DELIVERING CLEAN TRANSPORT

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Claudio Rodríguez Suárez – GASNAM Maritime Vice President

Korea Pavilion

LNG in the crossroads of the SEA
Transport Global situation

**Figure 2.19** Oil demand in transport by mode (left) and change in transport energy use by scenario in 2050 relative to today

Oil demand in transport falls to 20 mb/d by 2050 in the Sustainable Development Scenario and increasingly concentrates in transport modes where low-carbon options are limited.

Source: IEA WEO 2019

Heavy Haul Don’t have a roadmap toward a 100% Green Solution

+ 50% emissions came from Heavy Haul sector
Maritime Sector specific situation

At global level, various international bodies have decided on targets for reducing greenhouse gas emissions, in particular IMO has intervened on maritime emissions.

**GreenHouse Gas**

Pathways for international shipping’s CO₂ emissions

2015 - 2018 - 2030 - 2050

**MEDIUM-LONG TERM (2030 - 2050)**

Strategy on reduction of GHG emissions from ships.

Need to act as soon as possible

Reduction CO₂<40%

Reduction CO₂<70%

GEI<50%

**Pathways for international shipping’s CO₂ emissions**

2015 - 2018 - 2030 - 2050

**GHG emissions Targets IMO (MPC72)**

- 2018 as base year
- Peak as soon as possible
- Intensity: 40% red
- Total: 50% red, Intensity: 70%

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At global level, various international bodies have decided on targets for reducing greenhouse gas emissions, in particular IMO has intervened on maritime emissions.
**Abatement Potential Alternatives**

**WTW GHG Emission Abatement Potential**

- **9%** Reduction of Fossil Fuels
- **17%** Average Capacity Growth
- **52%** Newbuildings + Retrofits
- **22% GNL + Biomethane** To a lesser degree

**IMO TARGETS**

- **20% GHG**
- **Fugitive emissions**
- **Potential reduction**

**Boost Motorizations:**
1. Lean-Burn principle (OTTO)
2. HPDF

**Difficult to achieve**

**Efficiency in exchange for:**
- ↑↑ Investment
- ↑ Investigation

**Fuente:** Informe NGVA / Thinkstep, IEA 2017ª Mobility Model, Elaboración Propia

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Key points from Shipping (I)

Shipping sector is responsible for 3% of annual global greenhouse gas (GHG) emissions on a CO$_2$-equivalent basis.

- Bulkcarriers, containers, oil and chemical tankers
- Represent 20% of the global shipping fleet.

- Ferries,
- Tugs
- Car-Carriers
- Yacht
- Medium Containers and Tankers

Deep sea

- Very Large 7%
- Large 13%
- Medium 43%
- Small 37%

Source: Irena

Shortsea

Are responsible for

- 85% of the net GHG emissions associated with the shipping sector
- Air quality in the Port Cities (Sox, Nox and PM)

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According to the recent IRENA study, the average age of each type is grouped by size of vessel. The age of the fleet is a key aspect for the conversion or construction of new LNG ships.

1. Small and medium size: has a higher average age of fleet, this type of ships perform SSS with long stay in port damage the air quality in cities

2. Large and Very Large size: has a lower average age compared to the other segment, great impact on deepsea
Key points from Shipping (III)

A huge range of power is required...

Up to + 100.000 HP
# Alternative Solutions Catalog

<table>
<thead>
<tr>
<th>Technology</th>
<th>2020</th>
<th>2030</th>
<th>COST</th>
<th>COMMENTS</th>
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Abatement Potential

According to the recent ThinkStep study “Life Cycle GHG Emission Study on the Use of LNG as Marine Fuel”

The study showed that on an engine technology basis, the absolute Well-to-Wake emissions reduction benefits for gas fuelled engines today compared with HFO fuelled ships are between 14% to 21% for 2-stroke slow speed engines, and between 7% to 15% for 4-stroke medium speed engines.

Production and transport of LNG to Terminal

Logistics chain bunkering LNG

144 gCO₂-eq/KWh

129.12 gCO₂-eq/KWh

14.8

CH4

Source: Study “Life Cycle GHG Emission Study on the Use of LNG as Marine Fuel”

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Logistics has the KEY - competitiveness

Escenarios coste suministro

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<tr>
<th>Producto</th>
<th>LOGÍSTICA</th>
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<tr>
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<td>Optim</td>
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<tr>
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<td>HFO</td>
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Costes comparativo de combustibles

€/MWh

Justifies investment scrubbers
Justifies investment GNL

[Sin título]

Development of the NATIONAL POLICY FRAMEWORK with the contribution in the maritime part of the CORE LNGas hive project

COMPLIANCE with the NPF resulting from the European directive 5 YEARS BEFORE, being able to supply LNG in all ports of the Core network of the Iberian Peninsula.
Logistics has the KEY – the “Spanish case” (II)
Logistics has the KEY – the “Spanish case” (III)

- First European country that complies with the provisions of the directive for infrastructure for alternative fuels in the maritime sector, five years before the established deadline.
- 15 years of demand attention without the need for investments in fixed infrastructures.

An emerging market under development...

- Bunkering LNG in Spain (m³)
  - 2014: 50,000
  - 2015: 100,000
  - 2016: 150,000
  - 2017: 200,000
  - 2018: 68,454
  - 2019: 220,000
  - 2020: 220,000

- 26 STS operations
- 81 TTS operations

Demand for Natural Gas as fuel for mobility (Maritime, road and train) will reach between 3-4 TW (equivalent to 1% of Spanish Natural Gas demand).

The volume of bunkering LNG in Spain during 2019 has reached 68,500 m³ compared to 48,900 m³ in the Port of Rotterdam (the third largest bunkering port in the world).

5 LNG-Fuelled vessels in Spain

6 LNG-Bunker vessels in Spain
LNG: A solution for “all” the sector?

Nine types of ships have been studied, comparing the different alternatives available to comply with emission regulations.

- RoPax
- Portacontenedores de 1000 TEU
- RoRo de unos 1400 vehículos
- Petrolero de 20.000 TPM
- Remolcadores puerto
- ULContainer
- Crucero
- Barcos de pesca
- Granelero Panamax

Table 7.1-1: LNG break even times for evaluated exampled ships (vs MGO)

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<tr>
<th>LNG</th>
<th>Newbuild</th>
<th>Retrofit</th>
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<td>RoPax</td>
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<td>Tug</td>
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<tr>
<td>Container liner</td>
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<tr>
<td>Bulk carrier</td>
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<td>(6.5)</td>
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Results for new construction and retrofit
Short Term, only?, opportunities for H2 in the maritime sector:

**Horizon 1: Medium term**
Fossil H₂ with CCUS to be the initiator and accelerator of the H₂ society

**Horizon 2: Long term**
Renewable H₂ to become dominant through successive /disruptive innovation & significant cost reduction

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**Emissions from all materials used in passenger cars**
Million tonnes of CO₂ per year, globally

Towards a Sustainable Future?