UNEP Shipping

Electrification of shipping

TRANSPORT & ENVIRONMENT

T&E:

26 Countries

61 Members

5 National experts

Founding member of CSC

AirClim
Air Pollution & Climate Secretariat

BELLONA

CLEANAIR
TASK FORCE

Carbon
Market
Watch

eia
environmental
investigation
agency

NABU

Stichting
De Noordzee

SEAS AT RISK

Ocean
Conservancy

TRANSPORT &
ENVIRONMENT

Founding member of Clean Arctic Alliance

HFO-FREE ARCTIC

90 NORTH UNIT
OCEAN WILDLIFE CONSERVATION

AirClim
Air Pollution & Climate Secretariat

BELLONA

CLEAN AIR TASK FORC

GREENPEACE

ecodes
tiempo de actuar

European Climate Foundation

ALASKA WILDERNESS LEAGUE

GLOBAL CHOICES

THE ALTAI PROJECT

eia
environmental investigation agency

NABU

NÁTTÚRUVERNDARSAMTÖK ÍSLANDS

INTERNATIONAL CRYOSPHERE CLIMATE INITIATIVE

Ocean Conservancy

WWF

SURFRIDER FOUNDATION EUROPE

Stichting De Noordzee

STAND .earth

SEAS AT RISK

TRANSPORT & ENVIRONMENT

OCEAN TEMPERATURE INCREASE

As climate change has warmed the Earth, oceans have been increasing their temperature.

OCEAN ACIDIFICATION

Increasing amounts of carbon dioxide (CO_2) in the oceans combined with seawater produces carbonic acid, increasing the acidity of the water.

SEA LEVEL RISE

Climate change is causing the oceans to heat up, melting polar glaciers, resulting in rising sea levels.

CHANGES IN OCEAN CURRENTS

Increasing ocean temperatures and significant amounts of melting fresh water may result in a slowing of the ocean conveyor belt, altering oceanic current patterns, changing global weather conditions and disrupting marine food webs.

EXTREME WEATHER EVENTS

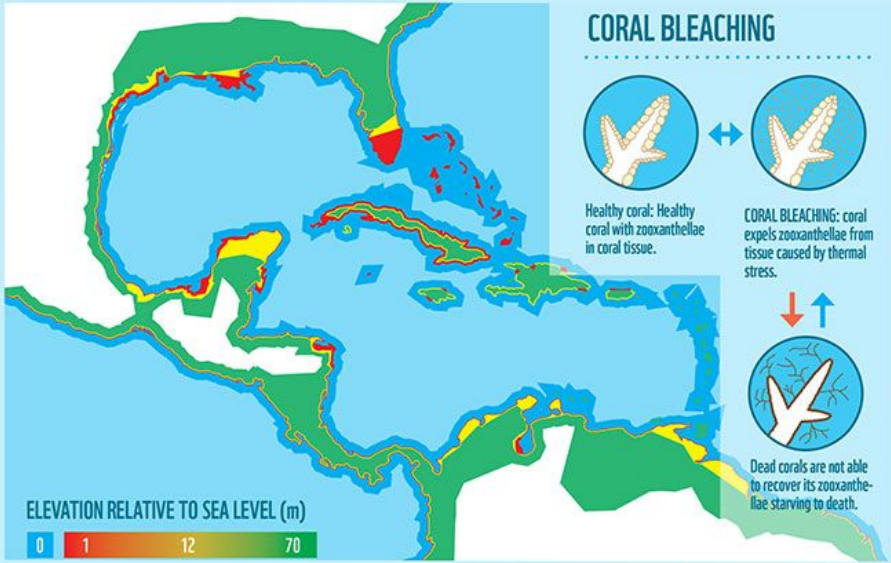
Increasing sea surface temperatures increase evaporation and atmospheric moisture, creating and facilitating environmental conditions for ocean storms to escalate into larger and more powerful systems.

Climate change is affecting the world´s oceans modifying their temperature, nutrient supply, water chemistry, wind systems, and ocean currents, dramatically impacting marine biodiversity. The situation is no different in the Mesoamerican Reef, the second largest reef in the world.

Climate change is exacerbating anthropogenic (e.g., water pollution, land run off, overfishing) and natural (e.g., storms, coral disease) threatening the heart of Caribbean culture and economies.

VULNERABILITY TO SEA LEVEL RISE

Numerous model predictions foresee a sea level rise of 1 additional meter by 2100, which would displace millions of people and would cause billionaire losses in infrastructure.



CORAL BLEACHING

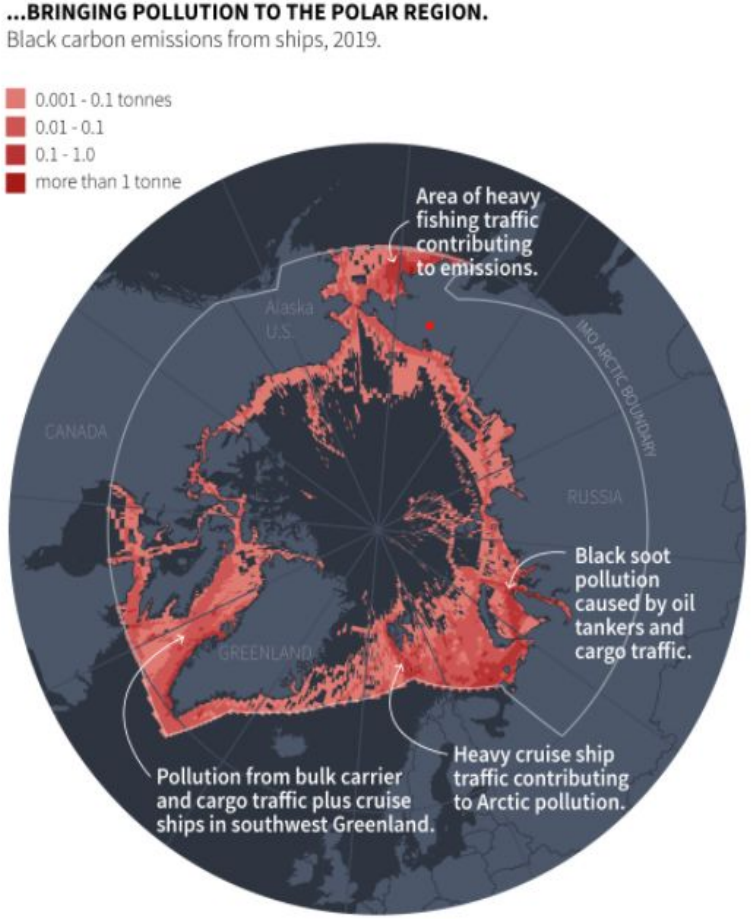
Source: WWF


The shipping industry emits over 1 BILLION TONNES OF CO2
per year

Air pollution from shipping

- ★ 400,000 premature deaths / year
- ★ Tiny airborne particles (PM) cause premature death through lung & heart disease.
- ★ 6.4 Million childhood asthma cases

Source: Sofiev st al. Nature 2018.



