# Udvikling af skibsfarts aftagermarked

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**Mærsk Mc-Kinney Møller Center**
for Zero Carbon Shipping

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Commercial vessels globally

100.000

Tons of fossil fuel consumed

300.000.000

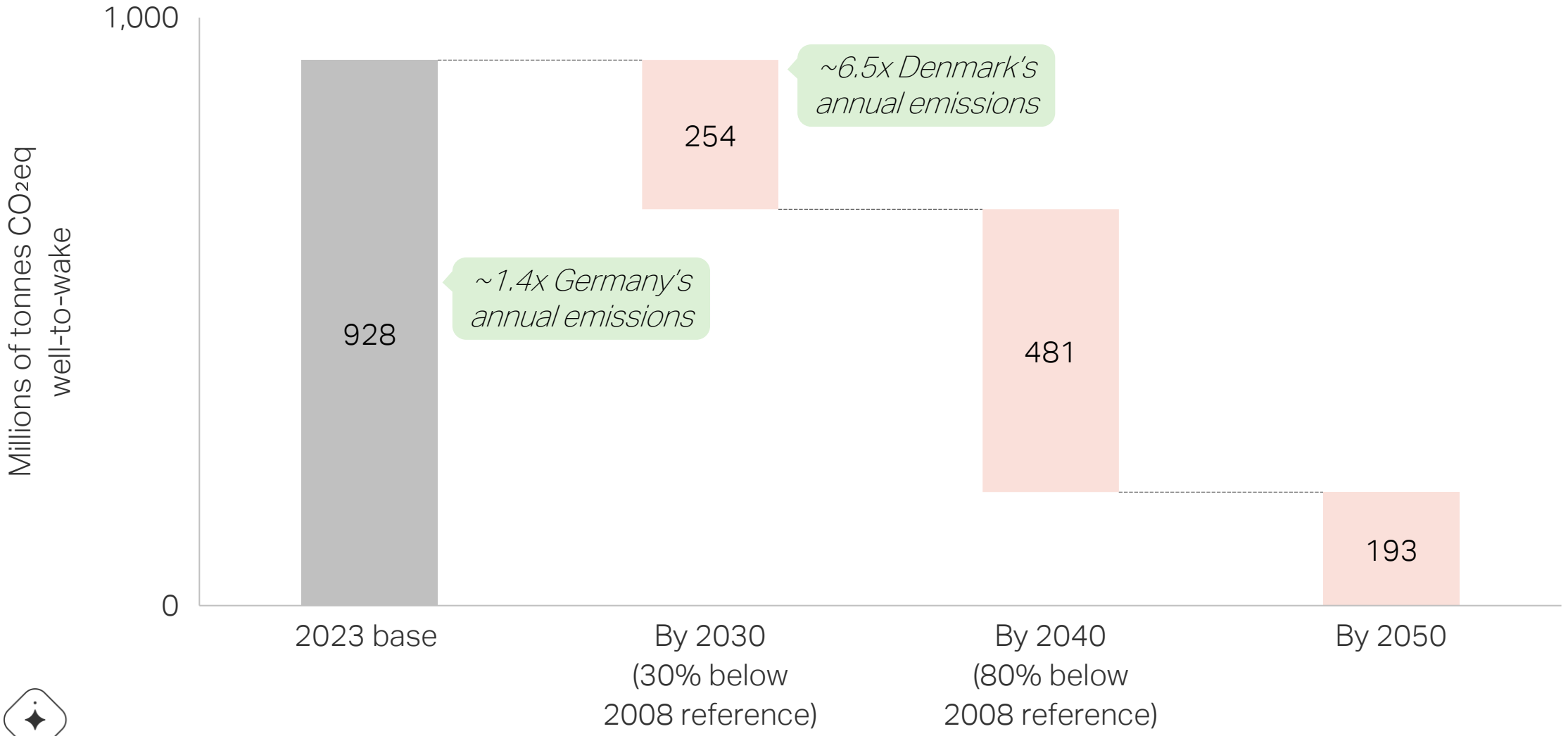
Tons $CO_2$ emitted annually

900.000.000

Share of global $CO_2$ emissions

3%

# GHG emission reductions to meet International Maritime Organization 'striving' targets




Emission reduction are the 'Base Trajectory' from DNV's 2024 Comprehensive Impact Assessment report. Country GHG emissions are 2023 totals across all sectors from EC EDGAR (2023).

# **Mærsk Mc-Kinney Møller Center** for Zero Carbon Shipping

Our vision is to sustainably decarbonize the maritime industry by 2050

Our mission is to be an independent and significant driver of a sustainable maritime decarbonization

## Not-for-profit

Money earned by or donated to the Center is used entirely to finance Center work.

## Independent

We are un-biased, solution agnostic and have no vested interest in any technology. We work collaboratively and bring together key players across the value chain.

