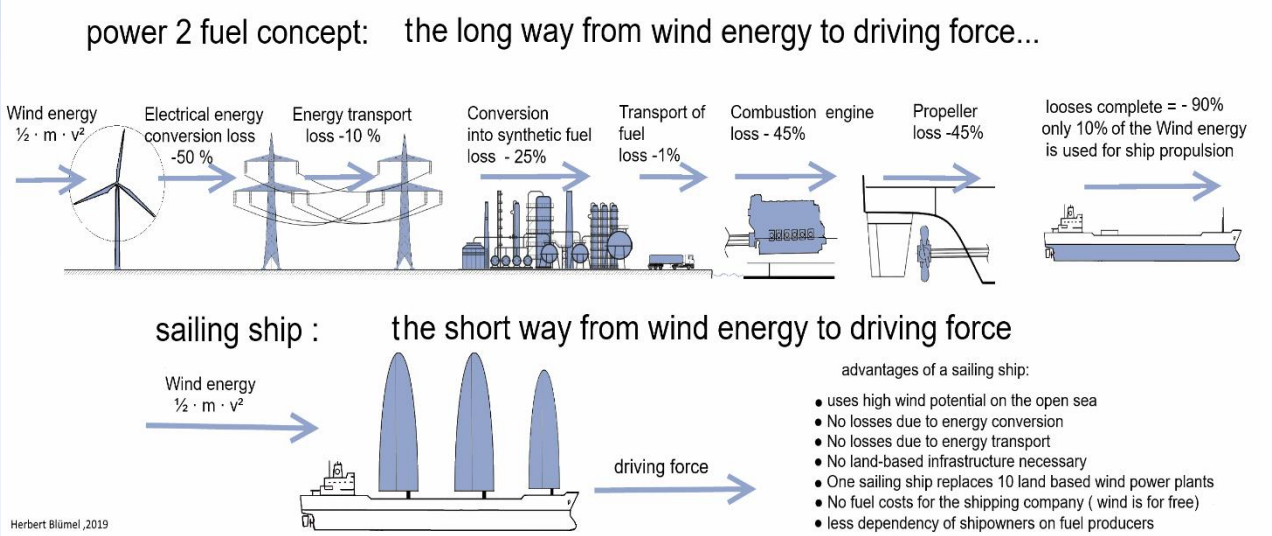
PARIS AGREEMENT

"All ships designed and built today must operate in a net zero emissions world at the end of their service life"



Source: International Council on Clean Transport (ICCT), Oct 2020

Direct Application of Wind Power



RETROFIT
5-20% propulsive energy & optimised up to 30%

OPTIMISED NEWBUILD
50-80%+ possible with operational changes

- Pure **Zero-Emissions** Energy Source
- Abundant & Available Worldwide **Today**
- **Free** & Delivered to the Point of Use
- No New **Infrastructure** or Onboard **Storage**
- Harvesting Technology **Available** Now
- **Compatible** with All Fuels
- **Facilitates** Secondary Renewable Fuels
- **Uniquely** Available to Shipping
- Shift from CAPEX to **OPEX** possible

Hybrid W.A.V.E.

