



WHEN TRUST MATTERS

Biofuels in shipping

What role can biofuels play in Maritime and what should shipowners consider?

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2023-10-24



A global assurance and risk management company

159
years

~13,000
employees

~100,000
customers

100+
countries

5%+
of revenue in R&D

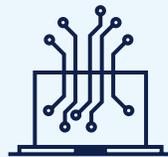
Ship and offshore
classification and advisory



Energy advisory, certification,
verification, inspection and
monitoring



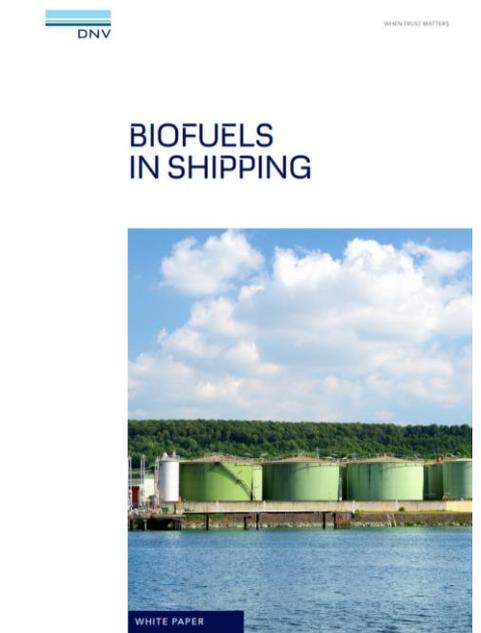
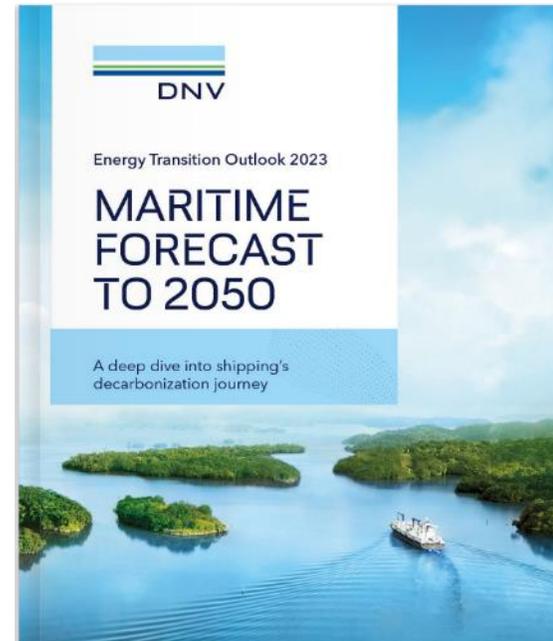
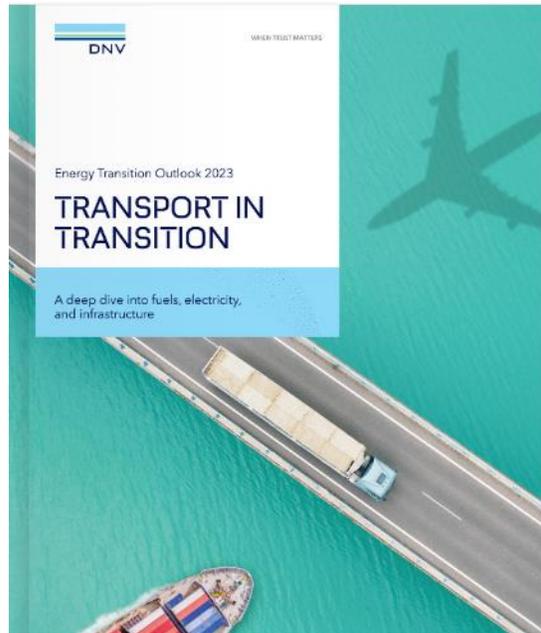
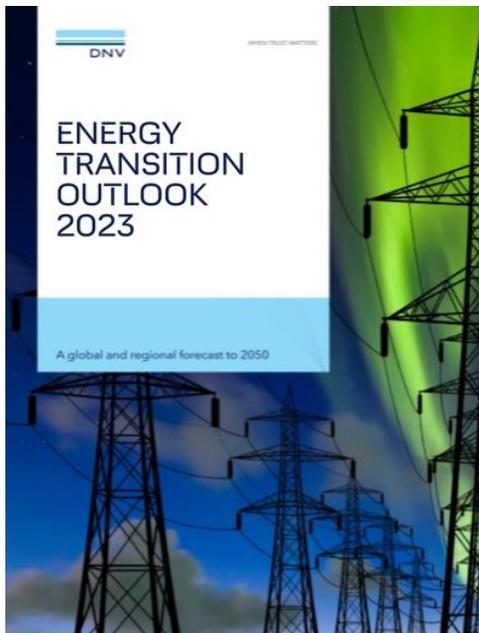
Software, cyber security,
platforms and
digital solutions



Management system
certification, supply chain and
product assurance



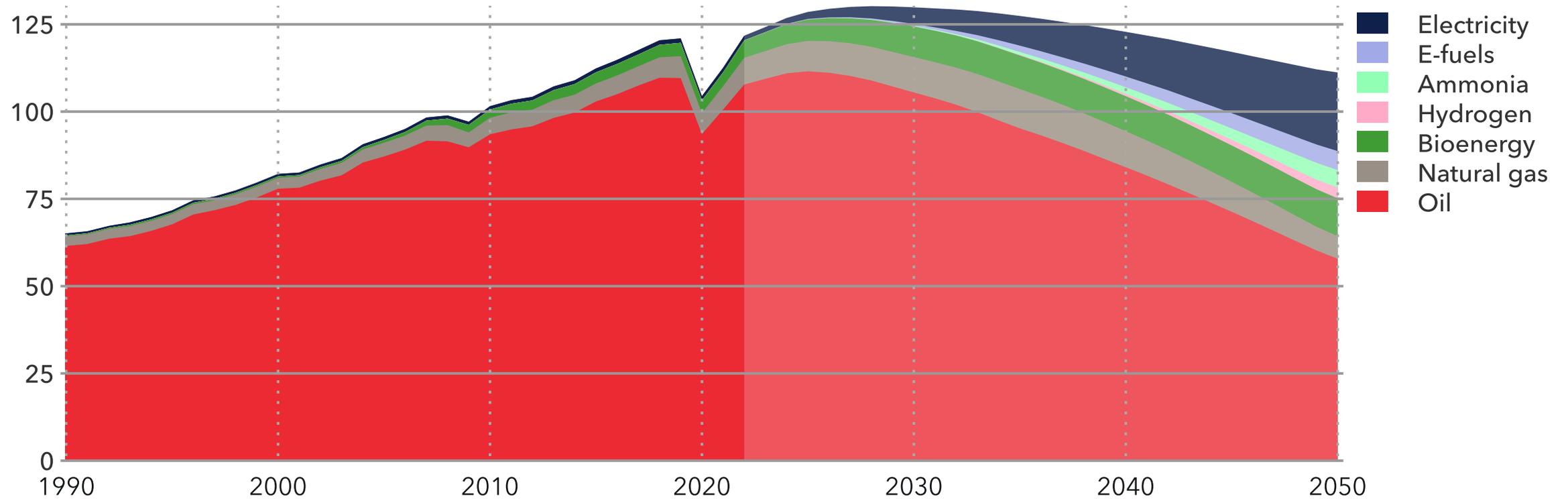
The research behind this talk is available in the below reports from DNV at dnv.com



Where are we going - Efficient electricity makes big inroads in transport, and oil use halves

