What is the potential future mix of marine fuels?

Carlo Raucci
UCL Energy Institute
carlo.raucci.12@ucl.ac.uk
How does the shipping system work?

How do shipping markets work, what is slow steaming, what happened in the recession, how can we model investment and ship operation?

What can we learn from analysis and models for:

a) shipping regulation to control GHG
b) Assistance to shipping’s stakeholders to lead transitions to a low carbon shipping system
We try to simulate the ship owner’s perspective

\[ p_a = R_{pa} - C_{s\_pa} - C_{v\_pa} \]

- \( f(\text{speed}) \)
- \( f(\text{technology}) \)
- \( f(\text{technology}) \)
- \( f(\text{speed}) \)
### 3 scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Oil/gas price</th>
<th>Bioenergy</th>
<th>Investment</th>
<th>Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status quo</td>
<td>Central estimate</td>
<td>Low availability</td>
<td>BAU</td>
<td>0.5% Sulphur in 2025, low carbon price</td>
</tr>
<tr>
<td>Global commons</td>
<td>Central estimate (low cost hydrogen)</td>
<td>Low availability</td>
<td>Better than BAU (more long-term)</td>
<td>0.5% Sulphur in 2025, high carbon price</td>
</tr>
<tr>
<td>Competing nations</td>
<td>High</td>
<td>High availability</td>
<td>Worse than BAU</td>
<td>0.5% Sulphur in 2030, no carbon price</td>
</tr>
</tbody>
</table>
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 fuel type.

Source: LR / UCL

- **HFO**
- **MDO/MGO**
- **LSHFO (0.5%)**
- **LNG**

**Status Quo**
Fig. 24 Evolution of marine fuel demand, relative to the 2010 baseline for each fuel

Source: LR/UCL

- **HFO**
- **MDO/MGO**
- **LSHFO**
- **LNG**
- **Hydrogen**
- **Methanol**
- **Total Fuel Demand in 2010**

### Key Points:
- **Status Quo**
- **Global Commons**
- **Competing Nations**

**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°C scenario

http://www.ucl.ac.uk/~ucftrau
• Global Marine Fuel Trends 2030  (UCL Energy Institute and Lloyd’s Register)
• IMO 3rd 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