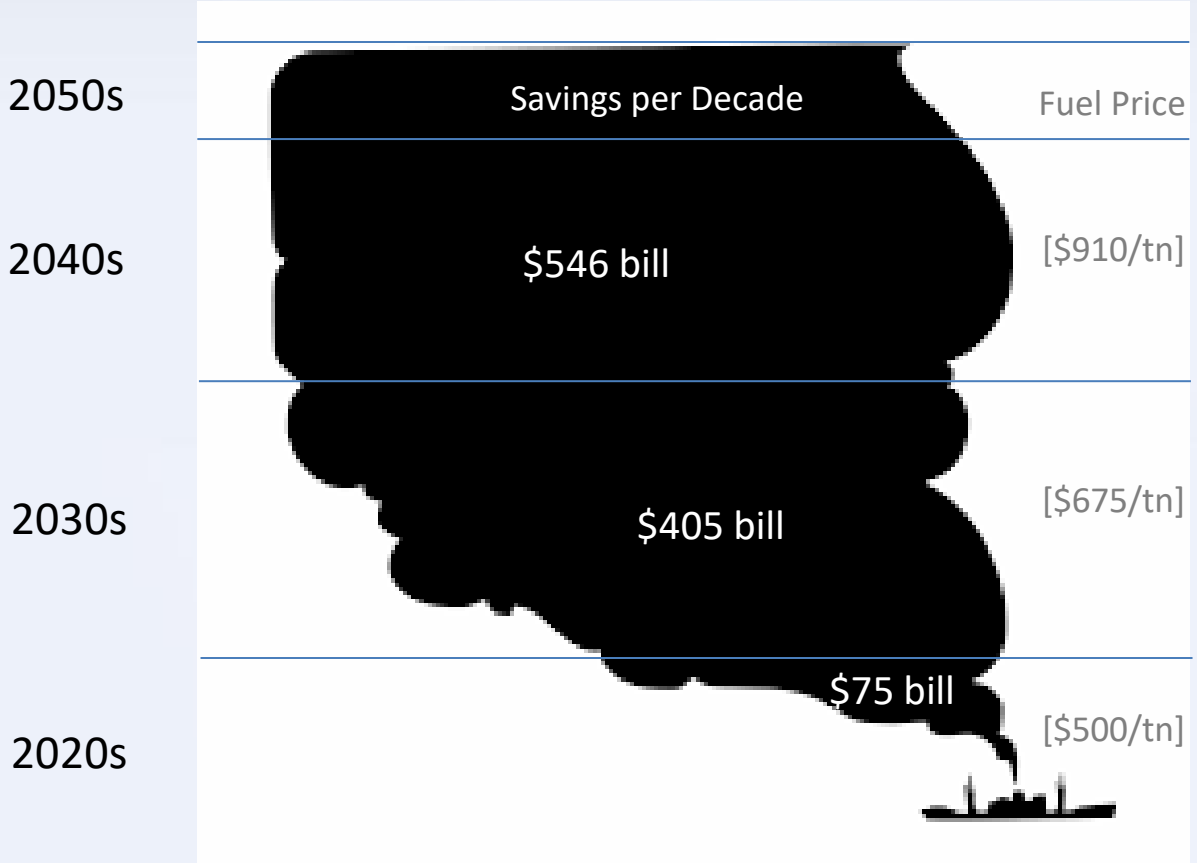
Wind	+	Activity	+	Vessel	+	Eco-fuels
Wind –assist or Primary wind power (Primary Renewable)		Operational optimisation		Vessel optimisation		Renewable energy or waste-derived fuels (Secondary Renewables)
-retrofit wind-assist (5-20% savings – possible up to 30%) -newbuild primary wind 50%++ -today's tech +optimise & cheaper -lease/OPEX approach		-voyage & fleet management -weather routing -speed reduction -virtual arrival -crew training -data/ blockchain -new business models etc.		-design -size & capacity -energy management system -energy efficiency measures -air lubrication -reduced engine power etc.		-2nd gen biofuels -batteries -synthetic fuels + CCS -bio-gas/liquids -H2 & H2 carriers *Electric propulsion systems enables modular approach
20-30%	+	20%	+	20-30%	+	20-40%

Note: All figures are estimates. Any one measure in each category could provide a significant % of the proposed total.

IWSA International Windship Association

The Shipping Decarbonisation Challenge….

Could Wind Propulsion Fund the Decarbonisation Transition of the Fleet?



- *Static fleet size*: 60,000
- *Fuel:* 300mill tn/yr
- *CO2*: 1bill tn/yr
- *Price*: $500/tn (VLSFO/04 May 21)
- *Increase*: 35%/decade from 2030s
- *Wind*: 20% (inc. operation change)

NOTE: No IRR/Currency rates etc included

UMAS/ETC Report
IMO2050 (50%) = $1trill
100% Decarbonisation = $1.4-$1.9 trill

[$1.4 trill = 23 mill per ship]

WPT cost = $5 mill/ship = **$300bill**
+ Reduce total cost by 10-20%

$300 bill invested (2020s+) = **$1trillion**+ savings by 2050 + lowers total cost to **$1.1-1.7 trillion**

Large Vessel Installations

2021: 20 Ocean Going Vessels with Wind Propulsion Technology (WPT) installed

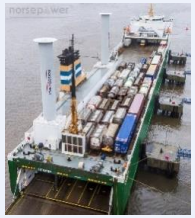
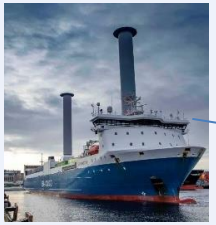
& 1 Wind-ready + more than 20 small sail cargo, fisheries & cruise vessels in operation

2022/3: 40-50 Ocean Going Vessels with WPT installed + Robust R&D pipeline

2030: Up to 10,700 WPT installations (10-15% of global fleet) EU commissioned report 2016/17

2050: 37,000 – 40,000 vessels with WPT (40-45% of global fleet) UK Clean Maritime Plan Research 2019





Current Installations
Tankers x 2 (1 x pending new build) 1 x VLCC, 1 x LR2 Tanker
Bulkers x 2 (+1) (2 x pending) 1 x VLOC, 1 x Ultramax 1 x Kamsarmax (wind ready)
RoRo x 2 (1 x pending new build)
Ferry/Cruise x 3
General Cargo x 5 (2 x pending) Various sizes: 2–12,000dwt
Fishing Vessels x 1