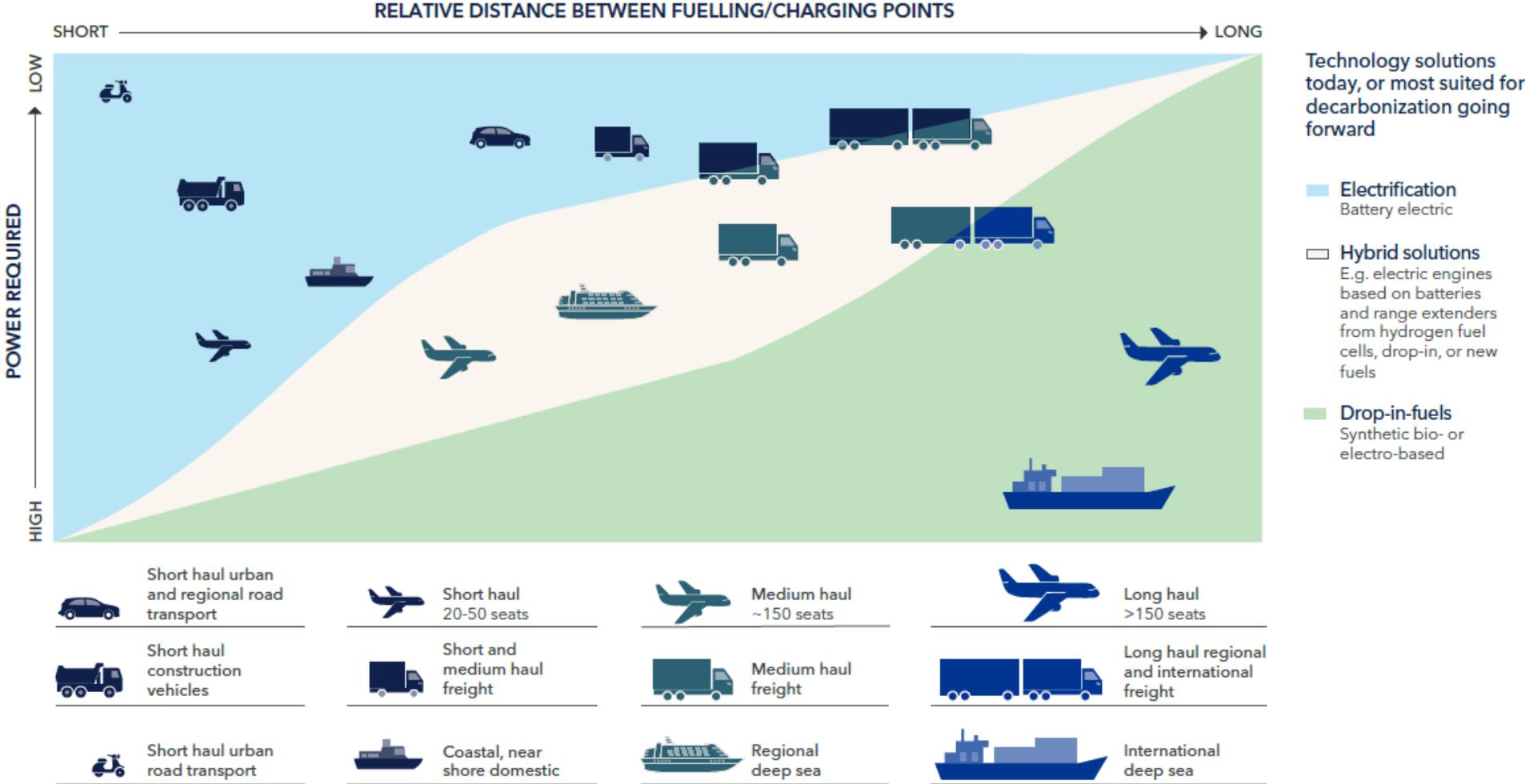
World transport sector energy demand by carrier

Units: EJ/yr



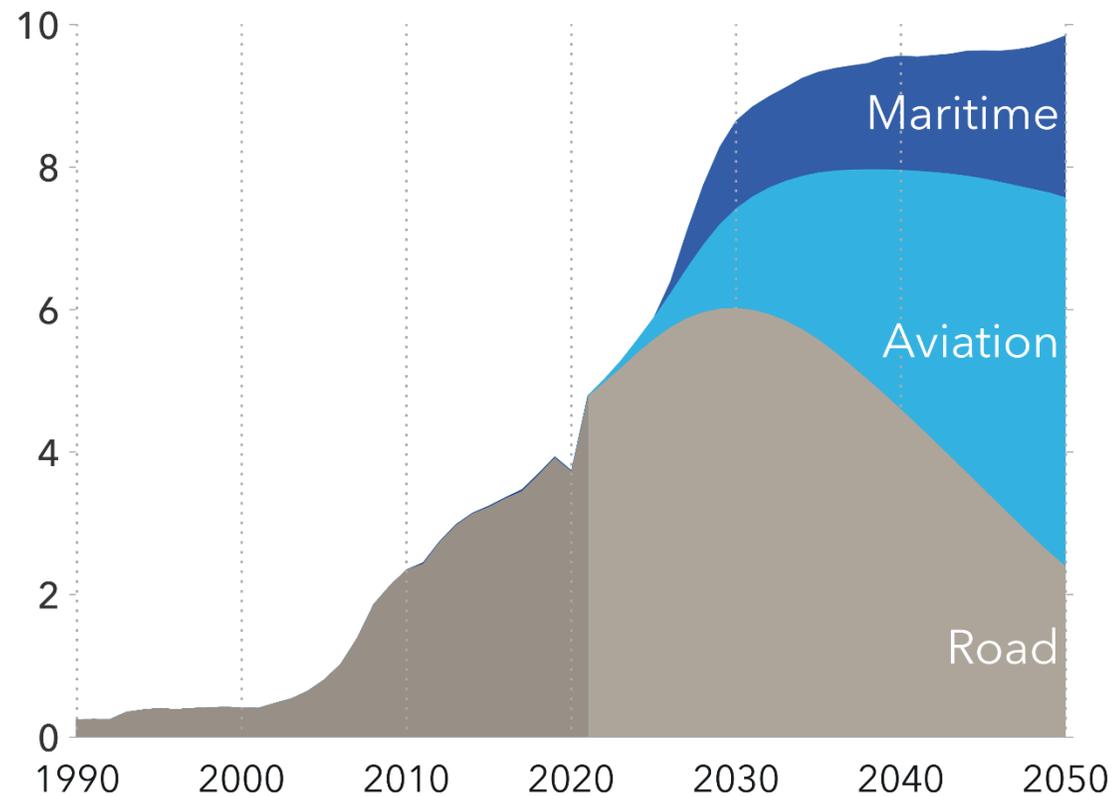
Historical data source: IEA WEB (2023)

Technology and fuel alternatives for transport decarbonization will differ based on application



Bioenergy use in transport

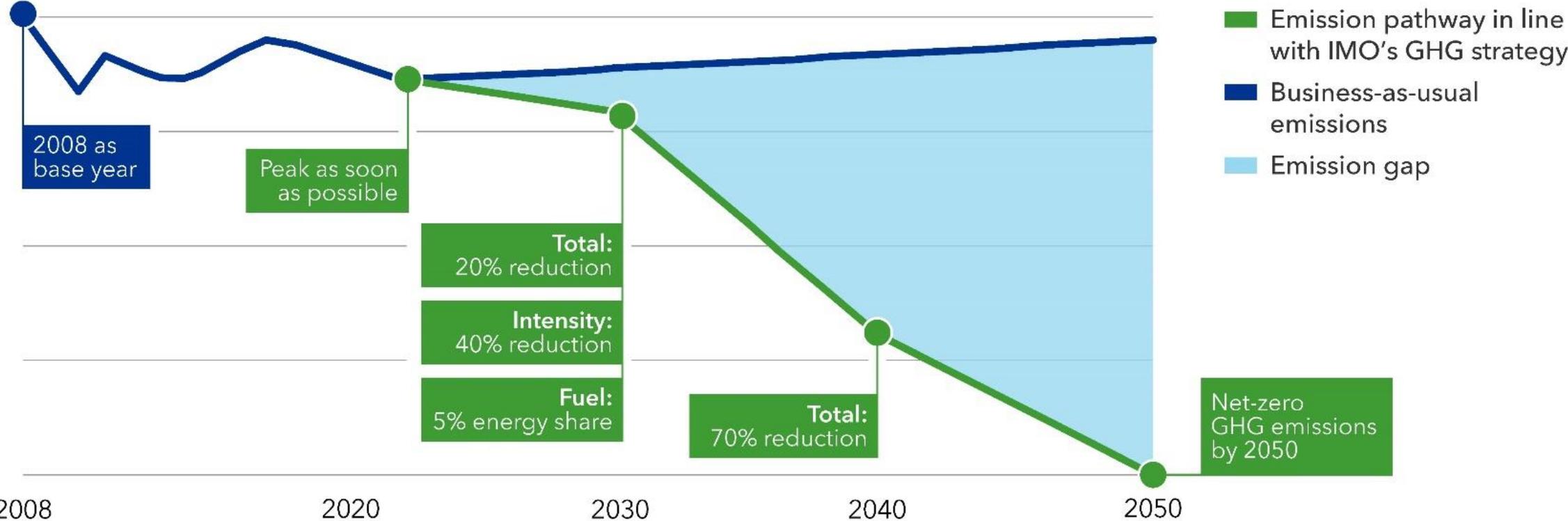
Units: EJ/yr



For hard-to-electrify sectors, Biofuel is a ready-now drop-in fuel, and is set for rapid growth this decade