Black Carbon emissions from Ships

Problem

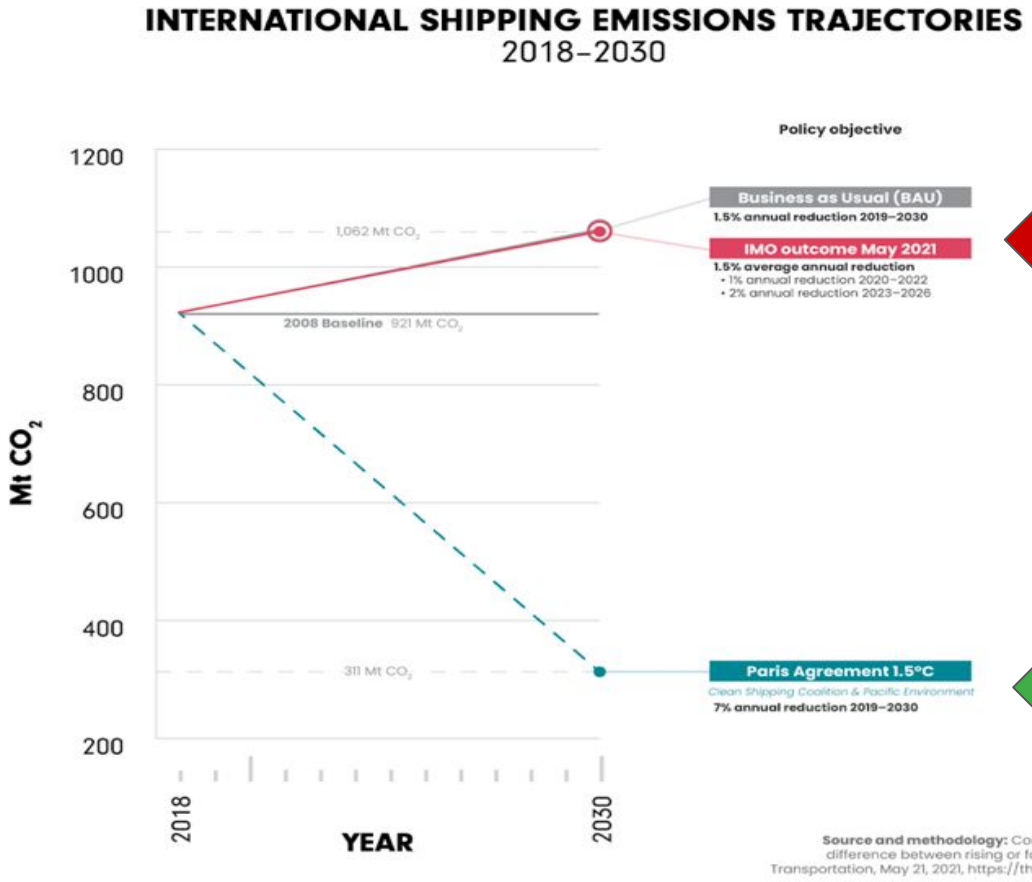
- 7-21% Ship Climate impact

Solution

- Switch to distillate fuels
- Transition to renewable fuels
- Avoid Arctic routes

Policy at IMO

- Decision on distillate fuel switch at Marine Environment Protection Committee next week!



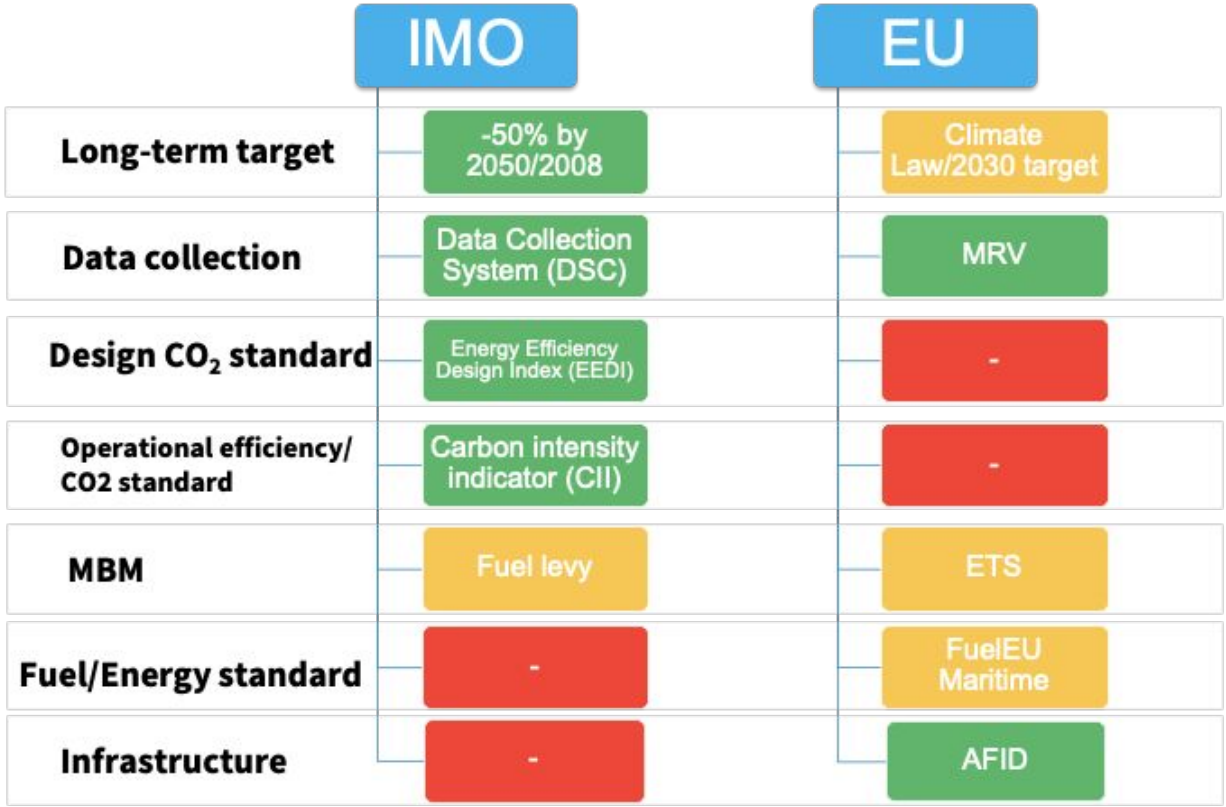
Current proposal at IMO to tackle climate is not aligned with Paris Agreement Goals