NOTE: More large WPT vessels currently in operation than all new alternative fuelled ships combined (excluding tankers & LNG/LPG)







IWSA International Windship Association

Win-Win-Wind Propulsion….

www.wind-ship.org

Gavin Allwright
secretary@wind-ship.org

Charting a Course for Decarbonizing Maritime Transport

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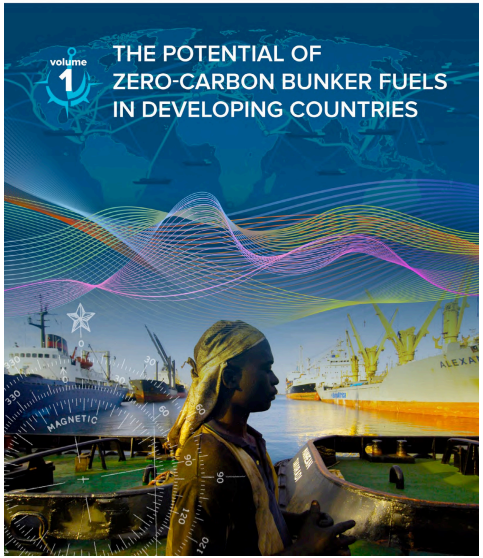
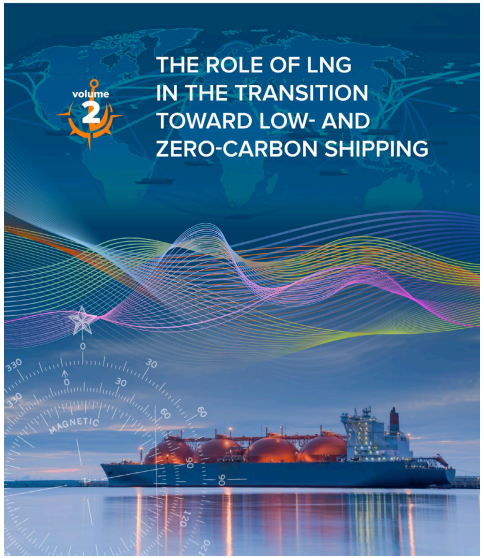
Edoardo Casarotto, WB Maritime and Shipping Consultant
T&E "How to decarbonize shipping by 2050?"
Tuesday, 6 July 2021