Focusing on shipping - IMO strategy on reduction of GHG has been made more ambitious in line with Paris agreement

Units: GHG emissions



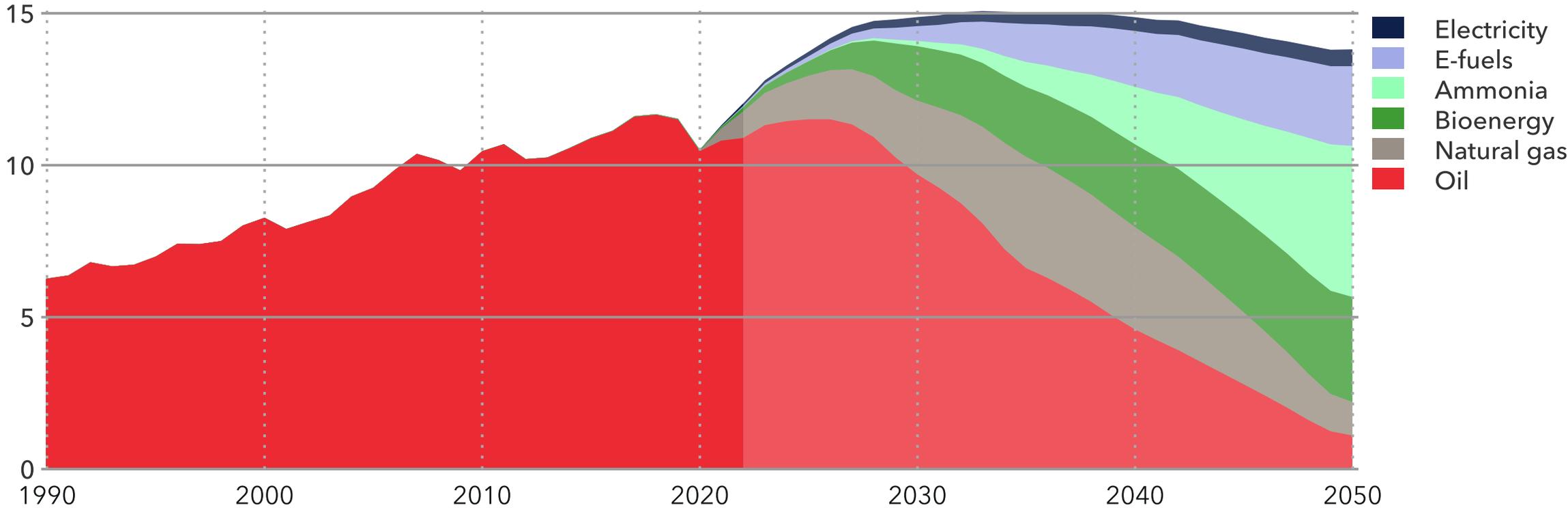
Total: Well-to-wake GHG emissions; **Intensity:** CO₂ emitted per transport work; **Fuel:** Uptake of zero or near-zero GHG technologies, fuels and/or energy sources

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DNV project that this will change the maritime fuel mix dramatically...

World maritime subsector energy demand by carrier

Units: EJ/yr

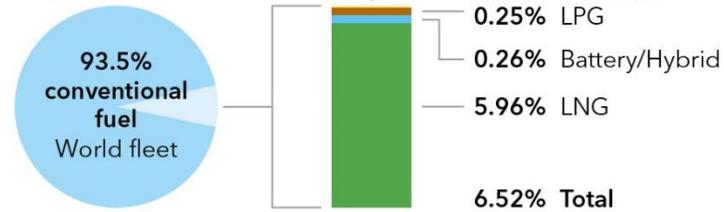


Natural gas includes LNG and LPG. Historical data source: IEA WEB (2023)

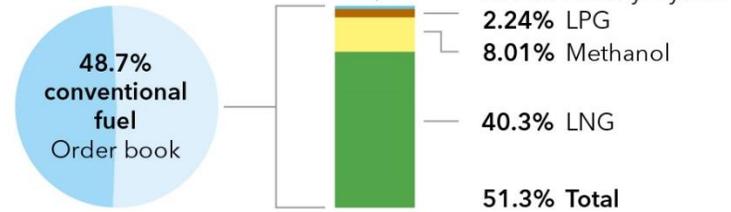
...and therefore, shipowners investing in fuel flexibility – half the ordered tonnage can run on alternative fuels