We need to reduce emissions 7% a year to meet 1.5ºC goal

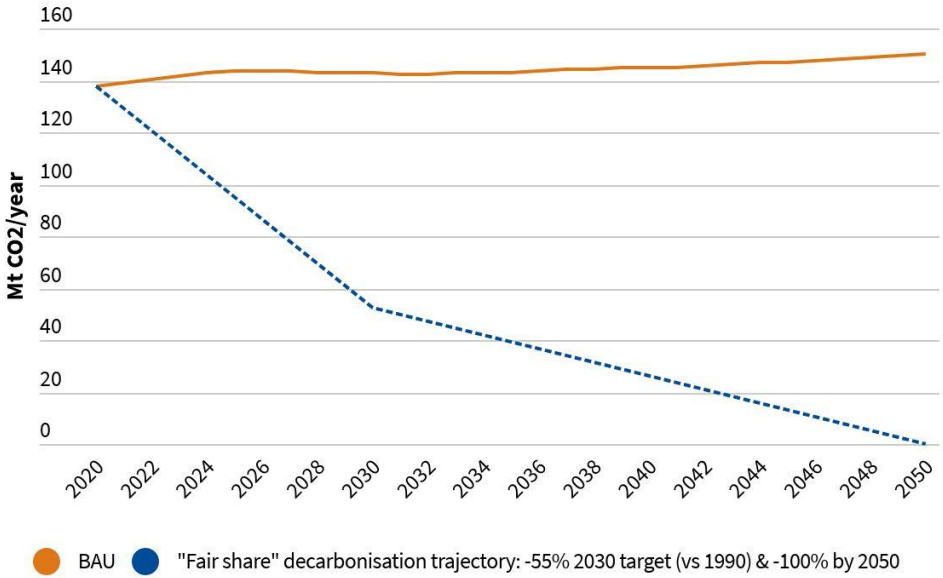
Source: https://theicct.org/blog/staff/imo-carbon-intensity-target-may2021

Shipping Climate Regulation

16



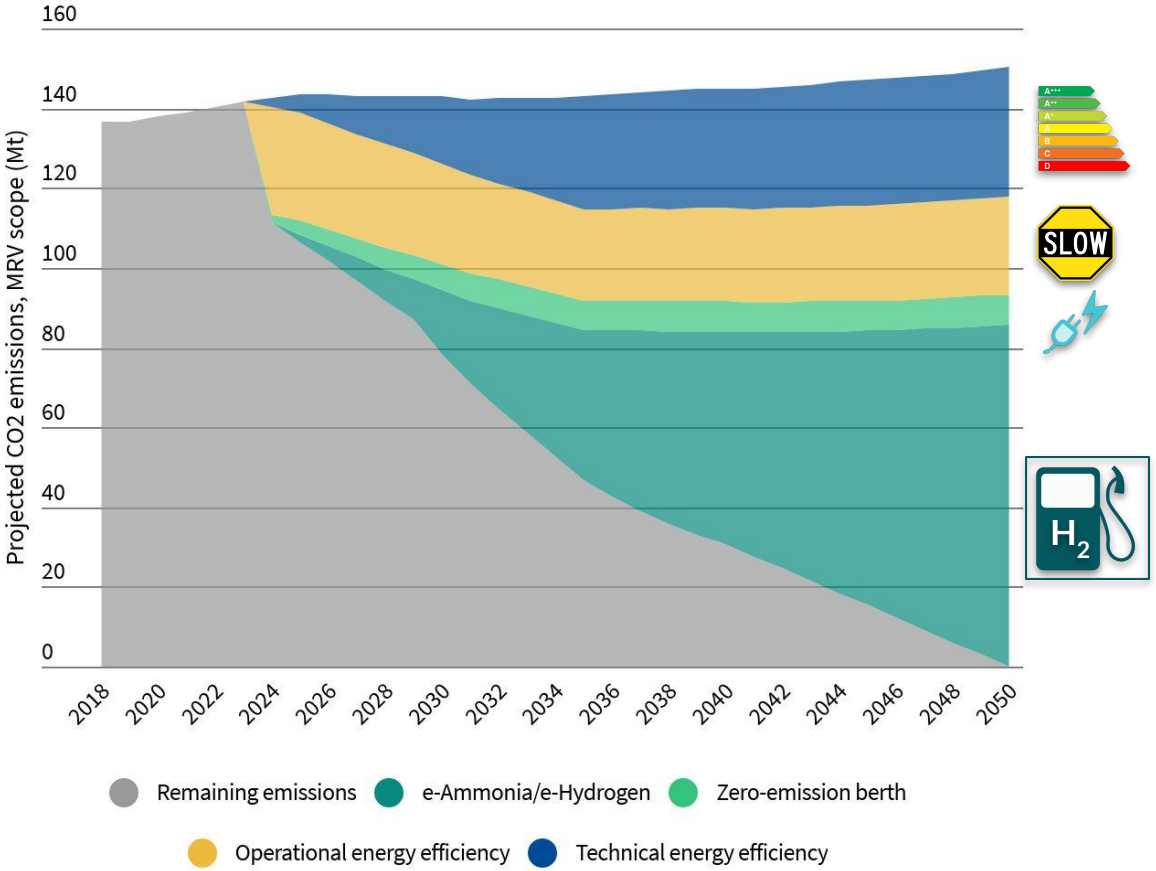
"Fair share" decarbonisation of EU shipping



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 needs to slash 90Mt CO_2/year in the next decade.