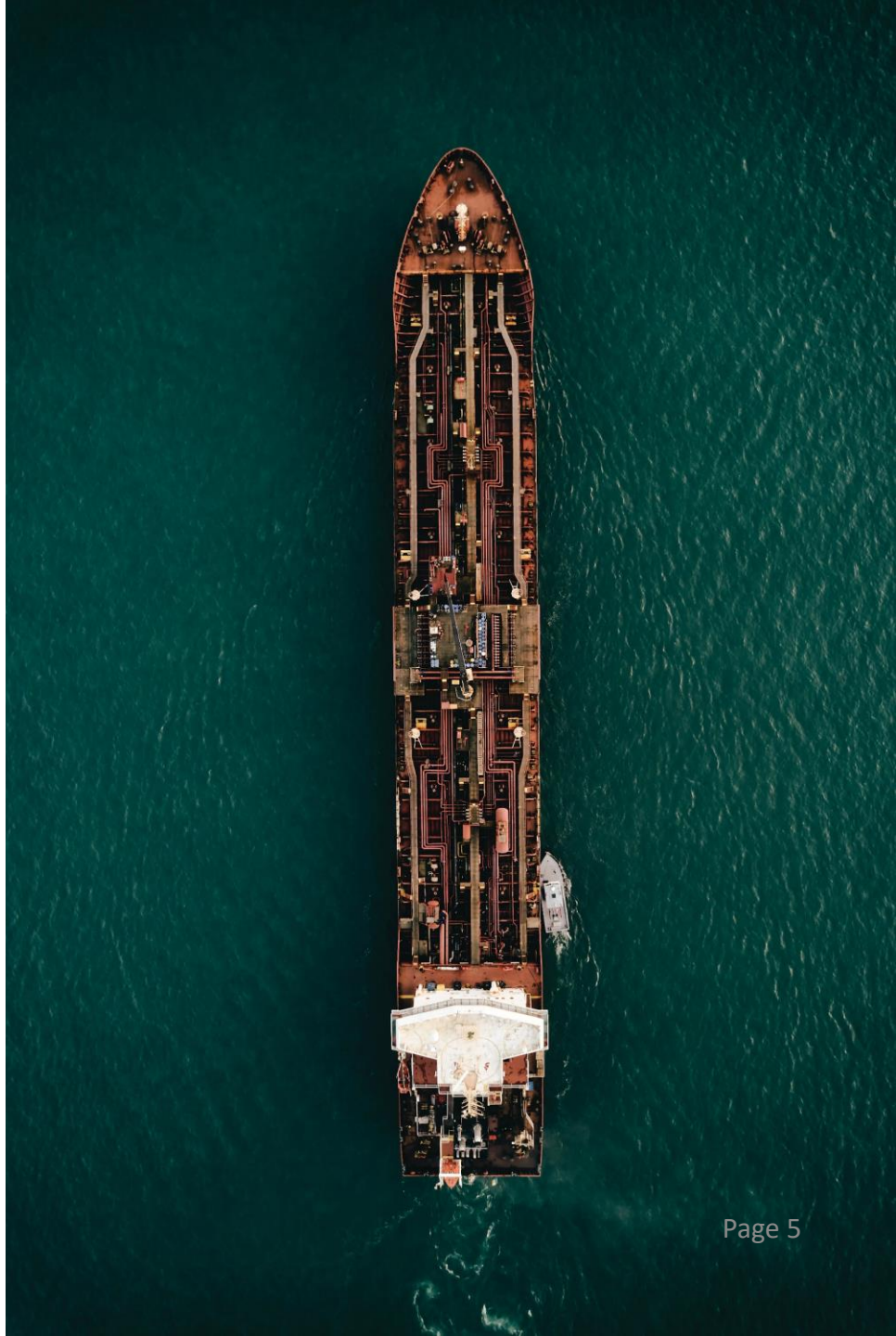
## Science-based

We commit to climate science and use a data driven approach to explore viable decarbonization pathways.

