

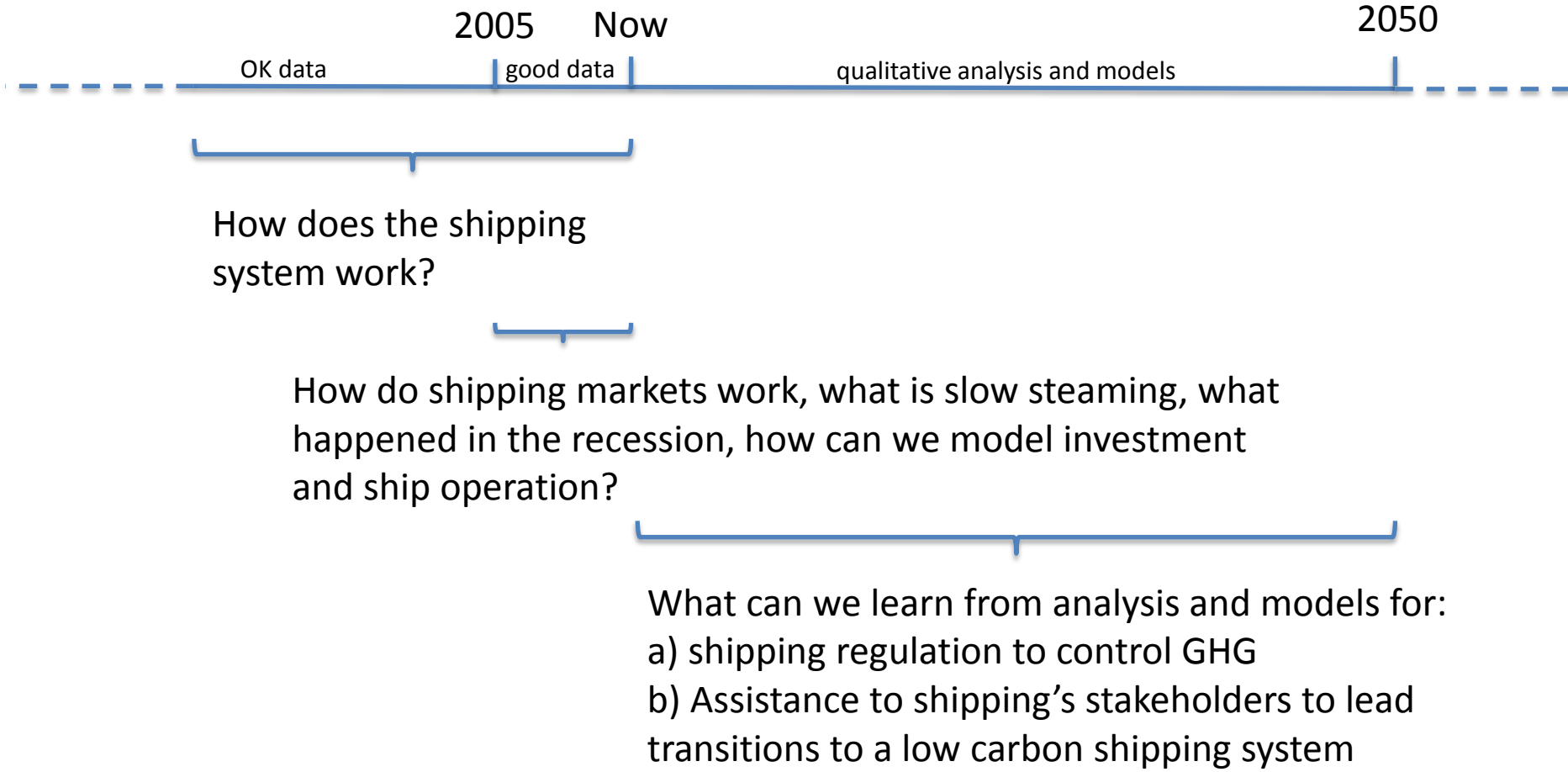
# What is the potential future mix of marine fuels?