GROSS TONNAGE

Ships in operation

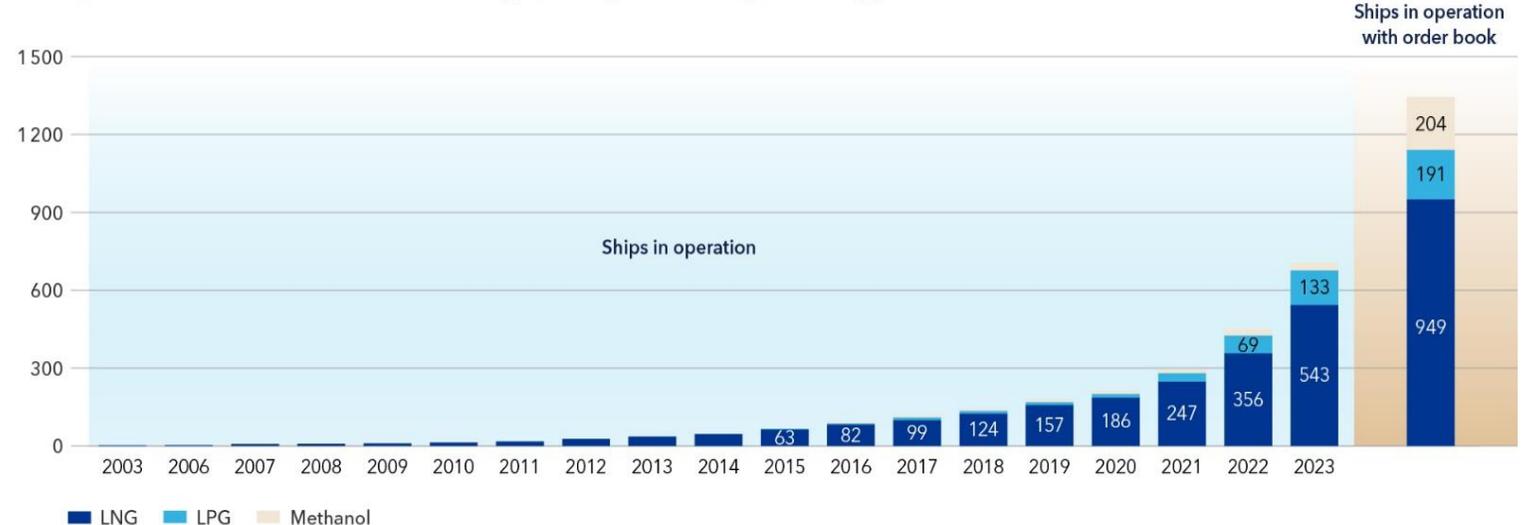


Ships on order

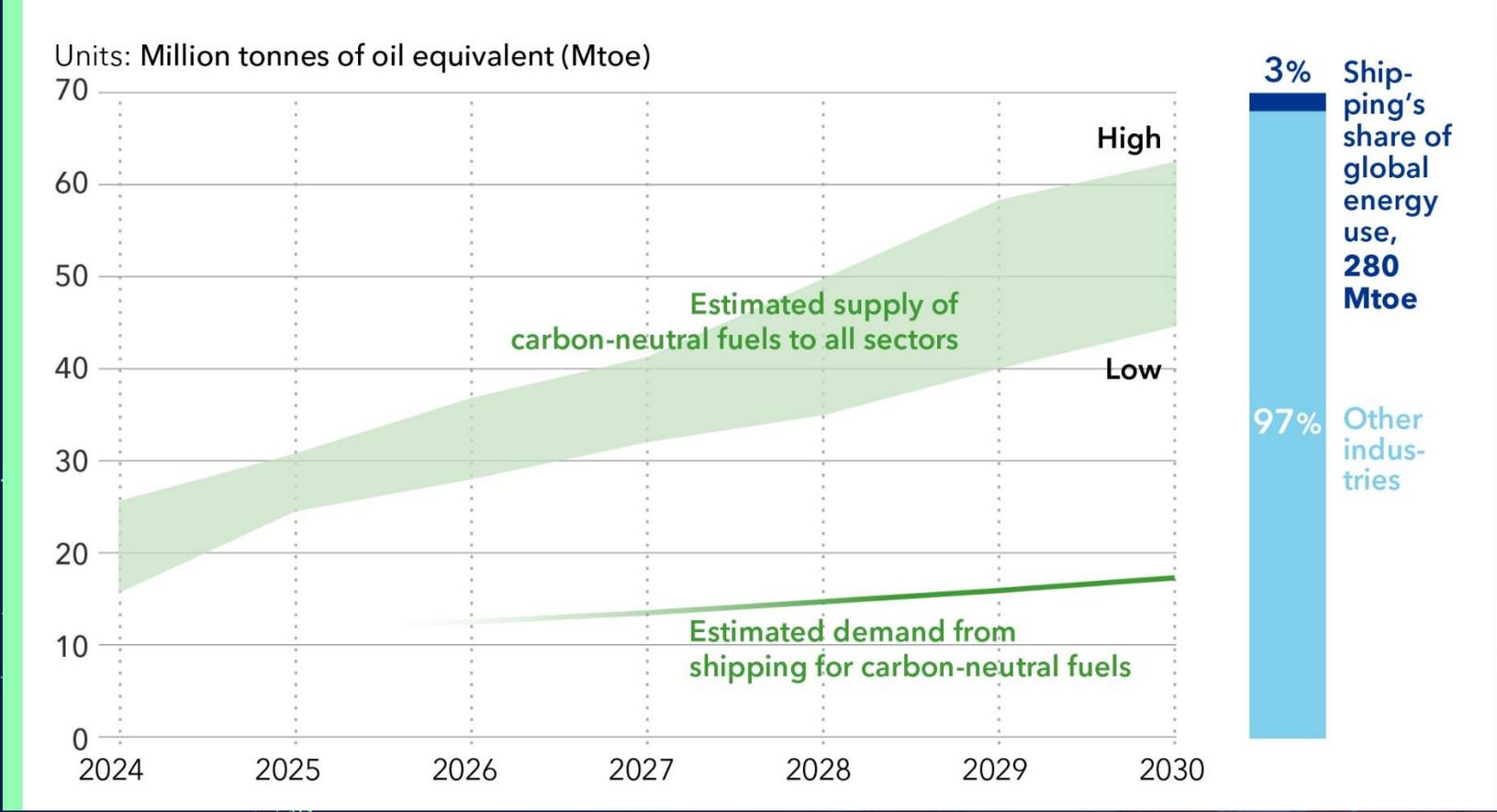


Sources: IHSMarkit (ihsmarkit.com) and DNV's Alternative Fuels Insights for the shipping industry - AFI platform (afi.dnv.com)

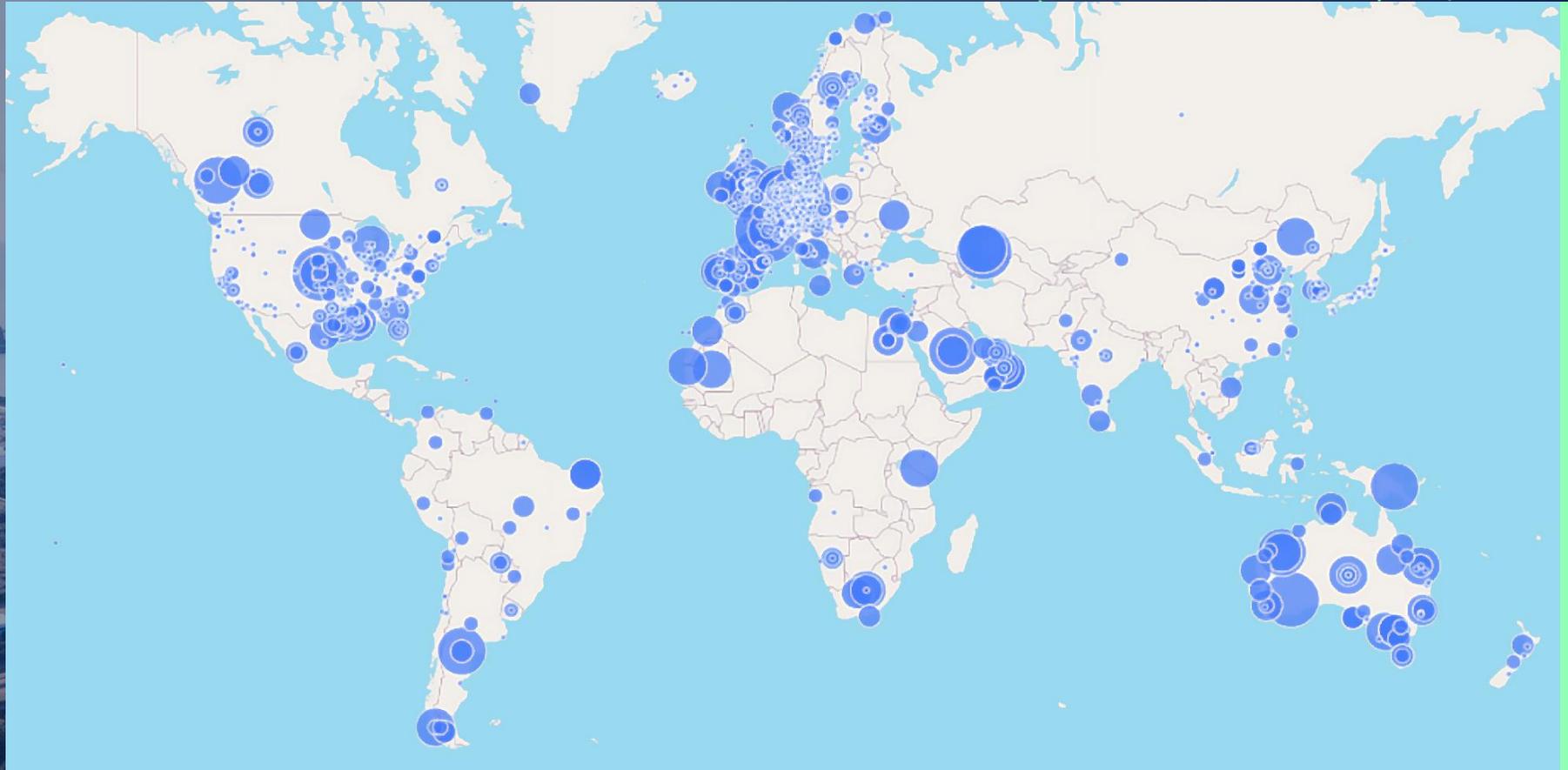
Development of LNG, LPG and methanol fuel technology uptake by number of ships, excluding gas carriers