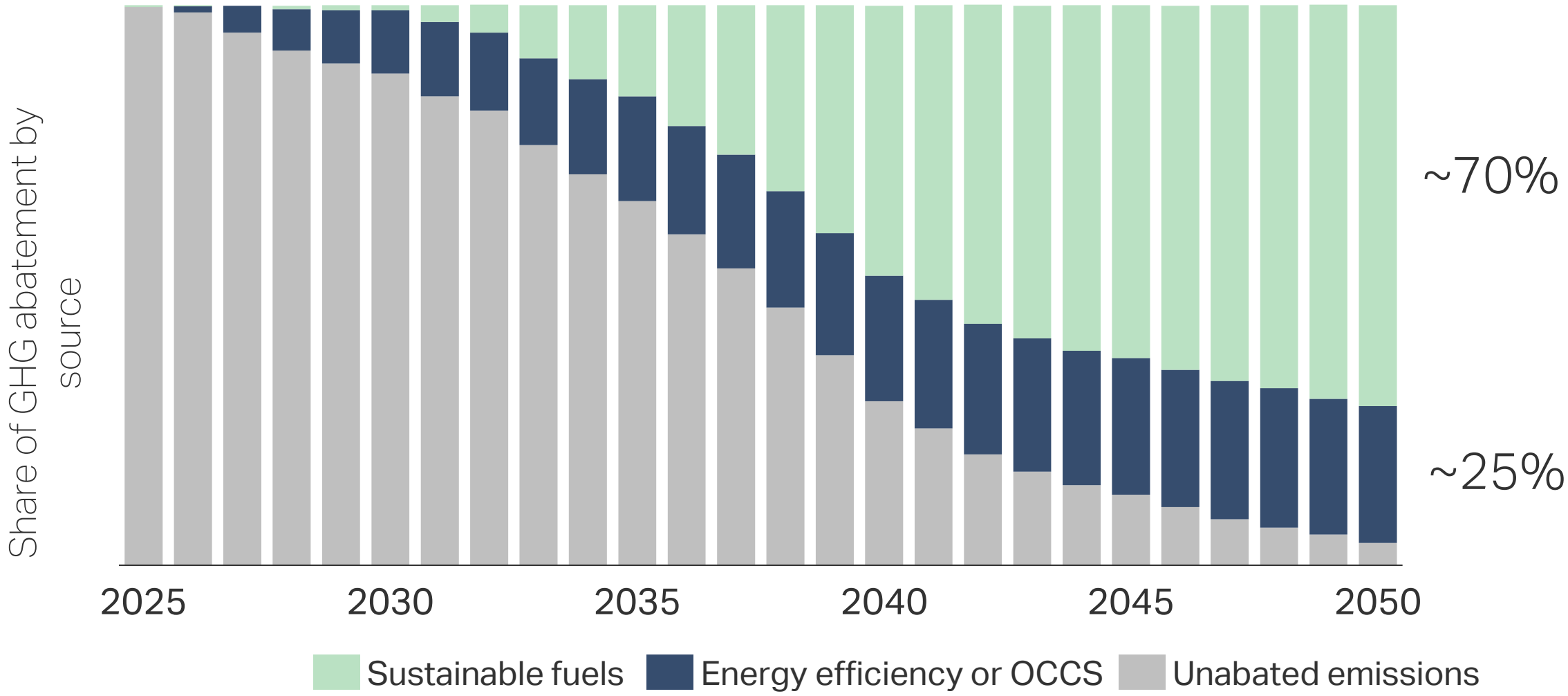
# Decarbonization in its (over)simplified form is a product of three variables

$$GHG = T \cdot f_T \cdot ef_{GHG}$$

| | |
|---|---|
| $GHG$ | Total emissions from shipping |
| $T$ | Transport units by shipping |
| $f_T$ | Fuel units per transport unit |
| $ef_{GHG}$ | Emissions per fuel unit |