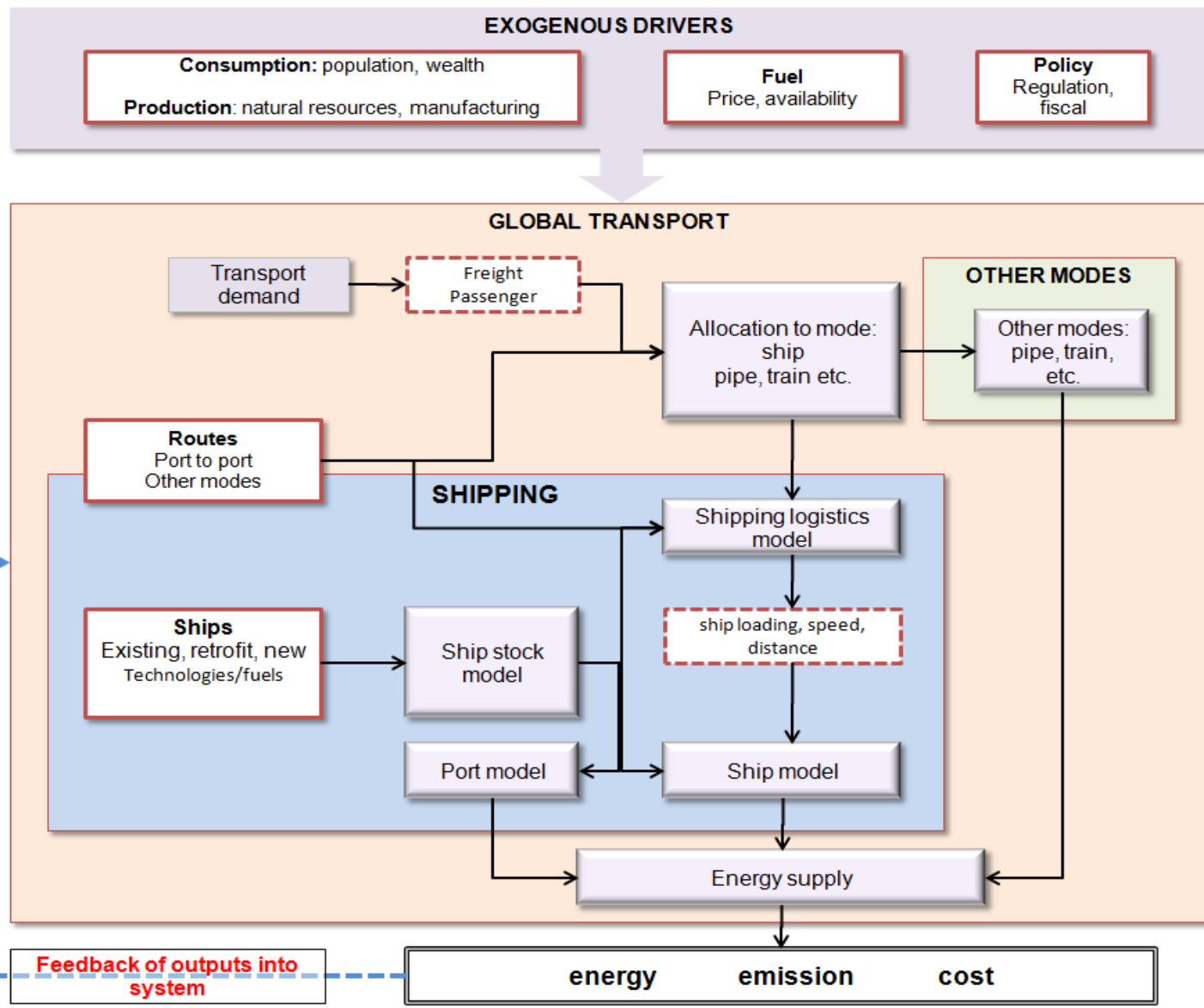
Carlo Raucci

UCL Energy Institute

[carlo.raucci.12@ucl.ac.uk](mailto:carlo.raucci.12@ucl.ac.uk)