Key references

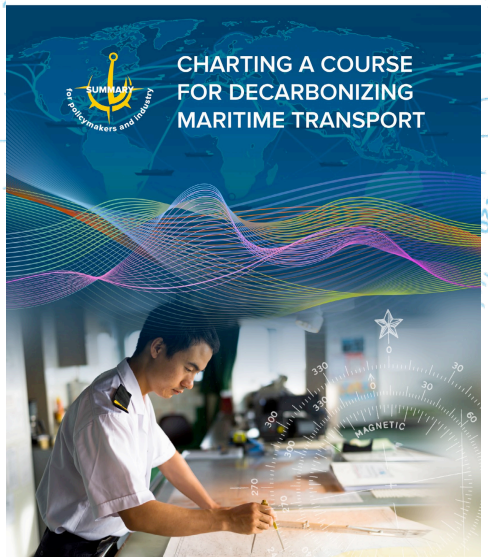
Volume 1:
Zero-carbon bunker fuels



Volume 2:
Role of LNG



Summary
for Policymakers and Industry



Key findings

1 Development opportunities – Major opportunities for countries in decarbonizing shipping

2 Ammonia and hydrogen – Most promising zero-carbon bunker fuel options to date

3 Role of LNG – Limited role as a fuel, more important role as a feedstock

Our journey

1. Development context
2. Emissions challenges
3. Alternative fuels
4. Development opportunities
5. Implications

Around the world: shipping as a development issue

Key enabler for developing economies

15 out of
the 20 largest ports

9 of the top 10
ship registries

1.2 million
jobs

Shipbreaking

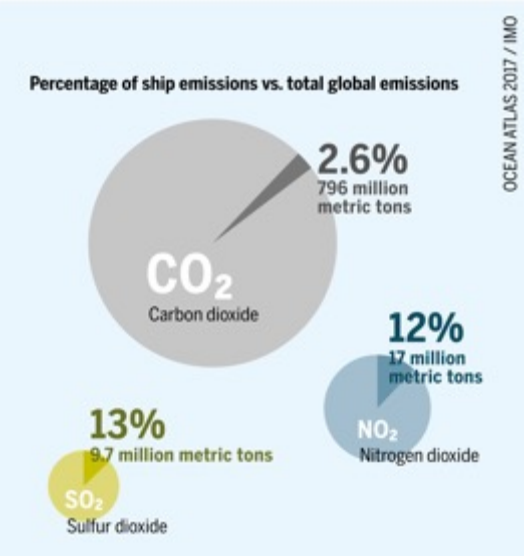
Crucial lifeline
for SIDS

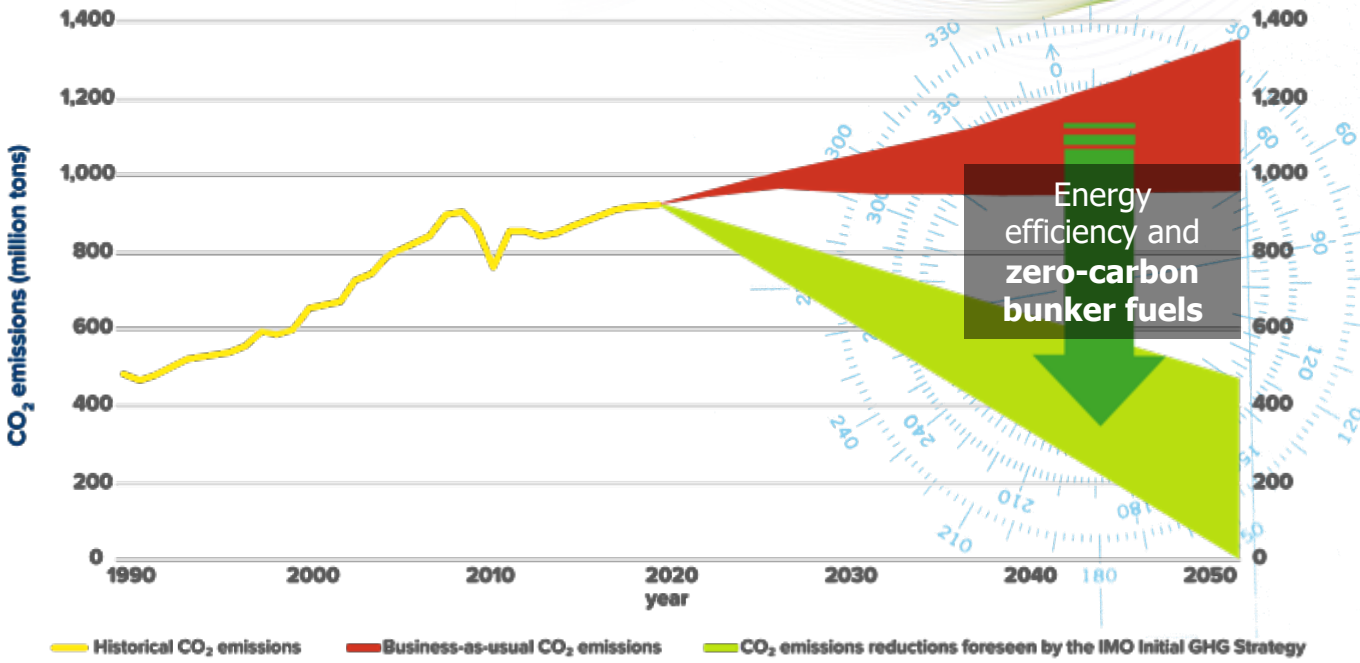
and more…

Our journey

1. Development context
2. Emissions challenges
3. Alternative fuels
4. Opportunities for client countries
5. Implications

Forward lookout: shipping's emissions trajectory





Source: Heinrich Böll Foundation, Ocean Atlas (2017)

Source: Own graph, based on the Fourth IMO GHG Study (2020)