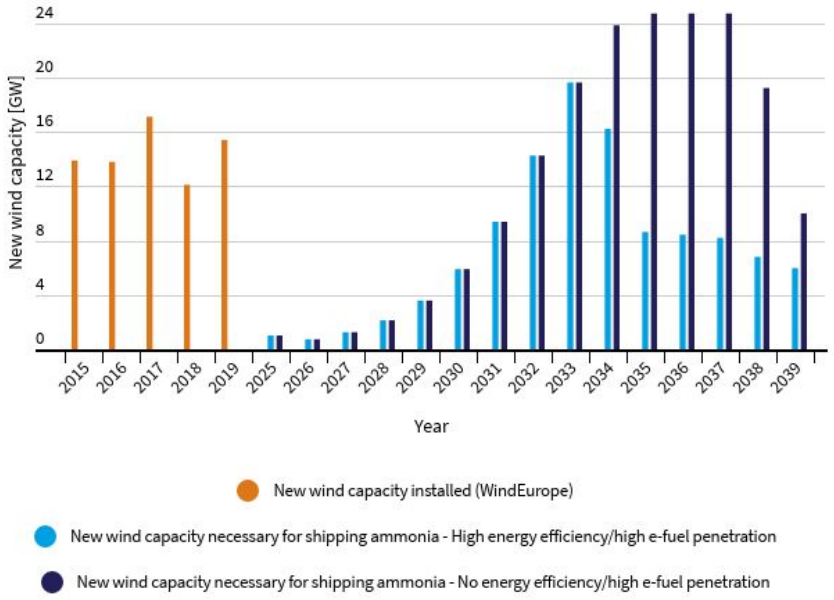
EU ship GHG abatement: efficiency & e-Fuels



Up to 1/3 of maritime GHG can be removed by efficiency alone.

But need e-fuels for the rest.

New wind capacity to install each year for shipping ammonia production

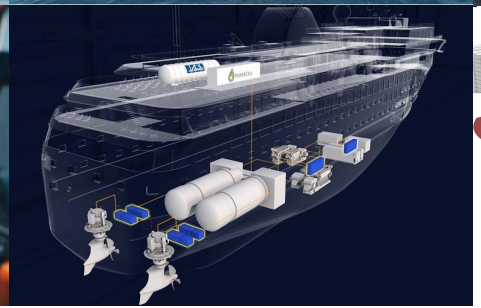


At its peak renewable electricity need, shipping would require to install each year 1.5x the total wind capacity installed in 2019 in Europe.

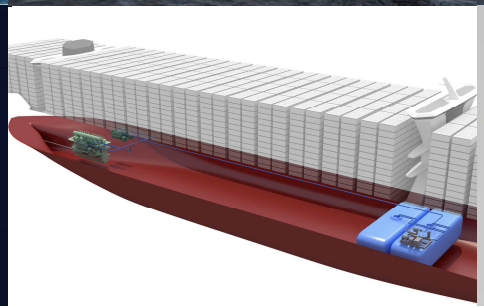
What are the realistic & sustainable technologies?

