Challenges for sustainable freight transport

Maritime transport

Elena Seco Gª Valdecasas
Director
Spanish Shipowners Association - ANAVE
1. **Shipping air emissions vs other transport modes.**

2. How can maritime transport further reduce its emissions?
   - Regulations already in force.
   - Additional regulations coming soon.
   - Long term challenges (decarbonisation).

3. Complying.
   - Air pollutant emissions ($SO_x$ and $NO_x$).
   - GHG emissions ($CO_2$).

World transport air emissions
Source: IEA, IMO and own estimates

- Road
- Aviation
- Navigation
- Rail (*)
- Others

(*) Only CO₂ emissions available for rail.
Transport air emissions

Grams per tonne∙km (kg for CO\textsubscript{2} emissions) - Source: UE and IMO

<table>
<thead>
<tr>
<th></th>
<th>Grams per tonne∙km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air freight - Boeing 727</td>
<td>4.0</td>
</tr>
<tr>
<td>Truck (&gt;40 tonnes)</td>
<td>1.0</td>
</tr>
<tr>
<td>Small cargo ship 2,000-8,000 dwt</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Rail CO\textsubscript{2} emissions (world average): 0.026 kg per tonne∙km (50% more than a small cargo ship)
Transport air emissions

Grams per tonne∙km (kg for CO₂ emissions) - Source: UE and IMO

- Truck (>40 tonnes)
- Small cargo ship 2,000-8,000 dwt

Rail CO₂ emissions (world average): 0.026 kg per tonne∙km (50% more than a small cargo ship)
Holistic approach

Penalising maritime transport (f.i. with tighter regulation) could lead to a modal shift from ship to road, with a final result contrary to the main aim.

Reduction in air pollutant emissions can increase GHG emissions ➔ f.i. eliminating sulphur from fuels is an energy intensive process.

Developing countries are growing faster thanks to cheap transport systems.

The three dimensions of sustainability: economic, environmental and social should be taken into account holistically.
1. Shipping air emissions vs other transport modes.

2. How can maritime transport further reduce its emissions?
   – Regulations already in force.
   – Additional regulations coming soon.
   – Long term challenges (decarbonisation).

3. Complying.
   – Air pollutant emissions (SO\textsubscript{x} and NO\textsubscript{x}).
   – GHG emissions (CO\textsubscript{2}).

Regulations already in force
MARPOL Convention, Annex VI (IMO)

Ratified by 88 countries which control 96% of world fleet

Sulphur oxides, $\text{SO}_x$
Nitrous oxides, $\text{NO}_x$
Particulate matter, PM
GHG, $\text{CO}_2$
Two different regulatory frameworks

- **High seas**: Less demanding rules.
- **Emission Control Areas (ECAs)**: More stringent limits.

**Why?**

- Air pollutant emissions ($\text{SO}_x$, $\text{NO}_x$, PM, ...) have a local effect (not global).
- More negative effects of acid rain in sensitive habitats.
- Desulphurisation of marine fuels and reduction of $\text{NO}_x$ emissions increase global $\text{CO}_2$ emissions (holistic regulation).
MARPOL Convention, Annex VI (IMO)
Air polluting emissions

**SO\textsubscript{x} emissions**

- **4.5%** (GLOBAL)
- **3.5%** (ECA)
- **1.5%**
- **1.0%**
- **0.5%**
- **0.1%**

**NO\textsubscript{x} emissions**

- Tier I (2000-2010)
- Tier II from 2011)
- Tier III (ECA)

From 2010 to 2020, reduction by 89% global and 93% in SECAS

 Rated engine speed, rpm

BP Madrid Forum on Energy & Sustainability
What about designating the Mediterranean as an ECA?

At IMO

• The ECA designation has to be unanimous. It will be very difficult to achieve (opposition from north African coastal States).

At EU level

• European Mediterranean ports would lose container transhipment trades.

• Serious threat to the development of intra EU trade (Short Sea Shipping –SSS-) and Motorways of the Sea in this area.

## MARPOL Convention - Annex VI (IMO)
### GHG emissions – In force from 2013

<table>
<thead>
<tr>
<th>New ships</th>
<th>All ships</th>
</tr>
</thead>
</table>
| • Must calculate their **Ship Energy Efficiency Design Index (EEDI)**, which should be lower than the EEDI prescribed by IMO.  
• Prescribed EEDI gets tougher over time: ships built from 2025 will have to be 30% more energy efficient than those built in 2014. | • Must have in place an **Energy Efficiency Management Plan** looking at issues like improved voyage planning, more frequent cleaning ship underwater parts or propeller, introducing technical measures such as waste heat recovery systems, or even fitting a new propeller. |
GHG emissions
Monitoring, Reporting and Verification

EU MRV

• EU Regulation 2015/757 on the Monitoring, Reporting and Verification of CO₂ emissions from maritime transport.
• Reporting yearly and per voyage fuel consumed and emissions, from 1 January 2018.
• Only voyages calling EU ports.
• EU Commission has just launched a process for alignment.