Our journey

1. Development context
2. Emissions challenges
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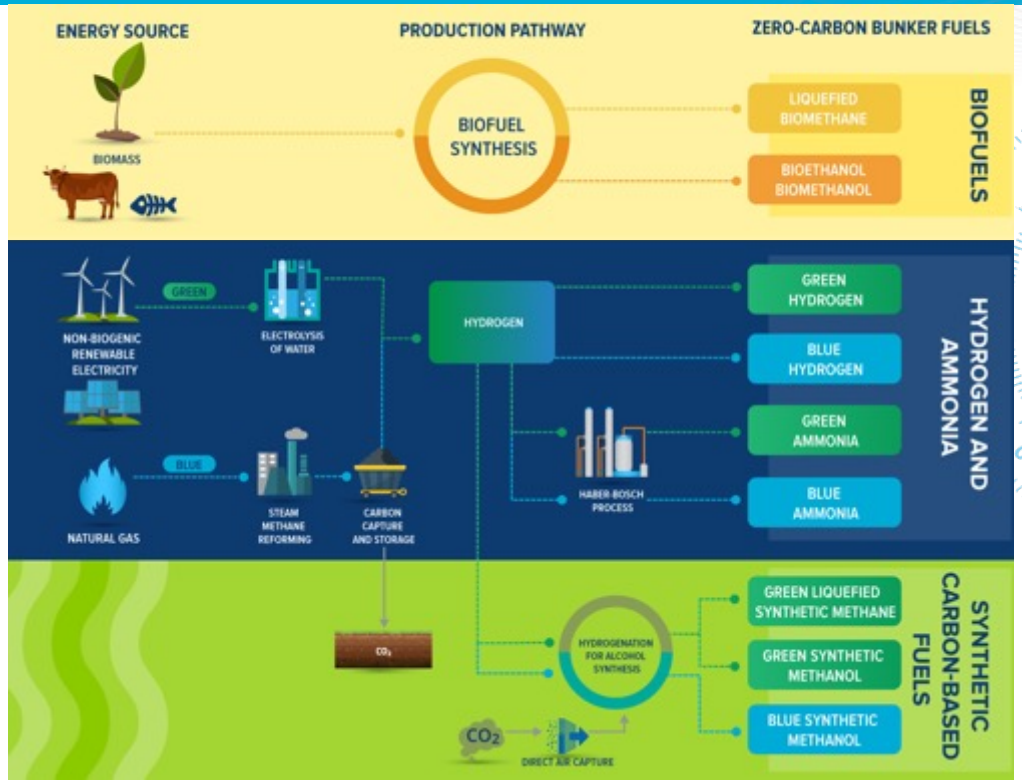
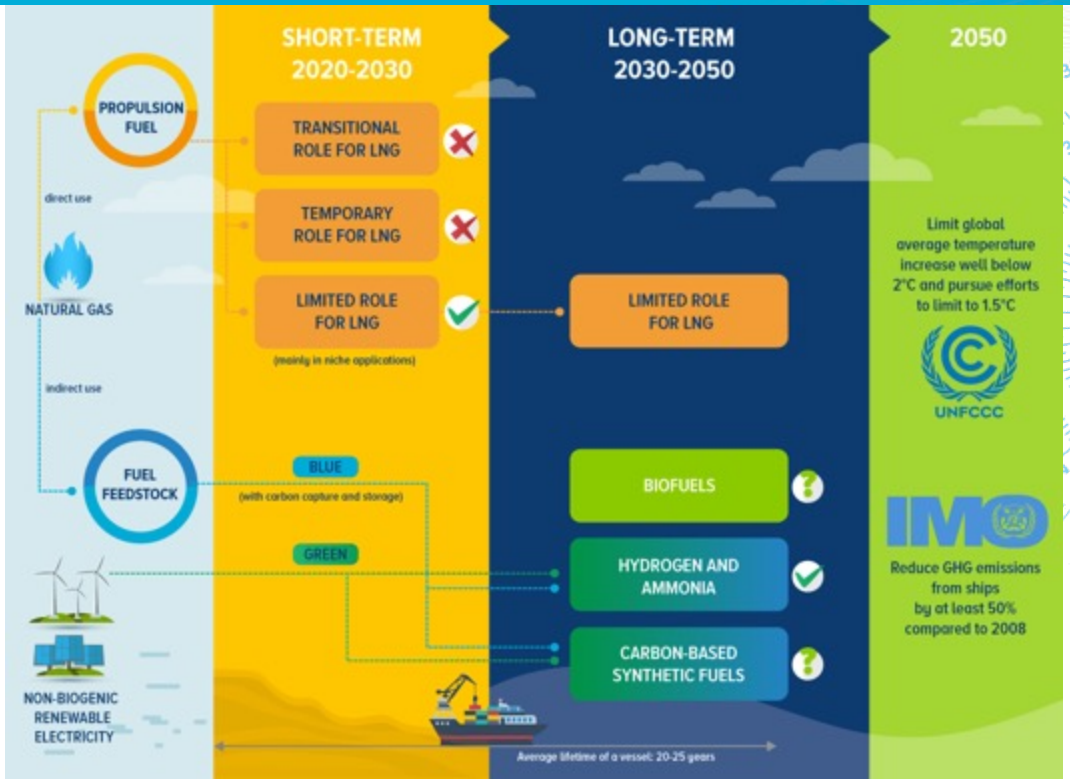
4. Opportunities for client countries
5. Implications