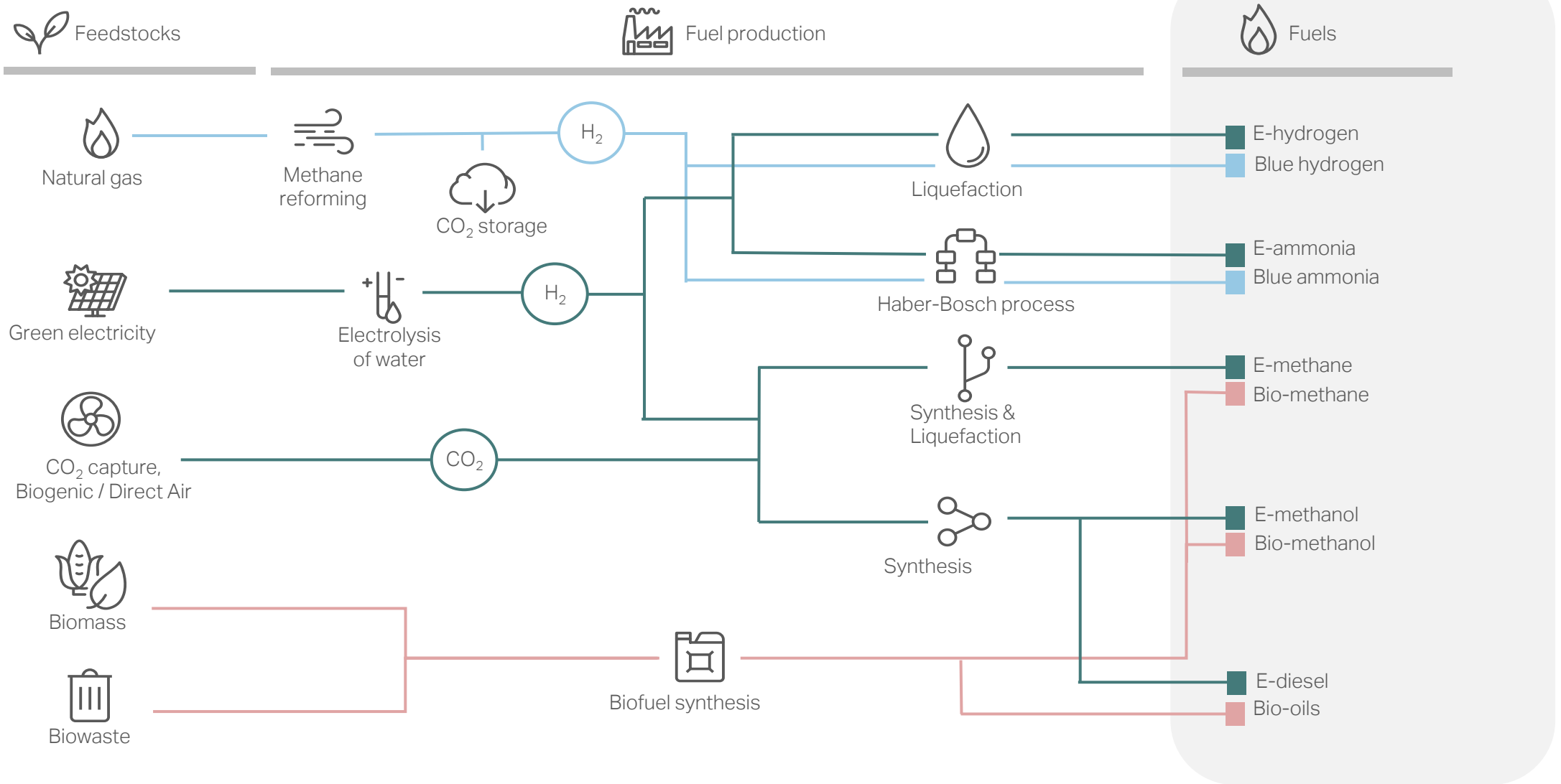
# Energy efficiency improvements and low-carbon fuels are critical




MMMCZCS modeled estimates using the NavigaTE integrated assessment modelling environment. Scenario has high sustainable fuel availability and IMO Revised GHG Strategy-consistent regulations.

# There are multiple alternative fuels suitable for maritime fuels

## Different production cost, scalability and abatement potential



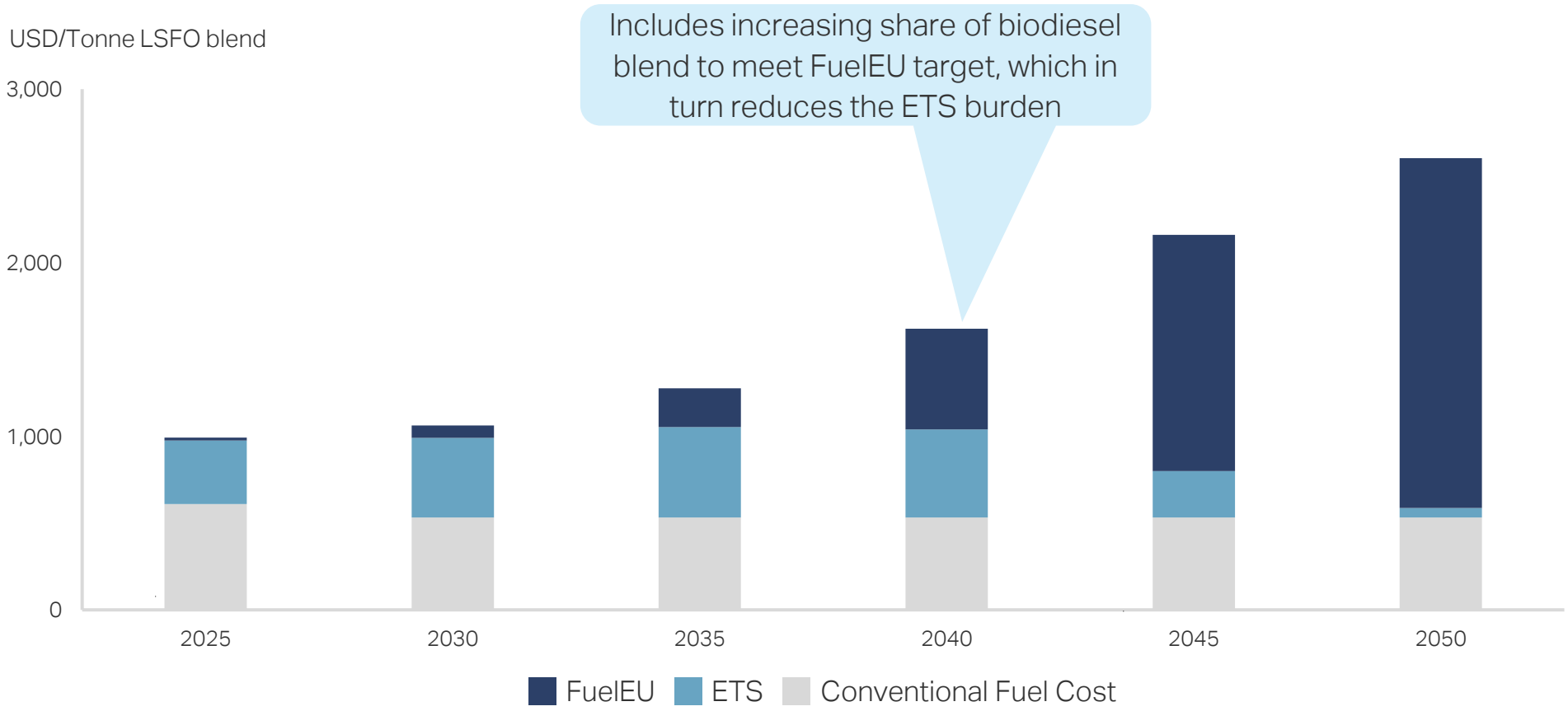
# The key drivers of a multi-fuel future are regulation, cost per emissions reduction delivered and availability of the different fuel and vessel technologies