Shipping requires an estimated 30-40% of global carbon-neutral fuels in 2030

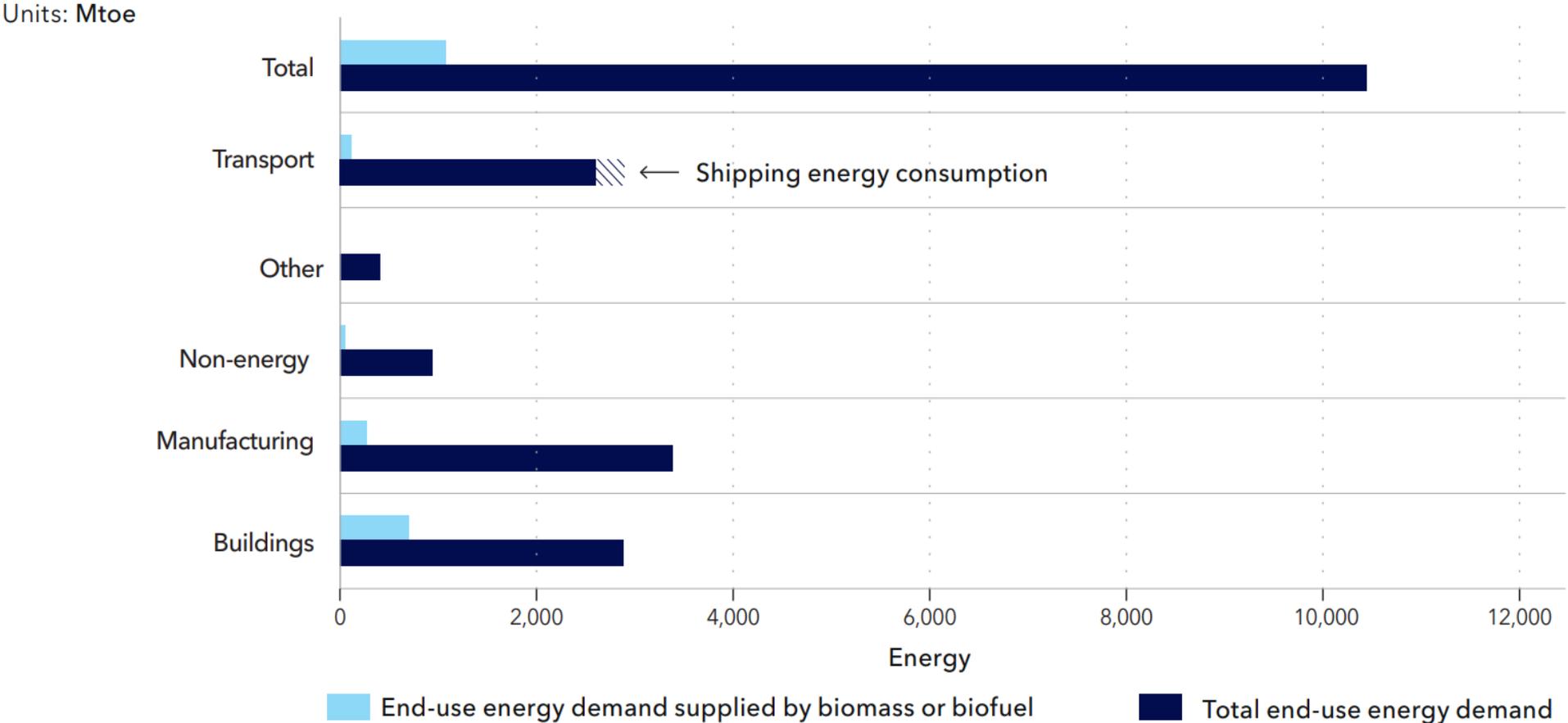


A lot is cooking - 2,200 carbon-neutral fuel projects identified, most without final investment decision



 afi.dnv.com

Low carbon fuels are in low supply – what role can biofuels play?



- There is already a significant biomass demand today, with the biggest sector being buildings
- Biomass-demand is dominated by conventional feedstocks, including traditional use of fuel wood for heating and cooking
- Only a small share of biomass demand, would be characterized as sustainable
- Note: We show the total biomass demand, regardless of sustainability criteria

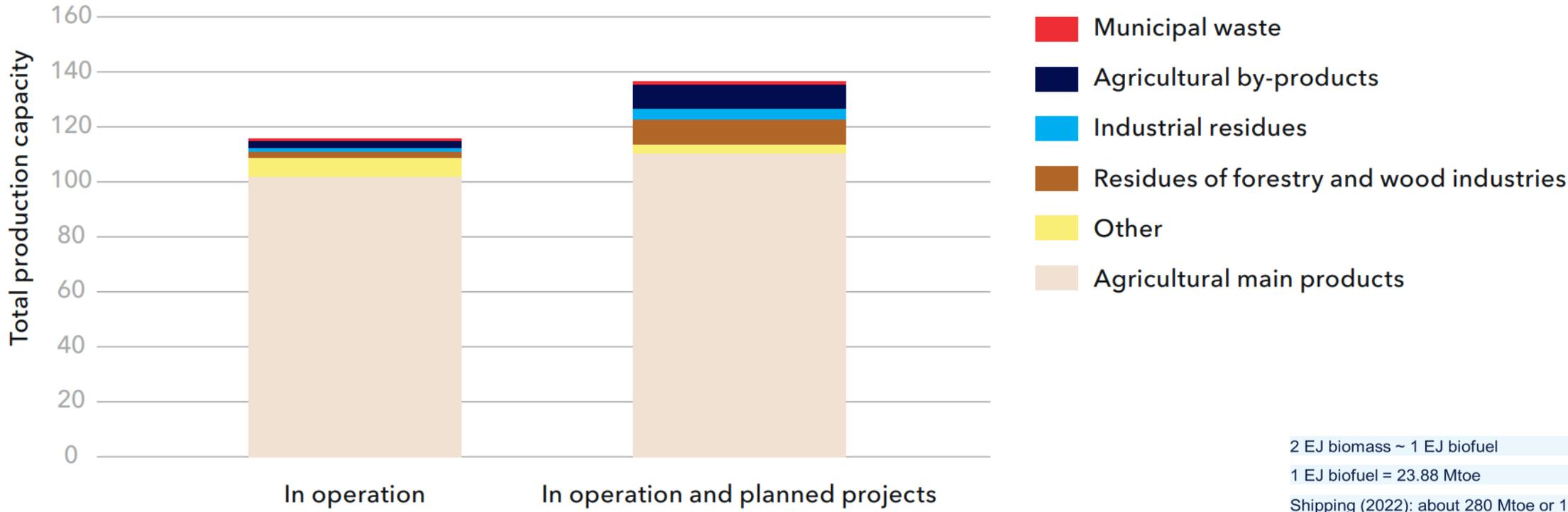
2 EJ biomass ~ 1 EJ biofuel
 1 EJ biofuel = 23.88 Mtoe
 Shipping (2022): about 280 Mtoe or 12 EJ biofuel

Currently, production of biofuels is dominated by use of conventional feedstocks

In future projects, the share of advanced feedstocks increases. For planned projects, the share of production using advanced feedstocks rises to almost half