On the horizon: zero-carbon bunker fuels



Navigating the shallows: the role of liquefied natural gas

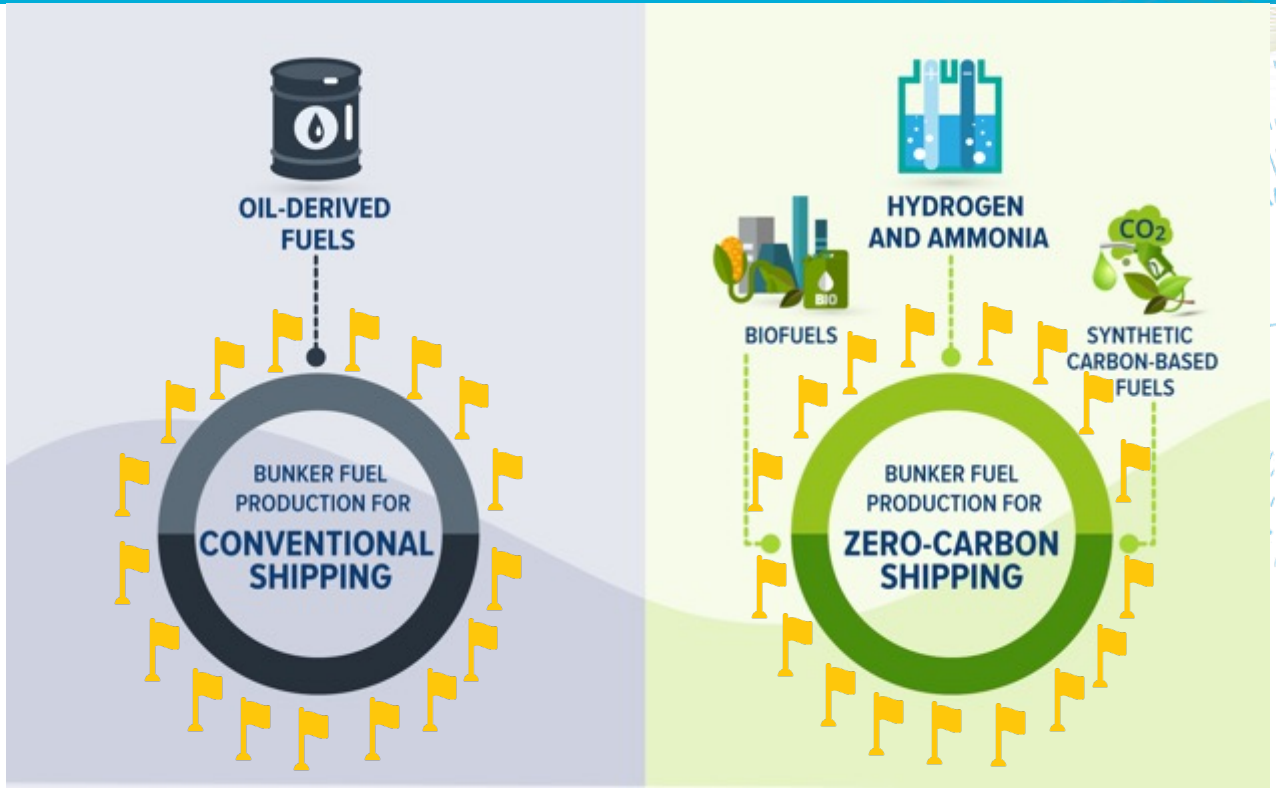


Our journey

1. Development context
2. Emissions challenges
3. Alternative fuels
4. Opportunities for client countries
5. Implications