We try to simulate the ship owner's perspective

$$\rho_{pa} = R_{pa} - C_{s\_pa} - C_{v\_pa}$$

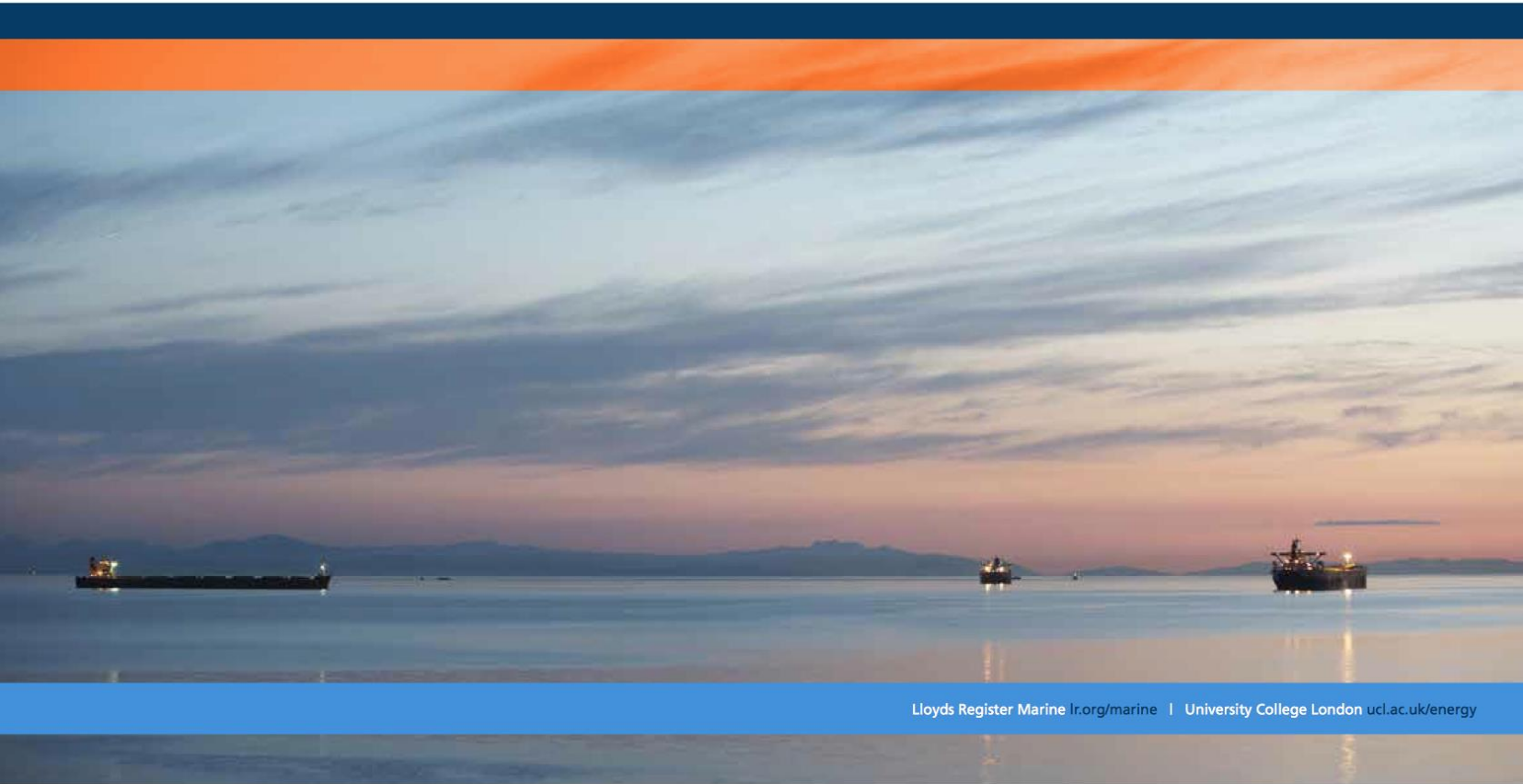
Diagram illustrating the components of the ship owner's perspective:

- $R_{pa}$  is a function of speed,  $f(\text{speed})$ .
- $C_{s\_pa}$  is a function of technology,  $f(\text{technology})$ .
- $C_{v\_pa}$  is a function of technology,  $f(\text{technology})$ .
- $C_{v\_pa}$  is also a function of speed,  $f(\text{speed})$ .