Regulation

Cost

Availability

# Regulations can help closing the cost gap between conventional and alternative fuels




ETS forecast based on 'ambitious scenario' in which EU policymakers withdraw allowances to meet a 55% GHG reduction by 2030 and net-zero by 2050 (Pitetzcker et al., 2021). Biodiesel forecasts is the average of low and high projections from a 2020 Lloyd's Register and UMAS Report (LR & UMAS, 2020). Figure shows estimates for LSFO vessels sailing exclusively in the EU
Source: MMMCZCS analysis. Fuel costs based on average across five regions in the Fuel Cost Calculator available at https://www.zerocarbonshipping.com/cost-calculator

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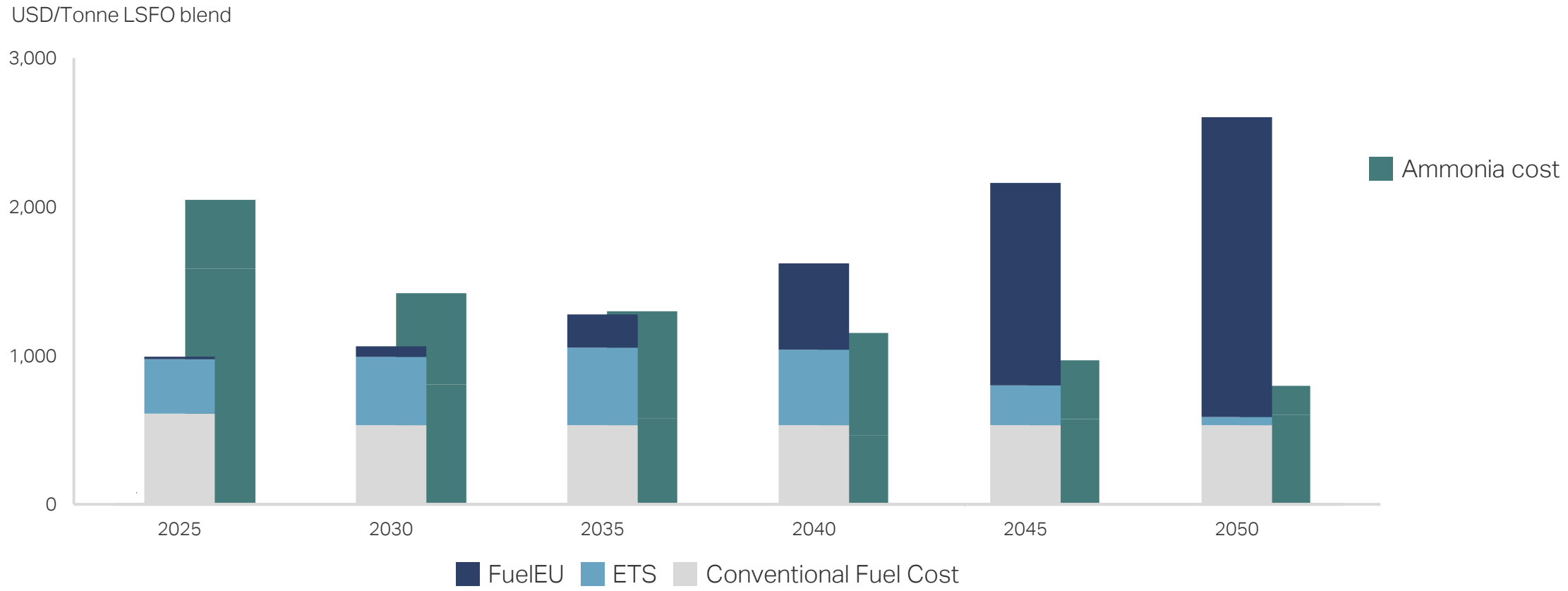


