Shipping Energy Transition

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Shipping CO$_2$ emissions, trade and carbon intensity

Historical and projected shipping emissions, transport work and carbon intensity

- **CO$_2$ (t)**
- **Trade (t)**
- **Carbon intensity (gCO$_2$/t-nm)**
Pathways for International Shipping's CO2 emissions

- **Business As Usual**
- **50% reduction in 2050 (85% reduction in carbon intensity)**
- **100% reduction in 2050**

If possible
Focus of our shipping research and consultancy work

- **2000’s**: Evidence of recent trends in energy efficiency
- **Now**: Using big data to understand trends and drivers of shipping activity, energy demand/emissions
- **2050**: Evidence of how the future of energy efficiency/GHG might look
  - Using models to explore what-ifs for future market and policy
Zero-emission fuel adoption 2030-2050 needs to be rapid, irrespective if the target is zero by 2050 or 2070.

Source: UMAS GloTraM (2019), UK Clean Maritime Plan

Graphs show optimal fuel mix reached in analysis of several candidate zero emission fuels for UK’s Clean Maritime Plan in 2019.

Source: UMAS GloTraM (2019), UK Clean Maritime Plan
Total cost of operation

Feedstock prices

Production process capex/opex/efficiency

Machinery and storage, capex, efficiency, size

= additional fuel cost + additional capital cost of mcy + additional capital cost of storage - lost capacity (revenue)
High price scenario, 80,000dwt bulk carrier, total annual additional cost

- Biofuel increases in price
- NG+CCS fuels consistently cheaper than e-fuel (but not zero)
- Ammonia consistently cheaper than synth hydrocarbons,
- Hydrogen and e-LNG 20-50% more expensive on total cost basis
- Ammonia competitiveness improves with time

LR and UMAS, 2020, Techno-economic assessment of zero carbon fuels
Total cost of operation, component costs

2050 (low price scenario)

- Bio-diesel ICE
- E-diesel ICE
- Bio-methanol wood ICE
- Bio-methanol waste ICE
- E-methanol ICE
- Bio-LNG ICE
- E-LNG ICE
- E-ammonia ICE
- NG-ammonia ICE
- E-hydrogen ICE
- NG-hydrogen ICE

Figures 4a – Relative cost implications of ZEV technologies for bulk carrier under low-price scenario and no carbon price.

LR and UMAS, 2020, Techno-economic assessment of zero carbon fuels
How might the transition happen?
Where will the hydrogen/ammonia come from?

Evaluation of potential for a “first blue then green” hydrogen transition

WB, UMAS (2020) Role and potential of zero-carbon bunker fuels
Based on this, S-curve modelling implies a need for ~5% of zero emission fuels in international shipping by 2030.

- S-curves generated to match UMAS scenarios as closely as possible.
- Works well for 1.5C scenario. For IMO scenario the implied increase from 27% to 61% in 2046 cannot be fitted to an S-curve, hence a lower value for 2036 is generated here, 11%.
- Curves suggest 3-5% needed by 2030. As the IMO-aligned curve produces a too low result for 2036 (11%) it is likely best to aim for 5% regardless of scenario.
Which ships will want zero carbon fuels?

5% zero-emission fuels in 2030 could be achieved by a combination of container, tanker and domestic shipping.

- 10 deep-sea container routes: ~1%
- Ammonia and LPG tankers use ammonia as fuel: ~2%
- National/regional shipping decarbonized 30%: ~3%
- Total energy from zero emission fuels 2030: 5-6%

Source: UMAS, 4th IMO GHG Study
First mover opportunities can be seized

• There is more than enough first mover potential – about 2x – to put shipping on the right track by 2030.

• Strategies should target routes where complexity is most manageable and fuel supply most feasible.

• First mover routes can almost by definition be stimulated by individual governments alone or in collaboration.

Leadership can emerge from many levels

- **Individual countries can drive the early stages of the transition**, using policy to push zero-emission fuels and influencing neighbours and trading partners.

- **Multiple countries may act in parallel** and in coordination to implement policies and solutions that have greater impact.

- **Commitments** on commercial fleet decarbonisation, ports and bunkering infrastructure and green finance can move faster than the IMO.
Leadership can emerge from many levels

PRESS RELEASE

L.A. City Council adopts Councilmember Raman’s resolution calling for transition to 100% zero-emission shipping at port of Los Angeles by 2030

NOVEMBER 9, 2021

The resolution also requires support for legislation or administrative action to rapidly decarbonize the maritime shipping industry and to create zero-emission shipping corridors along the California coast, the West Coast of the United States, and across the trans-Pacific trade route.

https://shipitzero.org/l-a-city-council-adopts-shipping-resolution/
Leadership can emerge from many levels

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- **Multiple countries may act in parallel** and in coordination to implement policies and solutions that have greater impact.

- **Commitments on commercial fleet decarbonisation, ports and bunkering infrastructure and green finance** can move faster than the IMO.

- Global action led by the IMO may prove challenging in the early phases, but will be highly impactful as the transition reaches scale.
Thank You!

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