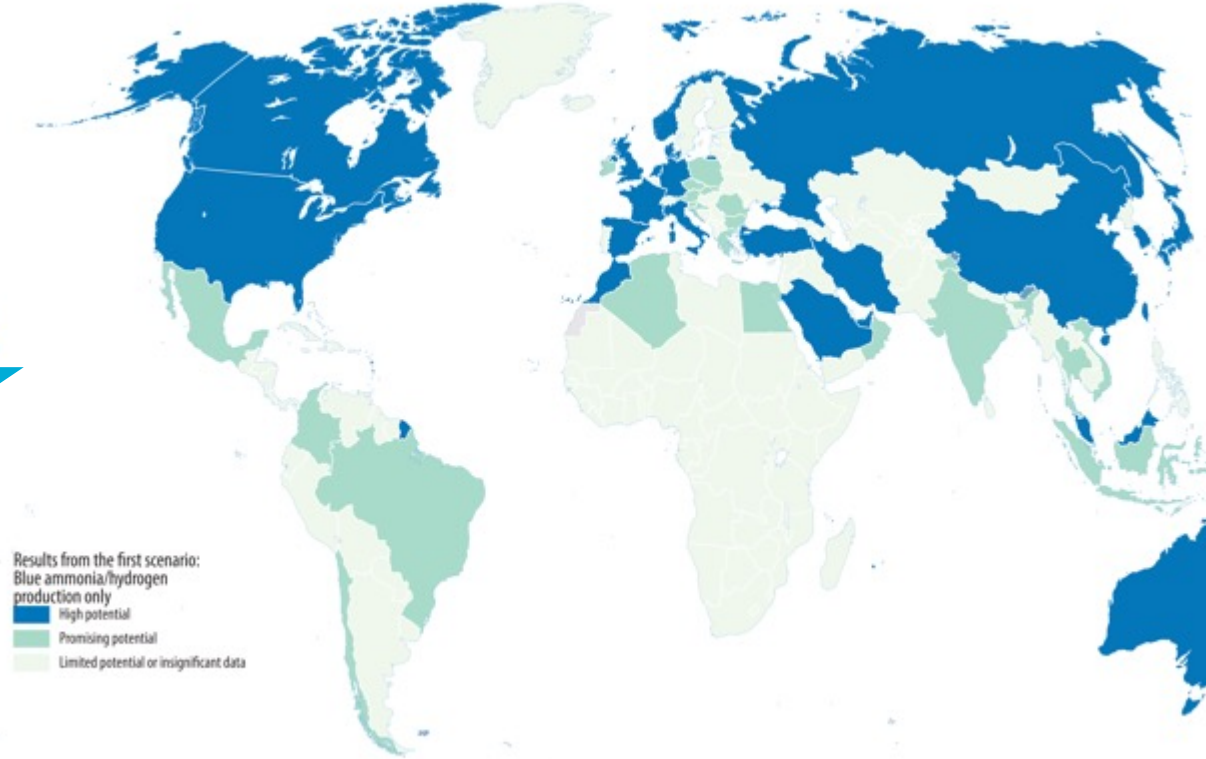
Turning tides: realignment of the fuel market

Country with no or insignificant oil reserves, but large renewable energy resources



Setting sail: the potential for blue ammonia/hydrogen for ships

Blue ammonia only



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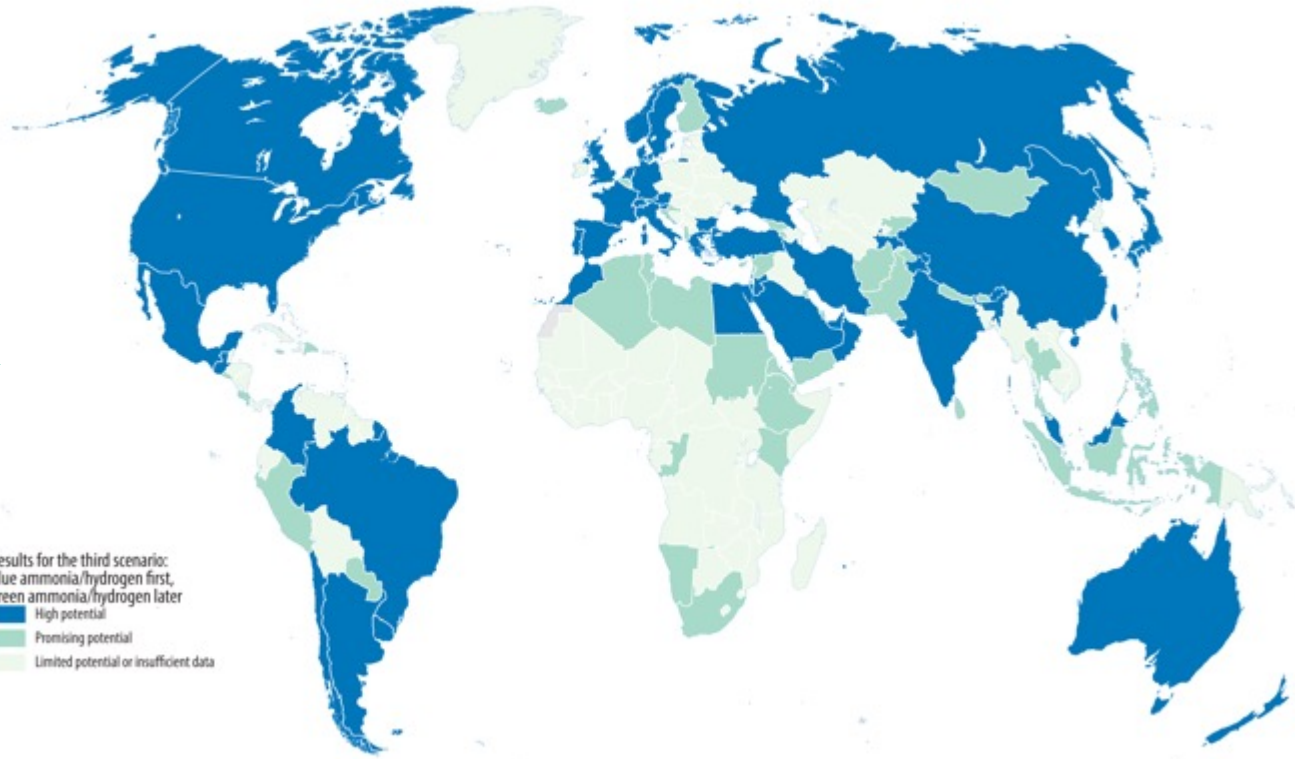
Setting sail: the potential for first blue, then green ammonia/hydrogen for ships