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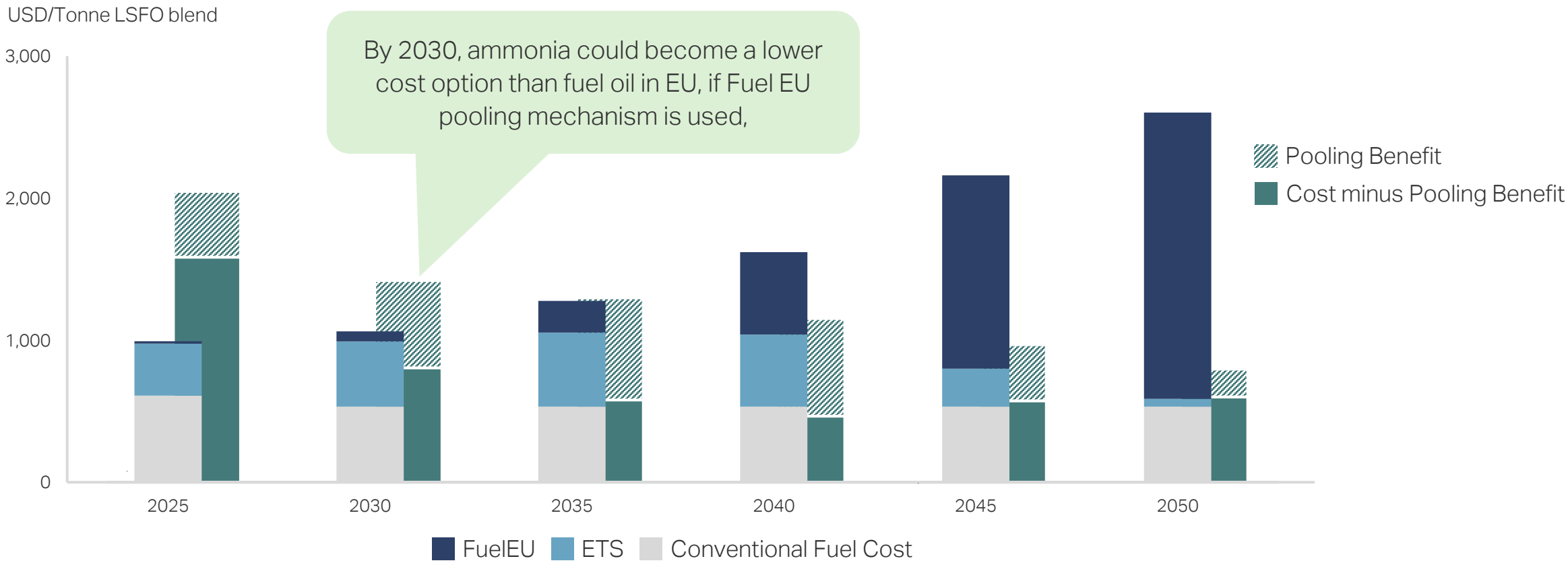