# Global Marine Fuel Trends 2030



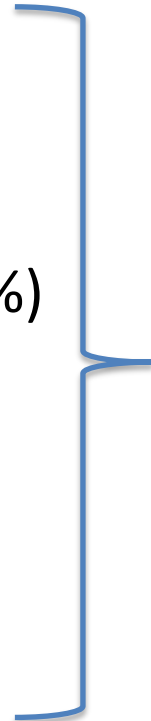
# 3 scenarios

Scenario	Oil/gas price	Bioenergy	Investment	Regulation
Status quo	Central estimate	Low availability	BAU	0.5% Sulphur in 2025,  low carbon price
Global commons	Central estimate (low cost hydrogen)	Low availability	Better than BAU (more long-term)	0.5% Sulphur in 2025,  high carbon price
Competing nations	High	High availability	Worse than BAU	0.5% Sulphur in 2030,  no carbon price



# Fuel/machinery considered

- MDO
- HFO
- LSHFO (0.5%)
- LNG
- Methanol
- Hydrogen



Bio feedstock  
blends/variants

2 stroke  
4 stroke  
Dual fuel / Gas  
engine  
Fuel cell

Storage  
technology



Fig. 24 Evolution of marine fuel demand, relative to the 2010 baseline for each  
Source: LR / UCL

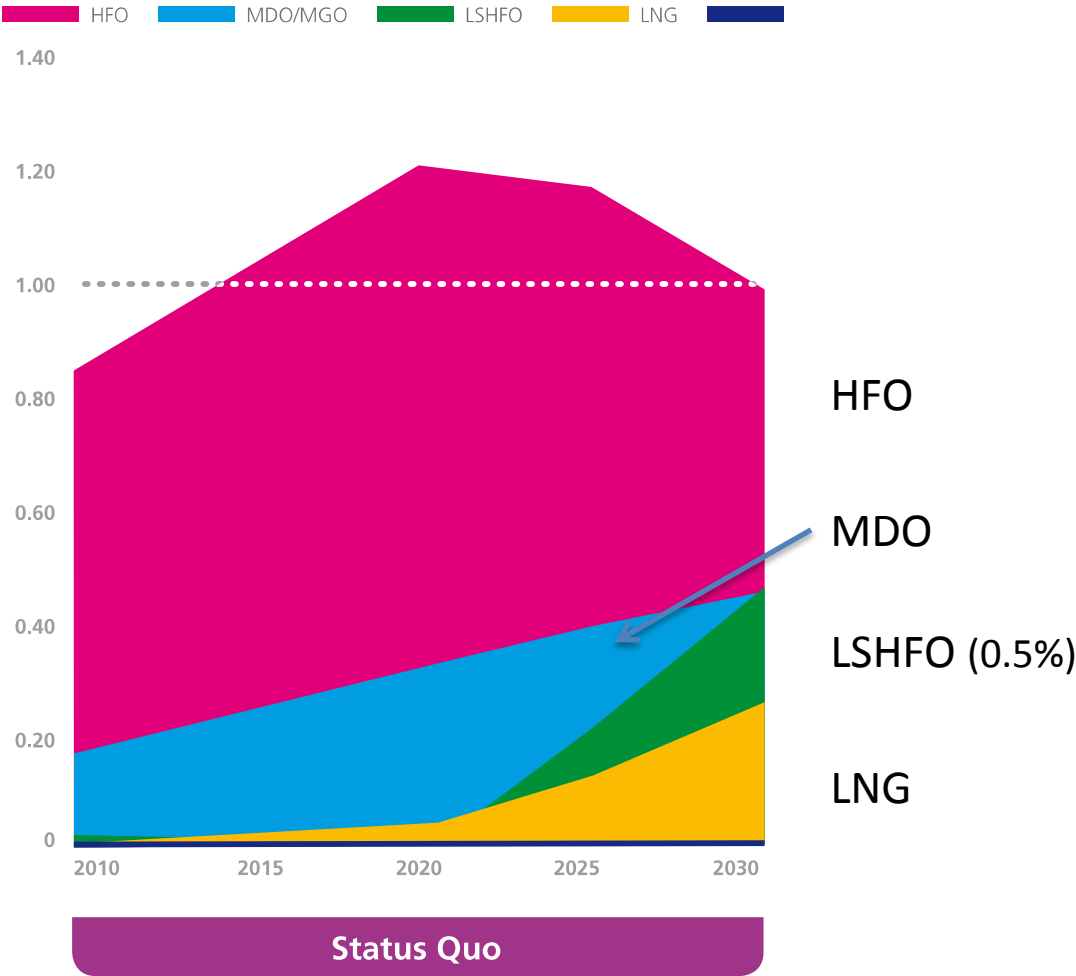
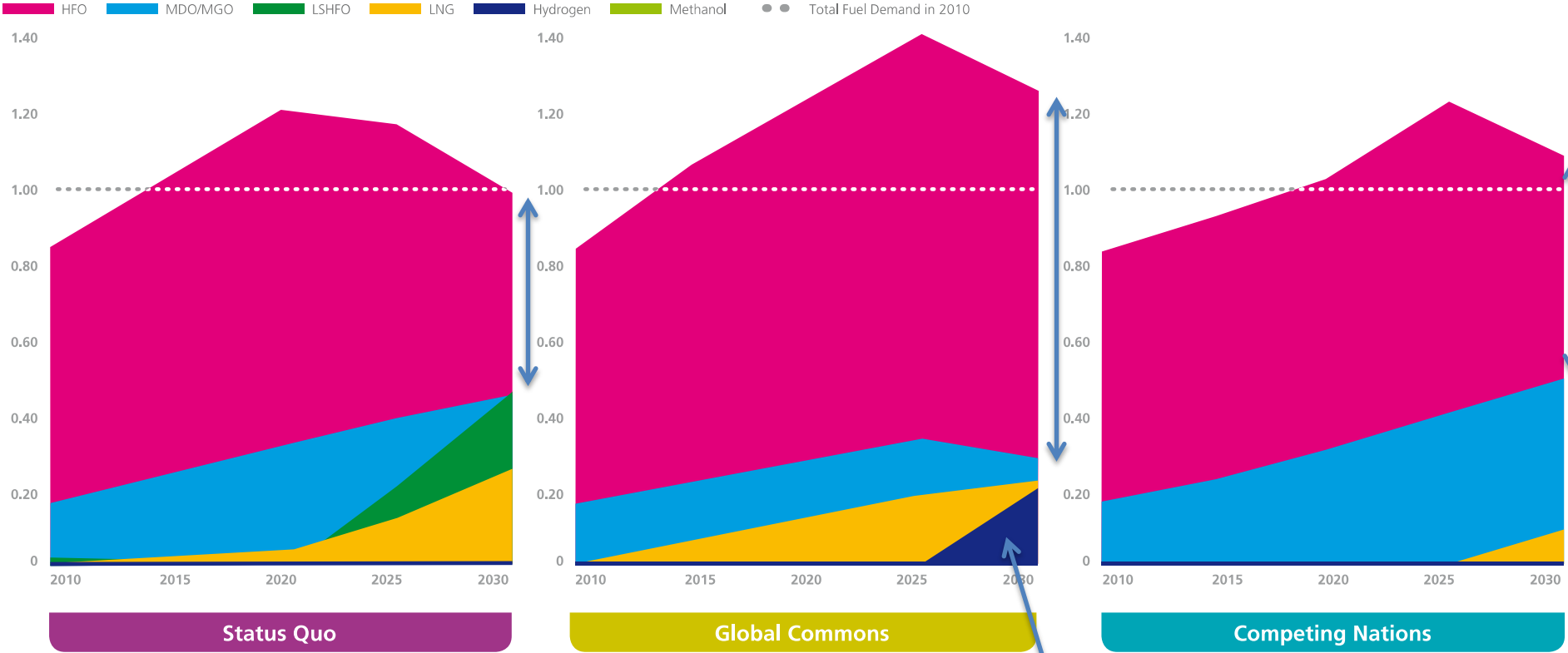