First blue, then green



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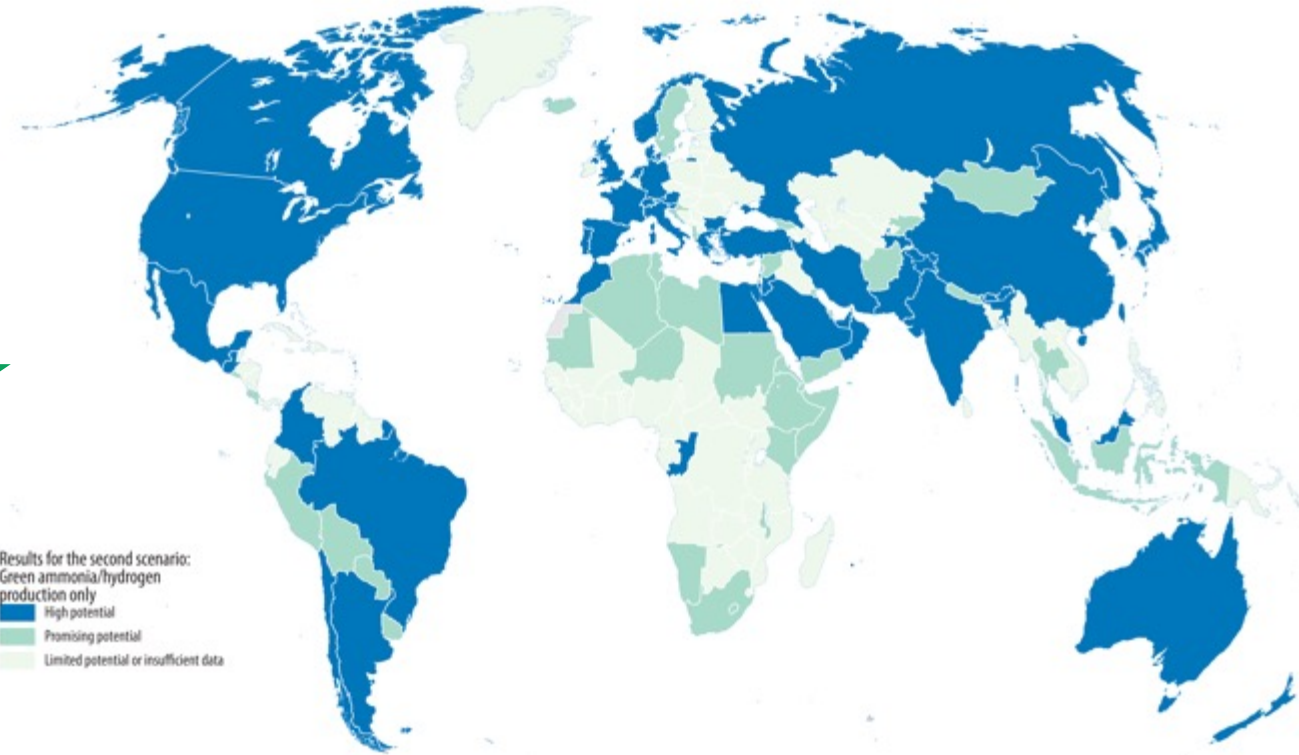
Setting sail: the potential for green ammonia/hydrogen for ships

Green ammonia only



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“Treasure Island”: wider development benefits

Our journey

1. Development context
2. Emissions challenges
3. Alternative fuels
4. Development opportunities
5. Implications

Charting a course: key implications for policymakers and industry

Public policies

Full lifecycle GHG perspective

"No-regret" options

Constructive collaboration

Main findings: (1) Development opportunities - (2) Ammonia and hydrogen - (3) Role of LNG

Policymakers

Industry

Charting a course: the catalytical role of governments

Internationally

Nationally

Create a level playing field and raise revenues	Enhance regulation	Initiate pilot and demonstrator projects	Scale up renewable energy production	Leverage public procurement and provide offtake certainty
Meaningful carbon price on bunker fuels, and strategic revenue use	Energy efficiency standards, port regulation, etc.	Direct subsidies, concessional loans, guarantees, fiscal incentives, etc.	Feed-in tariffs, priority dispatch, etc.	Green public tenders, offtake guarantees, etc.

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Thank you.

ecasarotto@worldbank.org