Battery-electric

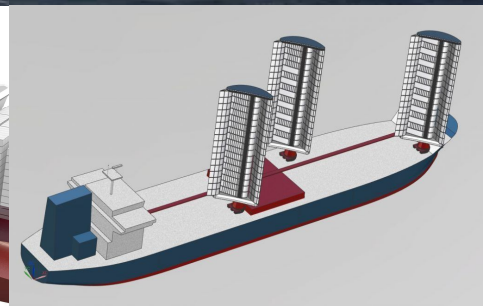
Hydrogen fuel-cells

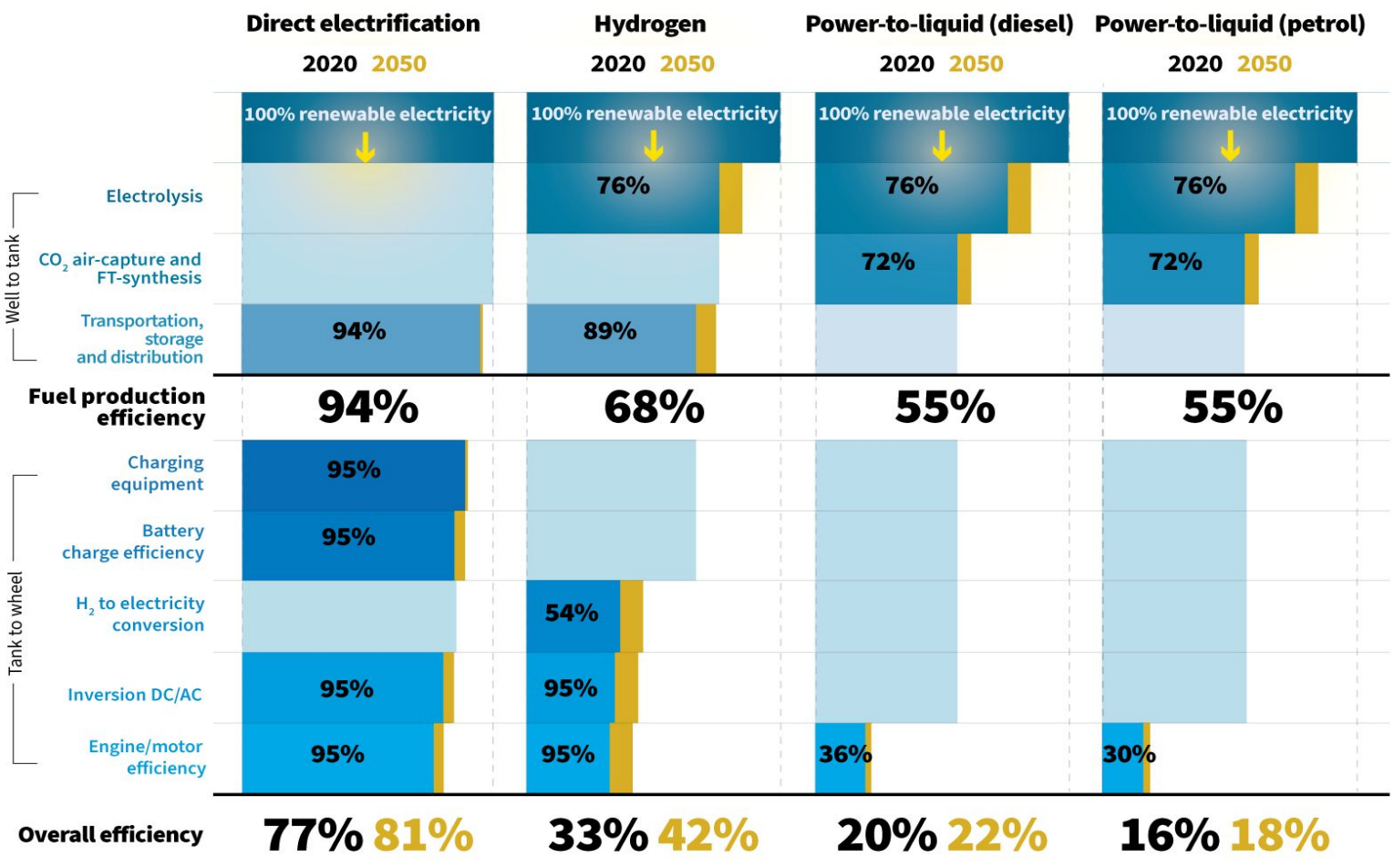


Green ammonia



Wind propulsion

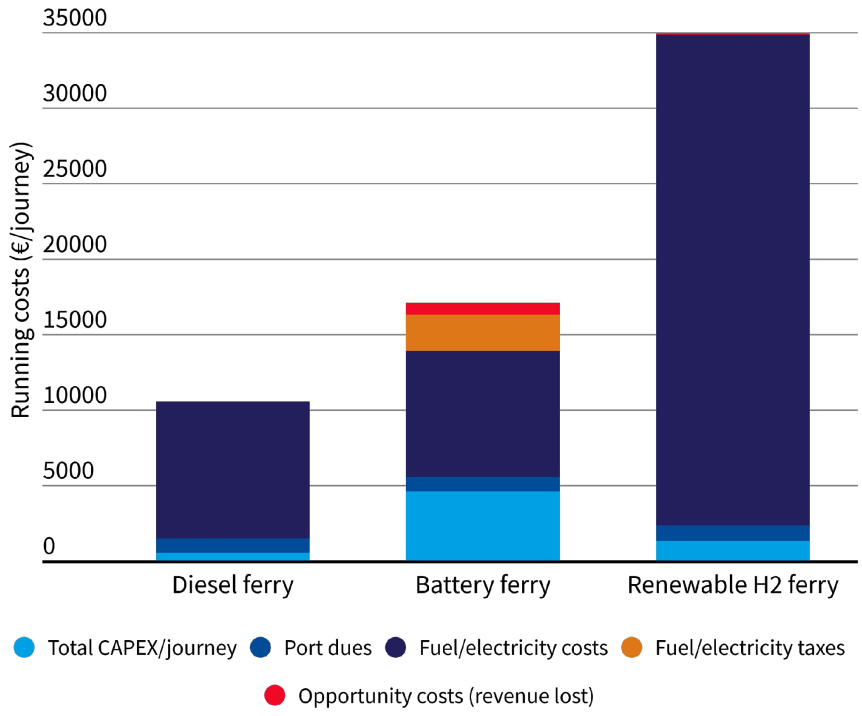




Notes: To be understood as approximate mean values taking into account different production methods. Hydrogen includes onboard fuel compression. Excluding mechanical losses.

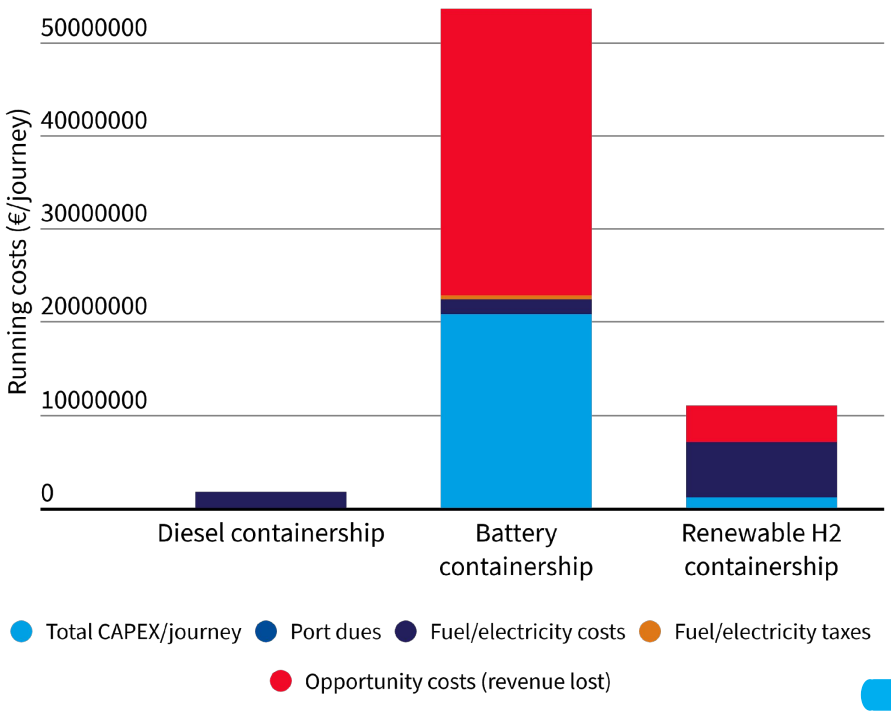
Current limitations batteries for shipping

Rotterdam-Harwich ferry (~230 km distance)



T&E analysis: modelled on per journey operational costs of the Selandia Seaways; based on 25 year ship lifetime, historical operations of 250 days per year and 2 journeys per day with a speed of 18 knots. CAPEX

Singapore-Rotterdam containership (~15,000 km distance)



T&E analysis: modelled on per journey operational costs of the OOCL Hong Kong containership; based on

Barriers

Why isn't the uptake happening on its own?