Production of biofuels

Units: Mtoe/year



2 EJ biomass ~ 1 EJ biofuel
 1 EJ biofuel = 23.88 Mtoe
 Shipping (2022): about 280 Mtoe or 12 EJ biofuel

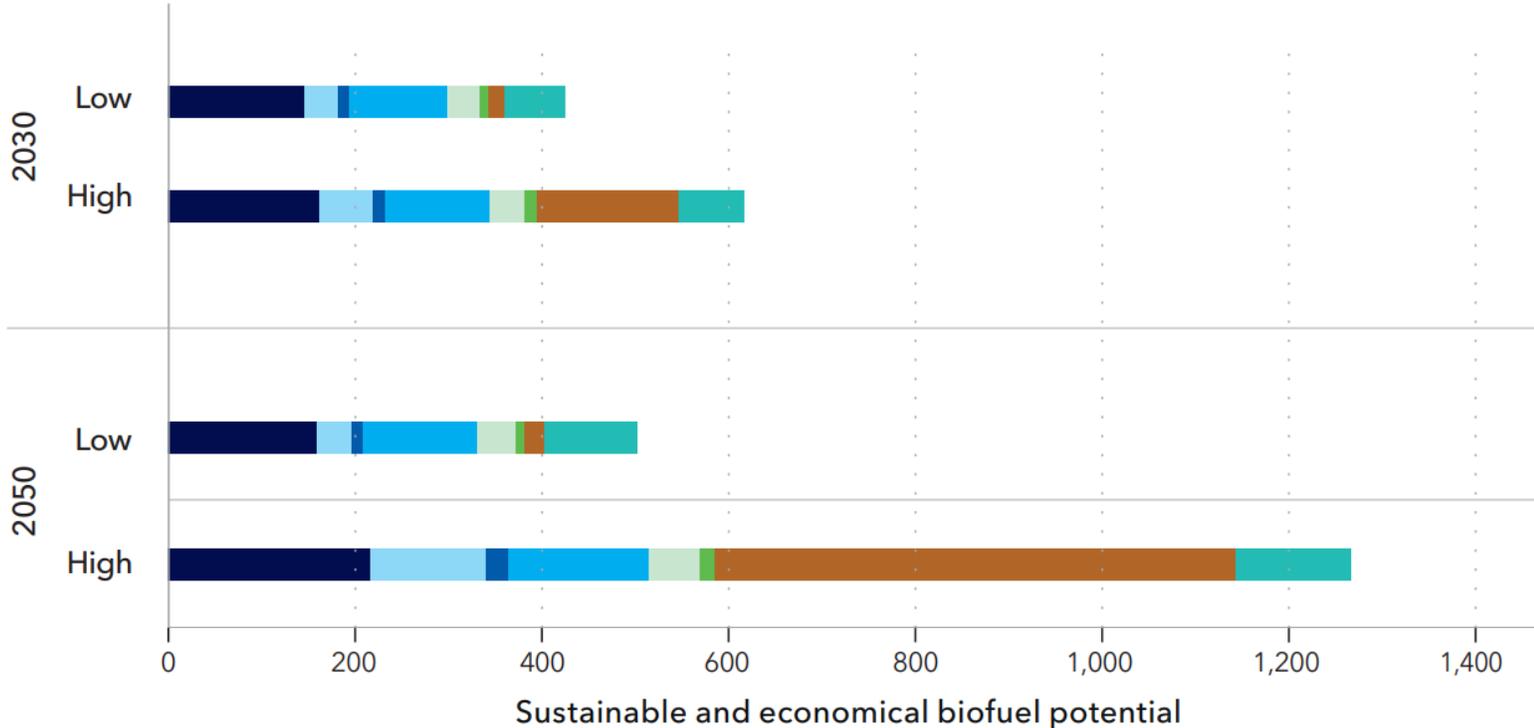
- Note:
- The above results are based on a compilation of data-sources, including IEA Bioenergy (2022). Some production projects may not be fully captured in the results.
 - Some production facilities may use different feedstock types. In the above chart, we only show the main feedstock type.

Today, agricultural residues, industrial waste and non-food energy crops are the largest sustainable biomass-sources

In the long-term, forest residues could have a great potential

Sustainable and economical biofuel potential by feedstock category in 2030 and 2050

Units: Mtoe



2 EJ biomass ~ 1 EJ biofuel

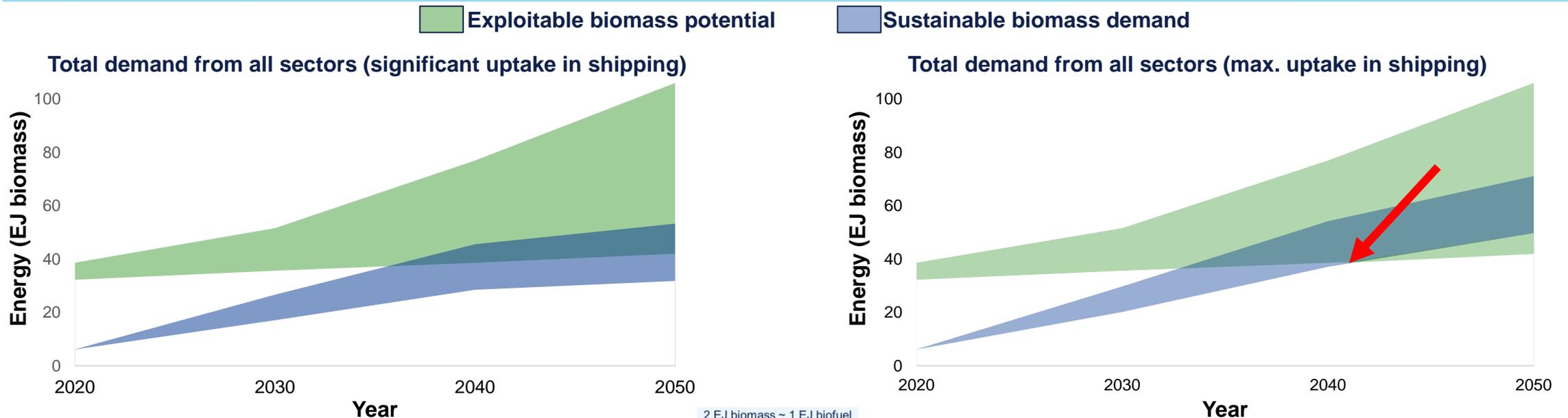
1 EJ biofuel = 23.88 Mtoe

Shipping (2022): about 280 Mtoe or 12 EJ biofuel

- Agri by-products
- Livestock Excretions
- Biowaste
- Industrial Waste
- Sequential Cropping
- Wastewater
- Forest Residues
- Energy Crops Non-Food

Increasing demand and uncertain supply of sustainable biomass

- Today, demand for sustainable biomass is relatively low, as most of the demand for biomass is covered by non-sustainable sources. This is expected, however, to change in the future
- We estimate a sustainable biomass **potential** today of 32 – 38 EJ, increasing to 42 – 106 EJ in 2050
- While there is a surplus of potential sustainable biomass today, this is set to decrease in the future, and potentially disappear around 2040 as demand picks up
- Ship owners wishing to use biofuels to reach decarbonization targets should have a strategy for securing future supply



2 EJ biomass ~ 1 EJ biofuel

1 EJ biofuel = 23.88 Mtoe

Shipping (2022): 288 Mtoe

Key assumptions:

- Existing usage of biomass from non-sustainable sources will continue, but all expansion must be taken from sustainable and exploitable potential
- Today, only a small fraction of the exploitable potential is tapped (from electricity generation and production of advanced biofuels for transportation)
- The below demand for biomass includes a significant upscale in biomass-usage within transportation, including shipping

Regulations are starting to incentivize uptake of biofuels - provided that they meet sustainability criteria's

GHG regulations

GHG regulations for biofuels	
EEXI/EEDI	No effect
DCS & CII	Reduction of CII if accepted by flag (Cf=0)
EU MRV & EU ETS	Reduction of the annually reported CO2 emissions (Cf=0) if sustainability criteria met
FuelEU Maritime	Actual WtW GHG emissions reduced, food and feed-based crops considered equivalent to fossil fuels

NOx regulations

MARPOL Annex VI Regulation 18.3 for biofuels	
Fuels with biofuel content <30%	No NOx testing or assessment required
Fuels with biofuel content >30%	In case no changes to NOx critical components are needed, use is permitted

- **Recognized certification schemes needed to make sure sustainability and GHG emission saving criteria is met (EU MRV, EU ETS, FuelEU Maritime)**
- Use of biofuels under CII to be considered at MEPC 80
- IMO in the process of developing Lifecycle Assessment (LCA) guidelines for all marine fuels, including biofuels. First version expected to be ready at MEPC 80

And hence, we see that biofuel-use in shipping is picking up

Many ship owners are testing biodiesels onboard vessels



CMA CGM Partners with IKEA to Test Marine Biofuel On Board Containership

gCaptain
10th March 2023
March 12, 2023



Stolt Tankers launches biofuel trial in collaboration with GoodFuels

Tanker operator becomes the latest to test how biofuels can help decarbonise shipping