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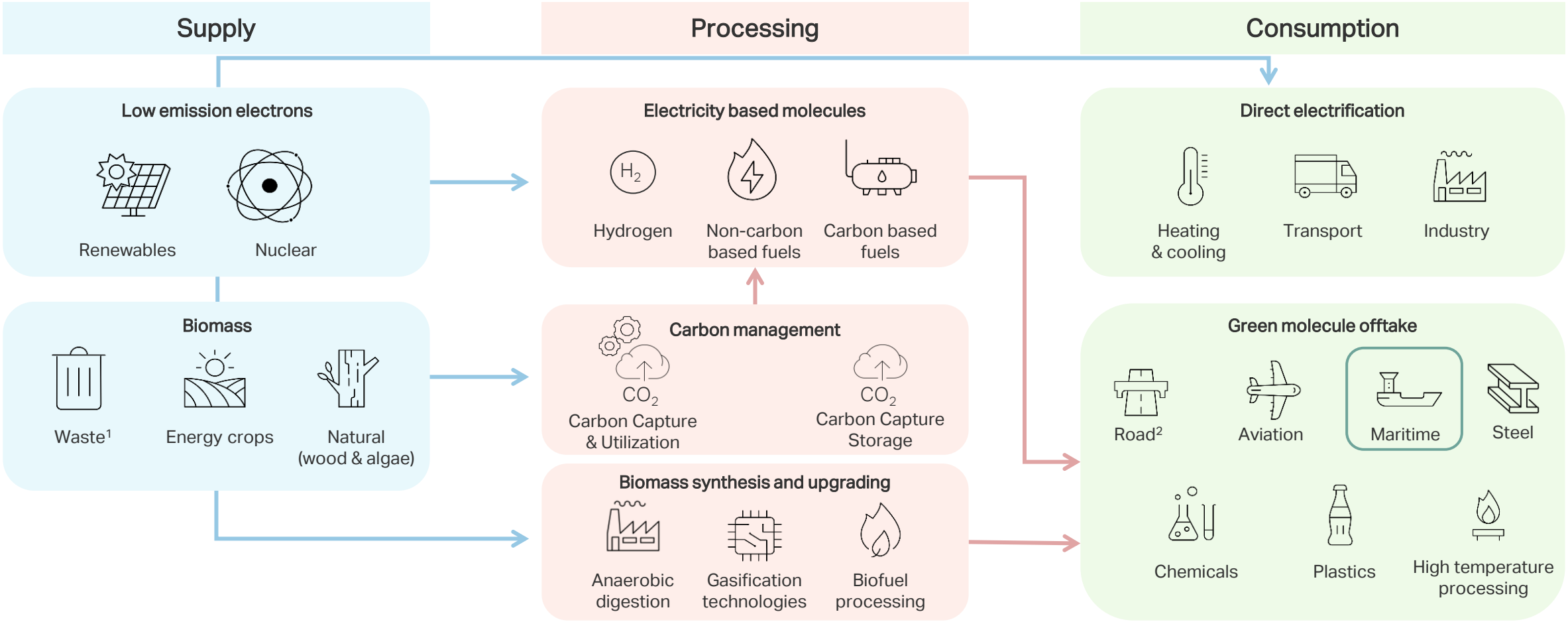
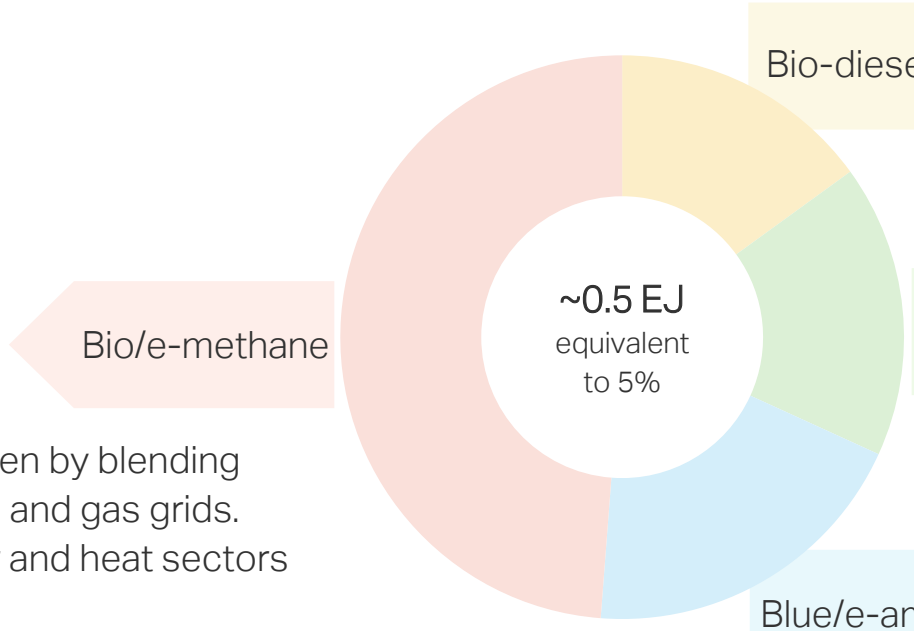
# Maritime is not an island – the green transition involves systemic change across the entire ecosystem




1. Incl. municipality waste and waste from agriculture e.g., manure (animal waste)
2. Heavy transport and offroad

# Shipping faces competition with other sectors to access alternative fuels and meet 5% uptake by 2030 set by IMO

## Distribution scenario for 5% alternative energy mix for intl. shipping in 2030[1]
*Illustrative*




**Bio-diesel**
Market determined, but supply constrained by regulatory cap. Competition with road transport with likely higher WtP

**Bio/e-methanol**
Supply constrained – low demand from high WtP sectors fails to create a market. Demand from shipping failing to trigger large-scale investments in production