How to incentivise electrification

Transparency and myth busting

- ★ Technical evidence and data
- ★ Environmental/climate benefits
- ★ Public pressure

Mandates & State aid

- ★ Exclusive licensing for ZEVs
- ★ Public service obligations
- ★ Subsidising ZEVs and shore-side infrastructure

Regulatory corrections

- ★ Electricity tax exemptions for OPS
- ★ Zero emissions at berth standard
- ★ Designate Emission Control Area (ECA)
- ★ Malus schemes: CO2/NOx charges
- ★ Port discounts for clean ships

Infrastructure for electrification / shore power

Ship plugged into shore power

Ship exchanging into containerised battery pack to use for propulsion

Amsterdam goes fully electric

Electric ferry - Ampere - Norway

Electric ferry - Ellen - Denmark

Hybrid electric Cruise ship - Hurtigruten - Arctic

Hybrid diesel electric sailing cruise ship

Battery Electric Inland Barge For Cargo

Ocean Bird hybrid sail cargo

Sailing cargo in Caribbean

Find out more on transition to zero emission shipping in our latest report

Lucy Gilliam

Aviation & Shipping Campaigner

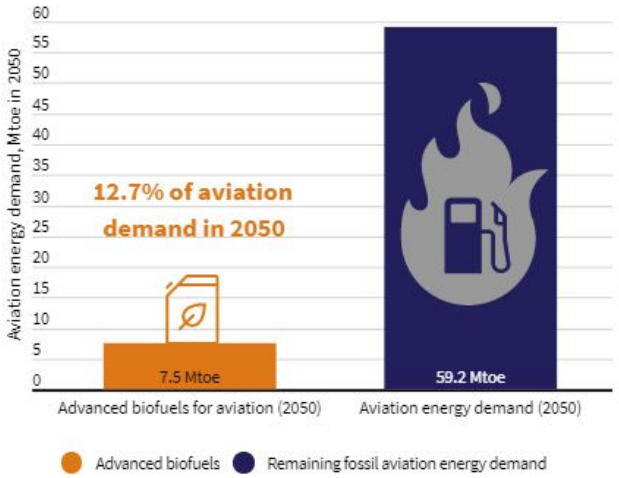
Transport & Environment

TRANSPORT & ENVIRONMENT
transportenvironment.org

This presentation includes icons from Flaticon

The advanced biofuels are too limited

Advanced biofuels won't be enough to decarbonise aviation by 2050

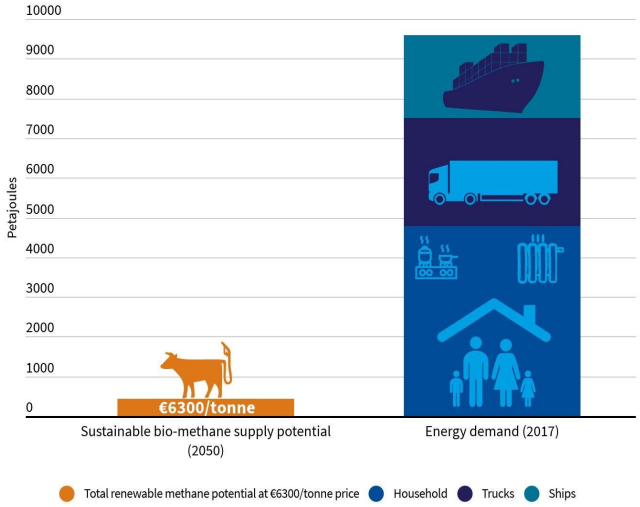


Notes: T&E assumptions for aviation energy demand in 2050 are based on 2016 European Reference Scenario and take into account 150€/tCO2 carbon price and aircraft efficiency improvements. T&E assumes 7.5Mtoe of the available stock of advanced biofuels would be used for aviation.

Focus on scalable technologies: electrofuels & hydrogen

NOT biofuels

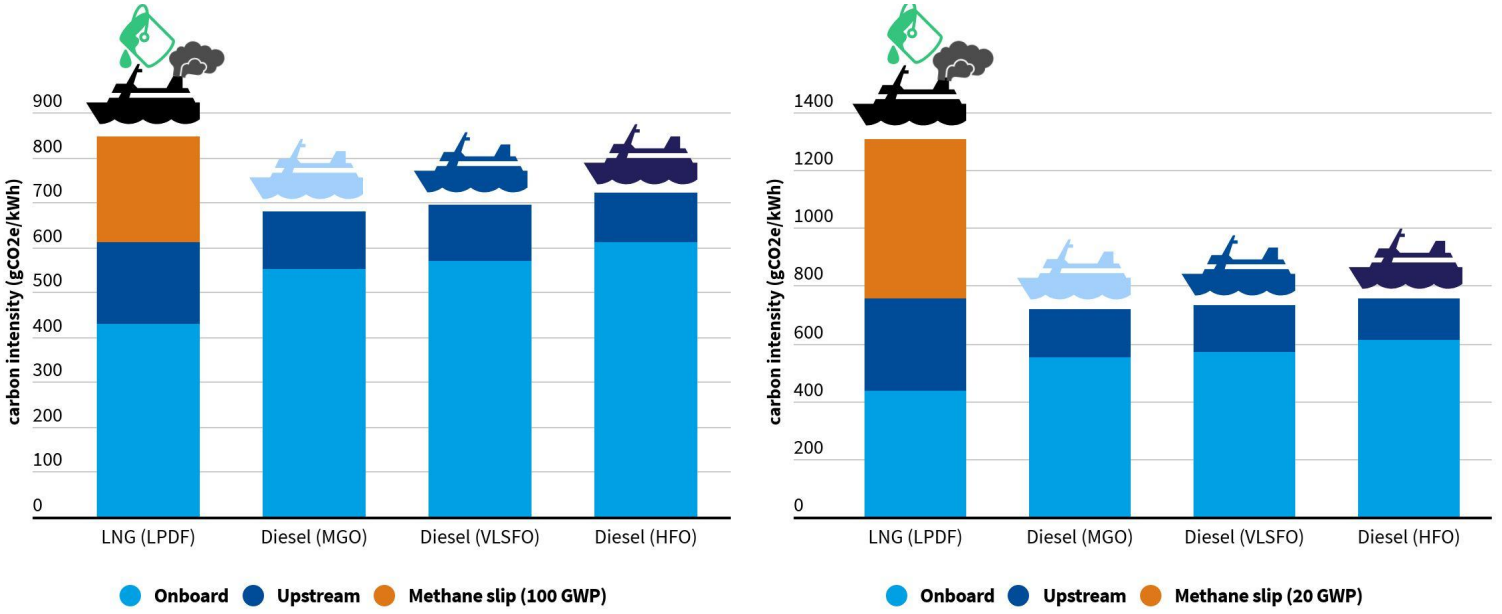
EU 2050 bio-methane potential not even enough for households



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.