8 April 2022 14:40 GMT | UPDATED: 8 April 2022 17:23 GMT



Meriaura aims for carbon-neutral voyages with biofuel and battery ship

Finnish group also looking at automation of cargo handling and more digital processes

14 April 2022 13:00 GMT | UPDATED: 14 April 2022 13:00 GMT

Marine Biofuel Successfully Tested by Stena Bulk in Vessel Operations



Photo courtesy of Stena Bulk
07 THE MARITIME EXECUTIVE 05-10-2022 05:16:51



UECC to Test Marine Biofuel on Ro-Ro Vessel

06 March 2023



A biofuel bunkering is expected to be conducted on DFDS Pearl Seaways (Image: Alfa Laval)

Alfa Laval set to begin marine biofuel testing

06 Nov 2020 By Reuters News

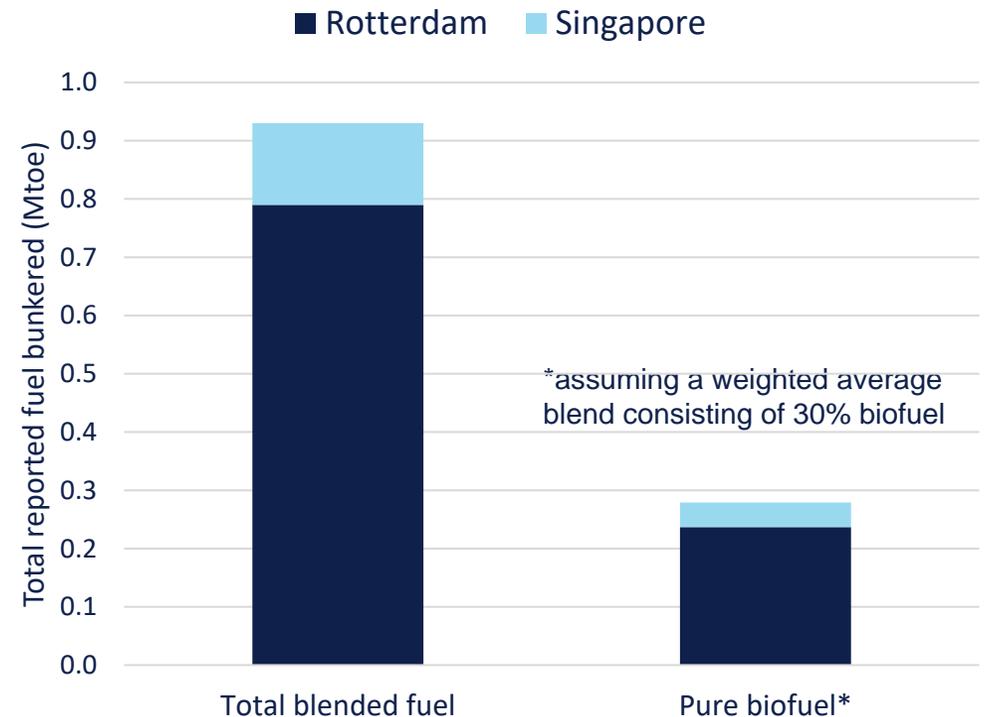


UECC reveals 'stunning' 60% emissions cut in 'smoothie' biofuel trial

Norwegian owner says old car carrier turned into environmental frontrunner through new bunkers

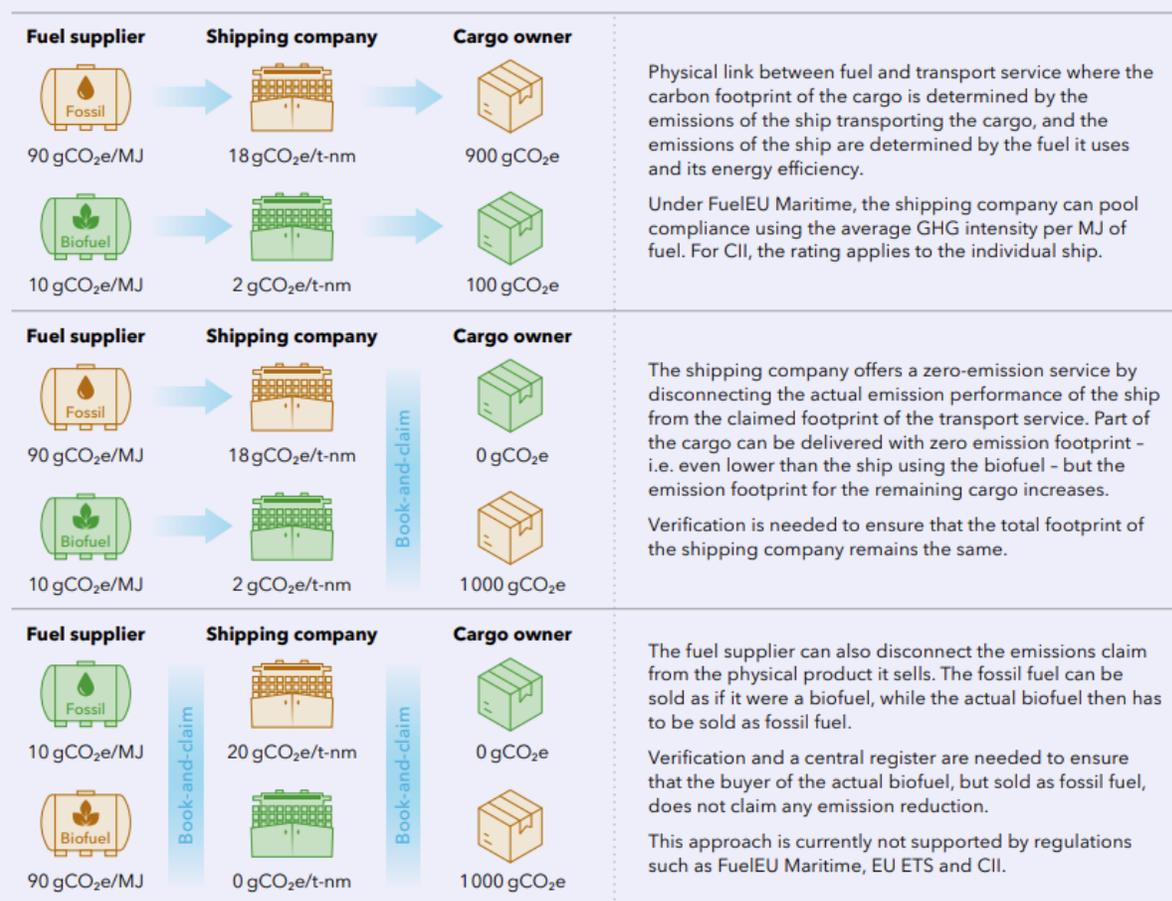
Sources: Tradewinds, Reuters, gCaptain, the Maritime Executive

Reported bunkering of biofuels in 2022 (Rotterdam & Singapore)