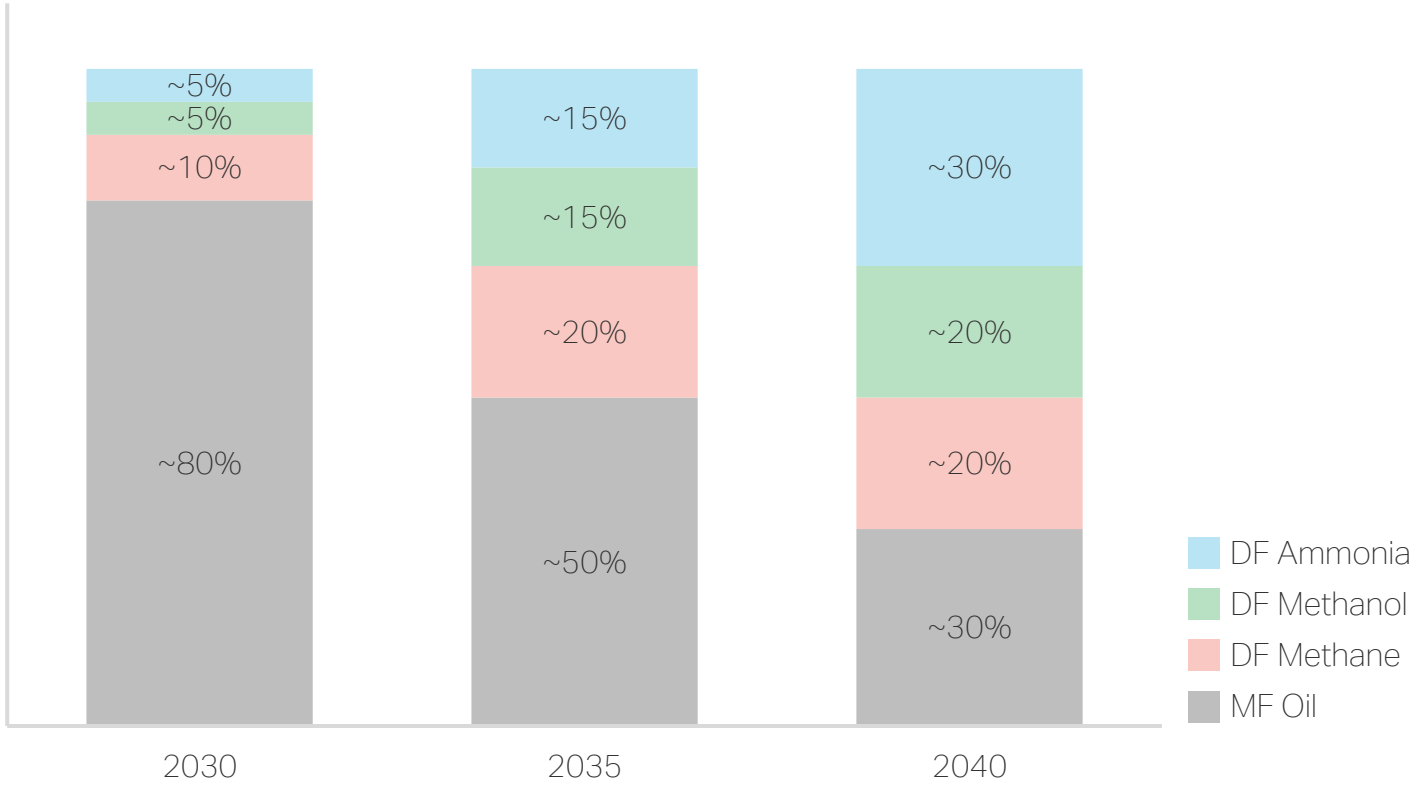
**Bio/e-methane**
Market determined, driven by blending mandates in heavy road and gas grids. Competition with power and heat sectors

**Blue/e-ammonia**
Limited early demand by shipping given the low maturity of vessel and engine technology. Market being created by demand from APAC power sector.

1) Expected energy demand from international shipping in 2030 is estimated at ~10 EJ

# We expect the fleet mix to be multifuel with no silver bullet solution

Share of total engine power in the fleet per year (GW/year) in a decarbonized scenario with a strict regulation




- The most likely outcome in a scenario with **strong global regulation** is a **multi-fuel future**.
- **All four fuel technology pathways** are in play including dual fuel methane, methanol and ammonia vessels.
- Early on, methane vessels will be the best option due to **cheap LNG and biomethane**.
- **After 2030**, we expect **ammonia vessels** being the most prominent fuel technology.

# Selected needed Action: Short term and Long term

| | Technology/Fuels | Regulation | Business |
|---|---|---|---|
| **Short term** | Develop and demonstrate new fuels/technologies | IMO Regulation developed: technical and market based | Initiate Green Corridors<br><br>Develop/demonstrate new business frameworks (ESG, Book&Claim, Fuel demand aggregation, etc) |
| **Long term** | Continuous innovation and improvement of fuels/ technologies<br><br>Complete fleet transition | Global Fuel/LCA standards, global carbon pricing | Green shipping economy, supporting green supply chains<br><br>Just and Equitable transition |