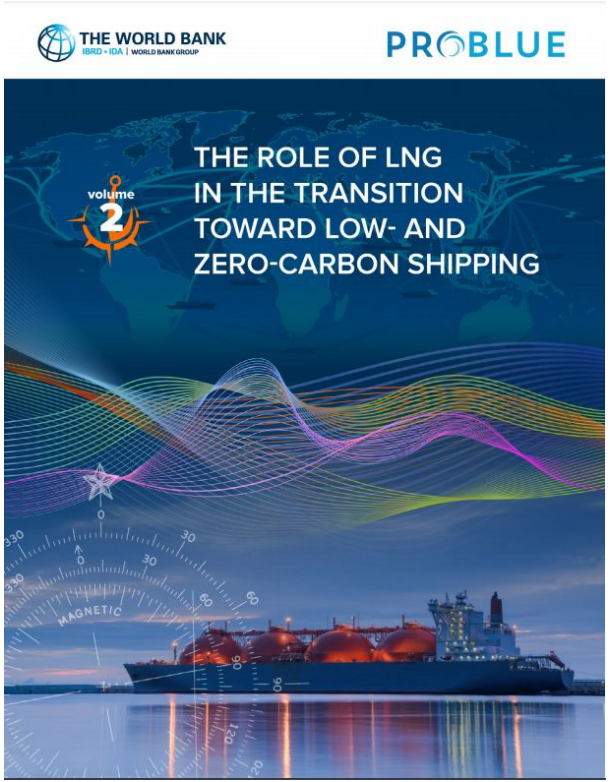
Sources: ICCT (2018), Eurostat (2017), UNFCCC (2017).

No subsidies to LNG ships: cure worse than the disease



Source: ICCT, 2020. **Note**: Medium speed, 4-stroke engines, which are the most wide-spread LNG engines among cruise vessels.

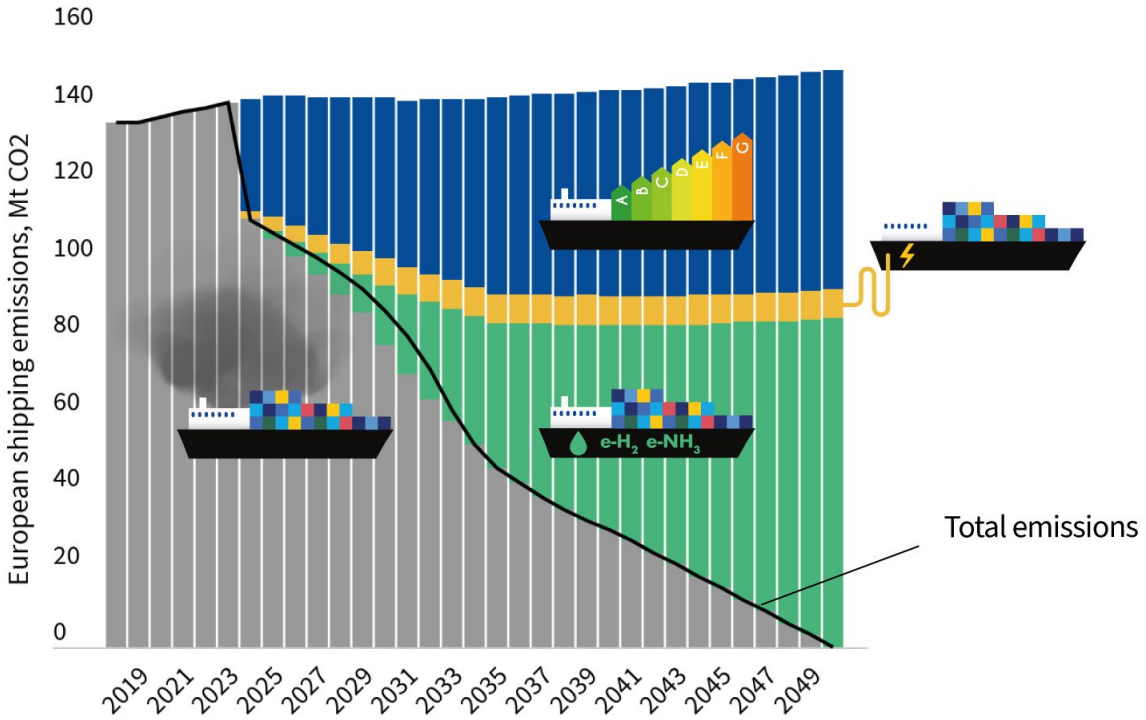
World Bank calls on regulators not to support LNG



"Over concerns about methane leakage, which could diminish or even offset any GHG benefits associated with LNG, and additional capital expenditures, the **risk of stranded assets as well as a technology lock-in**, the report concludes that LNG is **unlikely to play a significant role in decarbonizing** maritime transport."

"The research further suggests that **new public policy in support of LNG as a bunker fuel should be avoided**, existing policy support should be reconsidered, and methane emissions should be regulated."

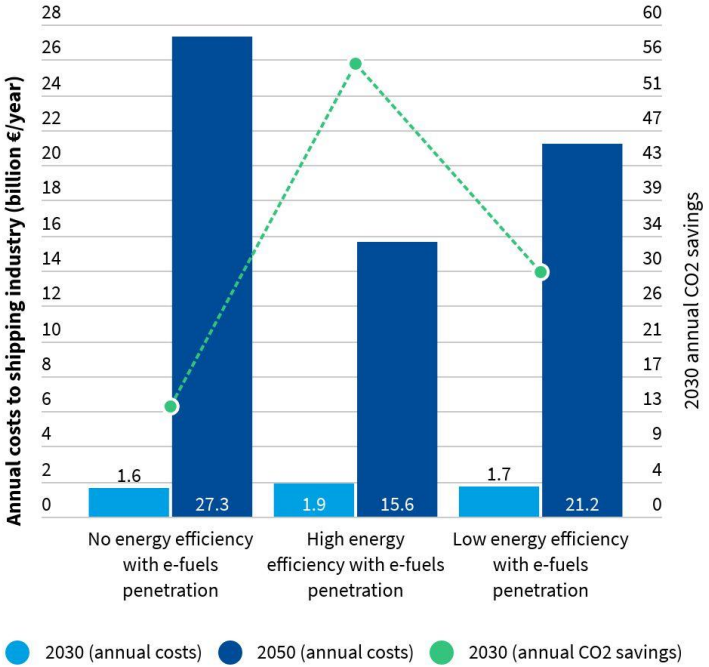
7% e-fuels by 2030 would kickstart the decarbonisation of EU shipping



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

Source: Transport & Environment

Cost-effectiveness of EU ship CO2 abatement under different decarbonisation scenarios



Note: T&E analysis based on MAC curves of the 4th GHG IMO study; green e-ammonia production costs of €606/tonne in 2030 and €519/tonne in 2050 (Ricardo EAE, 2020). Energy efficiency includes, inter alia, wind-assist and slow-steaming. Analysis excludes ship machinery and infrastructure costs.