Fig. 24 Evolution of marine fuel demand, relative to the 2010 baseline for each fuel  
Source: LR / UCL



Hydrogen



# Key takeaways

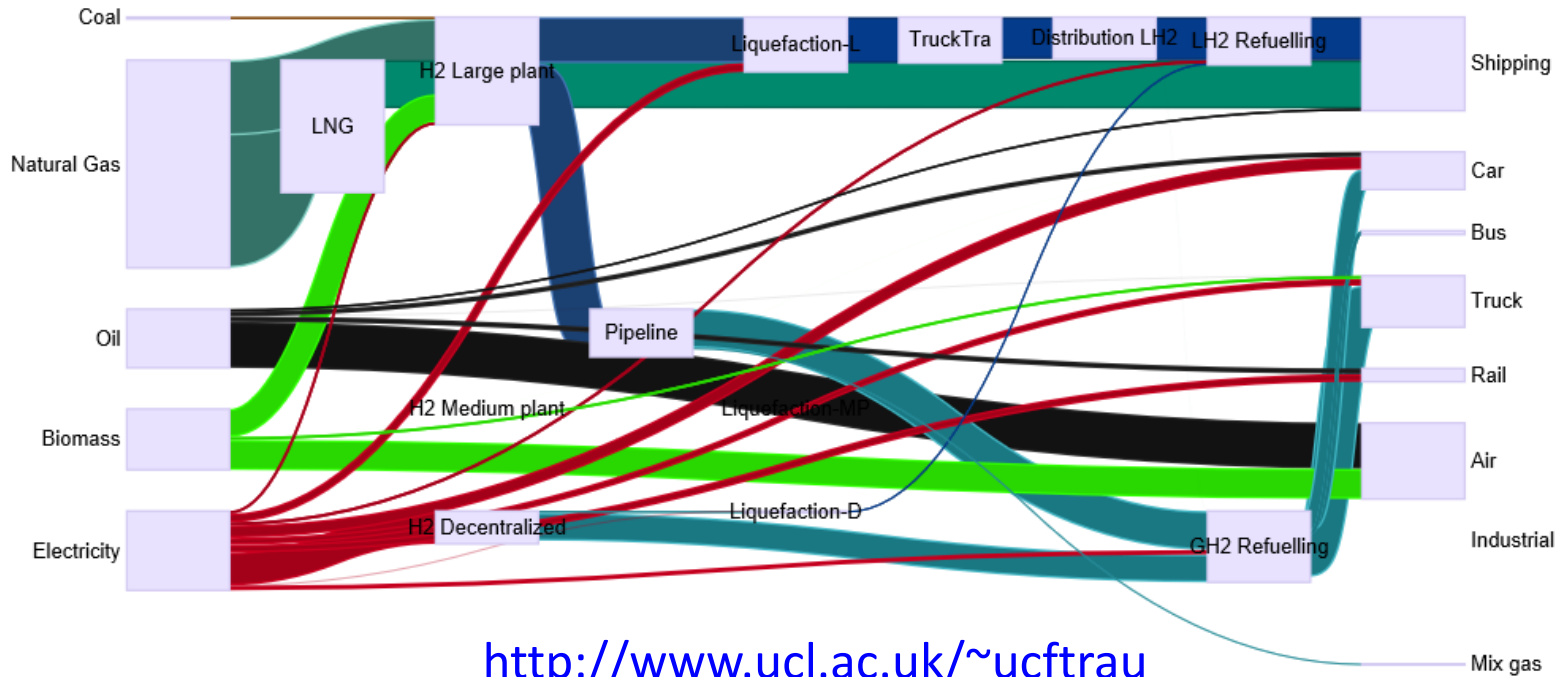
- The state of the shipping market drives the total demand for fuel, and can influence the fuel mix
- Achieving 30% EEDI reduction (2025) is not a significant driver of fuel switching
- HFO (with a scrubber) remains viable, but its share of the fuel mix is highly sensitive to key assumptions
- In just 15 years, with only moderate deviations from current BAU, significant disruption can occur (e.g. hydrogen)
- Fuel prices are key assumption and the dynamics with the rest of the energy system need addressing



# Next step

- Link a bottom-up energy system model to the shipping model
- Initial results from TIAM-GloTraM link :

Transport fuels supply 2050 under 2<sup>000</sup>C scenario



<http://www.ucl.ac.uk/~ucftrau>





# Global Marine Fuel Trends 2030



# UCL LOW CARBON SHIPPING A SYSTEMS APPROACH FINAL REPORT 2014

- Global Marine Fuel Trends 2030 (UCL Energy Institute and Lloyd's Register)
- IMO 3<sup>rd</sup> GHG Study (UN agency, the International Maritime Organisation)
- Low Carbon Shipping Final Report (RCUK final report)
- On the Attitudes and opportunities of fuel consumption monitoring and measurement (UCL Energy Institute and International Paint/Akzo Nobel)
- Hidden Treasure – Financial Models for Retrofits (UCL Energy Institute, Carbon War Room)
- Bridging the Shipping Gap (WWF, UCL)
- Transport Research Part A: Energy Efficiency and Time Charter Rates (Agnolucci, Rehmatulla, Smith)
- LCS and other conferences

[www.lowcarbonshipping.co.uk](http://www.lowcarbonshipping.co.uk)

Newcastle University  
 University College London  
 The University of Hull  
 The University of Plymouth  
 University of Southampton  
 University of Stirling  
 University of York  
 www.lowcarbonshipping.co.uk