300 000 tonnes VLSFO-eq. ~ 0.1% of total marine energy consumption

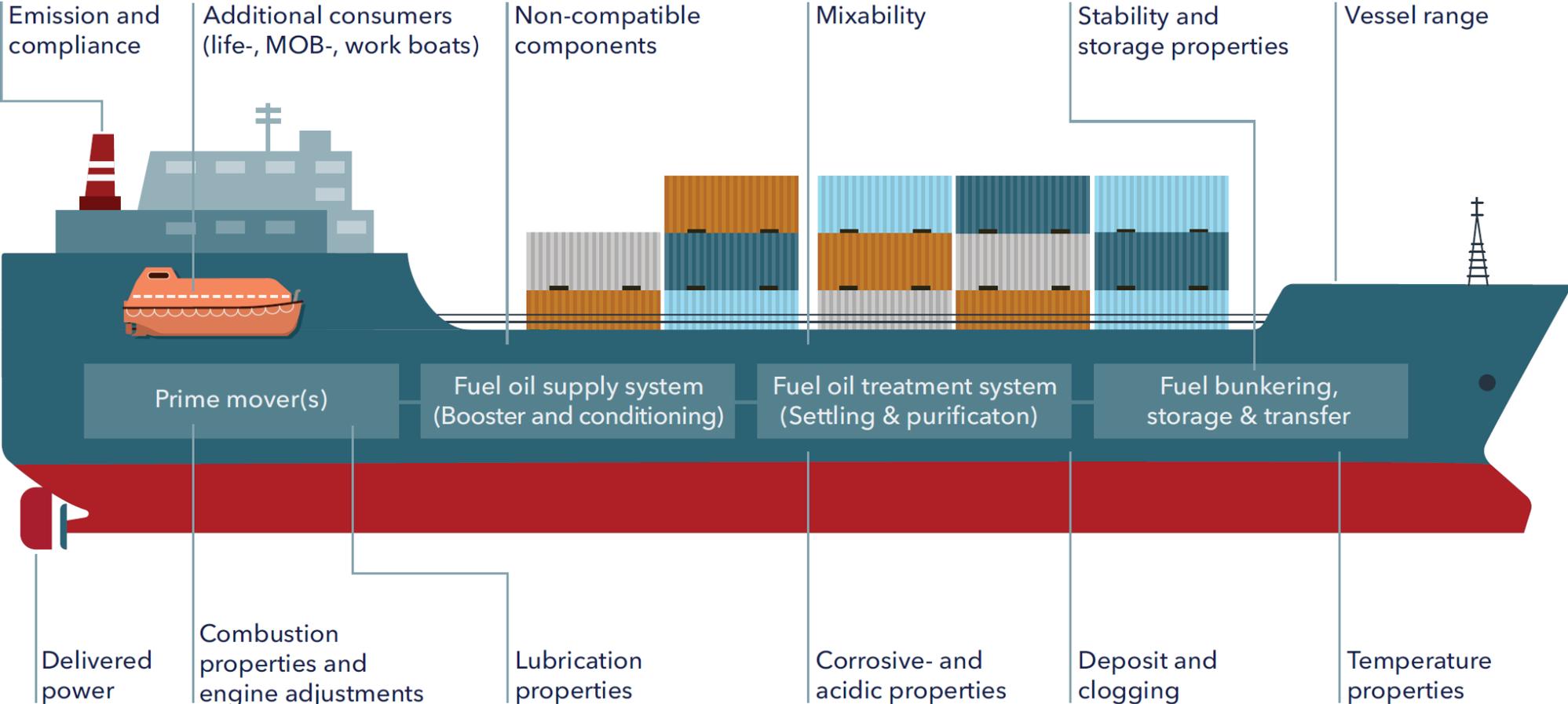
Pooling, banking, Insetting/book-and-claim enables and drive use of biofuels in some shipping sectors



The GHG intensity for the fuel under the fuel supplier is the well-to-wake GHG emissions. The ships are assumed to use 0.2 MJ fuel per tonne-mile, and the cargo transported is 10 kg over 5 000 nm, which is 50 tonne-miles; Key: Carbon dioxide equivalent (CO₂e); Carbon Intensity Indicator (CII); European Union Emissions Trading System (EU ETS); tonne-nautical miles (t-nm).

- There will be **options available** to **decouple** the physical link between **fuel used** on specific ship and the **cargo transported**.
- Methodologies needs to be in place to **verify** the systems employed ensuring that reductions are **claimed correctly**.
- This will have **significant impact** in **certain segments** of the shipping industry.

Focus areas when considering biodiesels and bioliquids – the overall system



Recommendations for ship owners considering biofuel

Initial screening of biofuel alternatives

Risk assessment to map compatibility of relevant biofuel (e.g., HAZID)

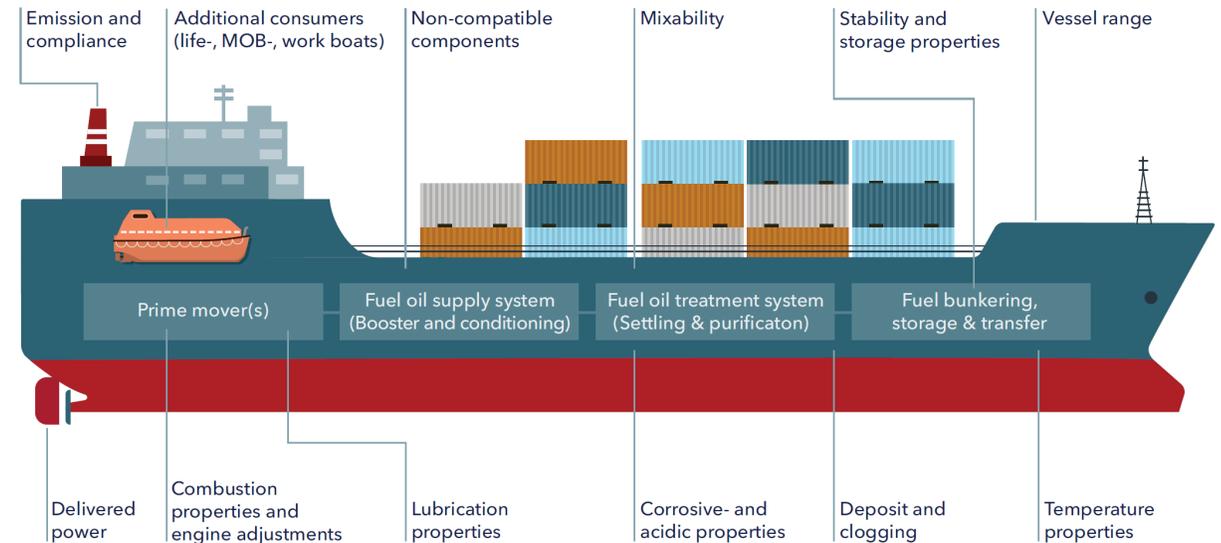
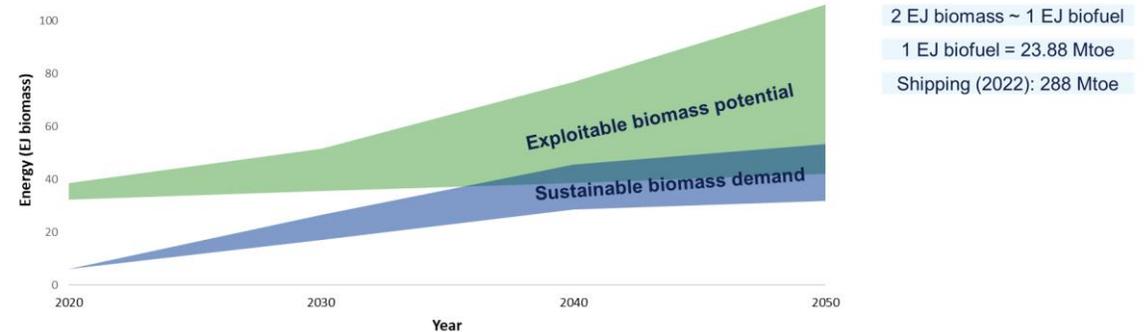
On-board preparation and modifications

Implementation and trialing

- ➔ Mapping of biofuel options: potential involvement of third party to provide market intelligence and knowledge related to various biofuel options.
- ➔ Ensure dialogue with relevant parties such as:
 - » Fuel supplier and/or laboratory (fuel specification and proper documentation).
 - » Engine maker (guidelines, recommended practice, compatibility statement, guarantee).
 - » Original equipment manufacturers of other relevant subsystems (guidelines, recommended practice, compatibility statement, guarantee).
 - » Flag/class (regulations, compliance, approvals, certification).
- ➔ Training and knowledge sharing with relevant personnel (on-board crew).
- ➔ Ensure proper follow-up, reporting and evaluation after implementation to capture the effects accompanying a fuel transition (long- and short-term effects of all affected systems).

Summary – 3 key take-aways

- 1 There is a **significant potential to scale up sustainable biofuel** production for shipping, but in the **long-term, supply may be constrained by biomass availability**
- 2 While biofuel production **today** is dominated by **non-sustainable biomass** sources, there is an **ongoing shift** towards use of **sustainable biomass** sources
- 3 **Compatibility** of each specific biodiesel and bioliquid should be **investigated before bunkering**



Thank you for listening!

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