Combined energy efficiency and e-fuels would save the industry up to 12bn€ to fully decarbonise by 2050

Maritime industry supports green H2 and ammonia

Future of shipping fuel is green hydrogen and ammonia, industry groups tell EU

For immediate release - 4 March 2021, Brussels
Link to PR: https://transenv.eu/3uOzSvE

The EU should promote the use of green hydrogen and ammonia by ships as part of its upcoming maritime fuel law, major shipping industry players and environmentalists have told the European Commission. The FuelEU Maritime initiative will require ships carrying EU trade to progressively switch to sustainable alternative fuels.

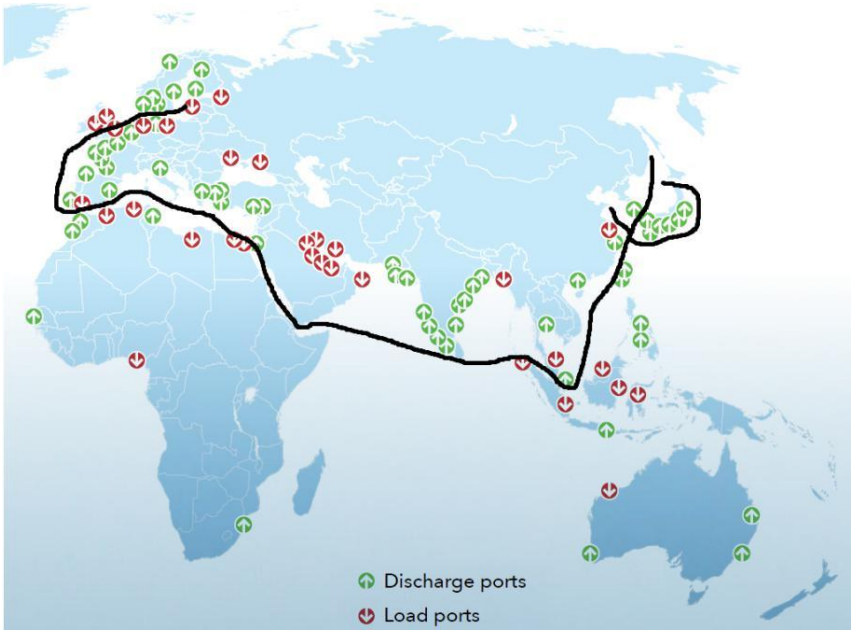
In a letter published today [1], shipping companies DFDS, CMB and Viking Cruises, commodities trader Trafigura, and green group Transport & Environment (T&E) say green hydrogen and ammonia are sustainable and can be produced in sufficient quantities to decarbonise the industry.

Biofuels, on the other hand, do not offer a sustainable alternative for shipping, the groups say, as crop-based biofuels emit more than the fossil fuels they replace and there will not be enough advanced biofuels. Instead, lawmakers must send a clear signal to potential investors to focus on renewable electricity-

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

Major opportunities for Maritime Climate Fund

De-risking initial deployments via contracts for difference (CfD)



Reduce administrative burden

ETS obligation is **limited** to paying for GHG emissions, as opposed to emissions trading.

Compatible with future IMO MBMs

ETS fund mimics a **CO_2 levy**, similar to global fuel proposals by the industry

Learn more: https://www.transportenvironment.org/publications/how-decarbonise-shipping-industry

Insignificant impact of including ETS on consumer goods

Product	Origin	Destination	Distance	Ship CO2 emitted per item	Additional costs with shipping in the ETS with €50/tonne CO2	Old Price in Belgium* without ETS	New price in Belgium* with ETS	Price increase due to ETS
 Banana (single)	Ecuador	Netherlands	10464 km	22 g	0.11000 € Cents	1.200	1.207 €/kg of banana	0.5500%
 iPad (single)	China	Denmark	19327 km	55 g	0.27500 € Cents	550	550.003 €/iPad	0.0005%
 Grain (1 kg)	Brazil	Holland	10416 km	21 g	0.10500 € Cents	0.16	0.161 €/kg of grain	0.6562%
 Diesel (1 litre)	USA	Italy	8575 km	24 g	0.12000 € Cents	1.4	1.401 €/litre of diesel	0.0857%

Source: Estimates made by T&E based on product emissions data from Danish shipping: www.navigatingresponsibly.dk

T&E priorities (in Europe)

Polluter pays principle + De-risking initial deployments via EU carbon markets

Predictable demand for investments in green marine fuel production

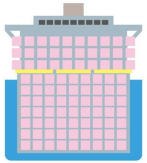
MANDATORY *in use* requirements for ships sailing to the EU.

Refueling infrastructure mandates in ports

MANDATORY *installation* of charging & hydrogen/ ammonia stations in ports.

Ship Types

#: 5,009
CO_2: 22%

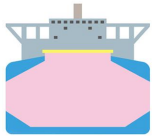


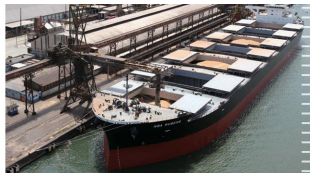
Container ships

#: 7,524
CO_2: 9%

Roll-on/Roll-off (Ro-Ro)

#: 11,435
CO_2: 20%





Bulk carriers

#: 10,973
CO_2: 6%

General cargo ships

#: 12,802
CO_2: 24%

Tankers

#: 477
CO_2: 5%

Cruise ships