IMO Data Collection System

• Adopted in October 2016 by amendment to MARPOL Annex VI.
• Monitoring and reporting yearly fuel consumed and other relevant data on energy efficiency, from 1 January 2019.
• All voyages.
• World fleet.
Part of a 3 steps strategy
Both, at IMO and EU

Implement a system for collecting data on fuel consumption and CO₂ emissions.

Analysis of these data with a view to determining emission reduction targets for the maritime transport sector.

Agree on further measures to achieve these objectives, including, where appropriate, market-based measures.
Step 2: Emission reduction targets for shipping

Aspirational objectives
Proposals from the main international maritime organizations to IMO (July 2017)

Maintain international shipping's annual total CO₂ emissions below 2008 levels.

Reduce CO₂ emissions per tonne-km, as an average across international shipping, by at least 50% by 2050, compared to 2008.

Reduce international shipping's total annual CO₂ emissions by an agreed percentage by 2050, compared to 2008.
Estimated evolution of seaborne trade and its CO₂ emissions

- Seaborne transport demand in Billion tonne per mile
- CO₂ emissions in Million tonne
- CO₂ emissions net emissions after compensation

Graph showing the evolution from 2010 to 2110.
Step 3: Likely Market Based Measures (MBMs)
Two alternatives

Emissions trading schemes (ETS)

• “Cap and Trade”
• “Baseline and Credit”

Levy on fuel

• Based on fuel consumption
Market Based Measures (MBM)
Fuel levy + International fund

- Shipowner upon bunkering
- IMO Climate Fund (IMOCF) Account

Monies collected

IMOCF

Levy

Certificate

Technical research to assist the shipping sector’s reduction of its CO₂ emissions

Out of sector GHG reduction projects in developing countries (CBDR).

18
1. Shipping emissions vs other transport modes.

2. How can maritime transport further reduce its emissions?
   - Regulations already in force.
   - Additional regulations coming soon.
   - Long term challenges (decarbonisation).

3. Complying.
   - Air polluting emissions ($SO_x$ and $NO_x$).
   - GHG emissions ($CO_2$).

### Existent compliance techniques for $\text{SO}_x$

<table>
<thead>
<tr>
<th>Use of very low sulphur fuels (MDO)</th>
<th>Scrubbers</th>
<th>LNG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to implement.</td>
<td>Important CAPEX cost:</td>
<td>Reduced emissions:</td>
</tr>
<tr>
<td>Strong increase in vessel OPEX (20% to 35%) with a very negative impact on SSS services.</td>
<td>Equipment (€ 5 to 10 M).</td>
<td>$\text{SO}_x$ and PM: 100%</td>
</tr>
<tr>
<td></td>
<td>Drydock from 2 to 6 weeks.</td>
<td>$\text{NO}_x$: 85%</td>
</tr>
<tr>
<td></td>
<td>Fuel consumption increase by 2-3% (and $\text{CO}_2$ emissions).</td>
<td>$\text{CO}_2$: about 25%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proven technology.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost and cargo capacity constrains.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lack of bunkering infrastructure.</td>
</tr>
</tbody>
</table>
Selective Catalytic Reduction (SCR).

- Reduces NO\textsubscript{x} by 90-99% and PM by 25-40%.
- Need to purchase reductant (urea) and carry it.

Exhaust Gas Recirculation (EGR).

- Increases fuel consumption (and CO\textsubscript{2} emissions) and PM.

Use of alternative fuels such as LNG.
Existing compliance techniques for CO$_2$

Use of LNG as fuel (about 25% less CO$_2$ emissions)

Increase ship energy efficiency:
- Better hull and propeller hydrodynamics
- Heat recovery from exhaust gases

No existing technique neither for decarbonisation nor to commit to an absolute reduction.
To reach decarbonisation we need alternative fuels non available yet (huge R&D needed)

Electric engines and batteries on board (charged on shore with clean electricity).

H₂ (liquefied on shore with clean electricity) to be used on board in engines or energy cells.

Nuclear power?
1. Shipping emissions vs other transport modes.

2. How can maritime transport further reduce its emissions?
   - Regulations already in force.
   - Additional regulations coming soon.
   - Long term challenges (decarbonisation).

3. Complying.
   - Air pollutant emissions ($SO_x$ and $NO_x$).
   - GHG emissions ($CO_2$).

Shipping is today the most sustainable transport mode ➔ the promotion of Short Sea Shipping in intra-EU trades is a priority in the European transport policy.

New environmental standards for ships can penalise the competitiveness of maritime transport, leading to a modal shift from sea to road, increasing CO₂ emissions ➔

Therefore, the regulation of air emissions from shipping must take a holistic approach.

There are already regulations in force that will reduce air polluting and GHG emissions from shipping between 20 and 90% (depending on the type of emissions).

Shipping industry is committed to advance to full decarbonisation, but will need a significant and sustained R&D effort, well coordinated and funded at global level.
Thank you!!!