Decarbonisation of Shipping: Grasping the Trillion-Dollar Market Opportunity

Webinar with the Getting to Zero Coalition

24 April 2020
The webinar will begin shortly
Any questions?

You can submit your question or comment in writing at any time during the webinar using the control panel on your screen. 
(The control panel is usually located in the top right or top left of your screen.)
Getting to Zero Coalition

Ambition of the Coalition

To have commercially viable Zero Emission Vessels (ZEVs) operating along deep-sea trade routes by 2030, supported by the necessary infrastructure for scalable net zero-carbon energy sources including production, distribution, storage and bunkering.

131 Coalition Members

109 Companies
8 Knowledge Partners
11 Supporters
3 Project Partners

14 Supporting Governments

Denmark, Belgium, Chile, Palau, Morocco, Korea, Ireland, United Kingdom, New Zealand, Sweden, France, Finland, Netherlands, Poland
Today’s panellists

**Johannah Christensen**  
Managing Director  
Global Maritime Forum

**Nick Ash**  
Principal Consultant  
Ricardo

**Aoife O’Leary**  
Director – International Climate  
Environmental Defense Fund Europe

**Benjamín Maluenda Philippi**  
Specialist - Energy Planning and Regulatory Impact Assessment Division  
Ministry of Energy, Government of Chile

**Tue Johannessen**  
Senior Innovation Portfolio Manager  
A.P. Møller – Maersk
A global strategic engineering and environmental consultancy that specialises in the transport, energy and scarce resources sectors

Ricardo Group
3,000+ people
85 nationalities
48 sites
21 countries
Our mission is to preserve the natural systems on which all life depends. Guided by science and economics, we find practical and lasting solutions to the most serious environmental problems.
This presentation draws on two Ricardo reports for Environmental Defense Fund

Sailing on Solar
Could green ammonia decarbonise international shipping?

Electrofuels for shipping
How synthetic fuels from renewable electricity could unlock sustainable development in countries like Chile

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1. Electrofuels will drive investment in renewables

2. The deployment pathway can begin using existing and familiar technologies (i.e. internal combustion engines)

3. There are established safety protocols for storing and transporting ammonia and methanol

4. Bunkering facilities could be located around the world, wherever there are sufficient renewable energy resources
"The scale of cumulative investment needed between 2030 and 2050 to achieve the IMO target ... is approximately USD 1.0 - 1.4 trillion."

Global Maritime Forum, 2020

“If shipping was to fully decarbonise by 2050, the total investments needed [would be] between USD 1.4 - 1.9 trillion dollars.”

Source: https://www.globalmaritimeforum.org/news/the-scale-of-investment-needed-to-decarbonize-international-shipping
A hypothetical case study at Mejillones Port in Chile

Scale of renewable plants required for four electrofuel plants at Mejillones

- Wind farm
- 8x concentrated solar plants (CSP) with molten salt storage
- Solar photovoltaic (PV) plants
- 4x electrofuel plants

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There is huge exploitable potential for renewable energy in Chile

Renewable electricity required to supply fuel to the ships visiting Chile's ports on an average day in 2018:
  - Hydrogen: 270GWh
  - Ammonia: 290GWh

Solar potential in Chile:
  - 1,261GW*
  - (~6,000GWh per day)

Average daily electricity consumption in 2018:
  - 210GWh**

Sources:
** CNE - Anuario 2018
The investment potential in Chile is $60 - 90 bn

Estimated level of investment for hydrogen and ammonia to fuel the ships visiting Chile’s ports in 2018

<table>
<thead>
<tr>
<th>Investment (billion USD)</th>
<th>Hydrogen low capital cost</th>
<th>Hydrogen high capital cost</th>
<th>Ammonia low capital cost</th>
<th>Ammonia high capital cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel production plant capex</td>
<td>10</td>
<td>20</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Renewable plants capex</td>
<td>50</td>
<td>80</td>
<td>60</td>
<td>70</td>
</tr>
</tbody>
</table>
Study showing how zero-carbon shipping routes could **catalyse investment** in sustainable industrial development within Central and South America.
Morocco case study

Key advantages

- Located along busy shipping lanes
- Abundant renewable resources with ambitions to expand
- Established inorganic chemistry sector

Map taken from MarineTraffic (www.marinetraffic.com)
There is vast exploitable potential for renewable energy in Morocco

Renewable electricity required to supply ammonia container and dry bulk vessels passing through Morocco's ports in 2017: 300 GWh/day*

Theoretical potential of solar + wind: ~48,000 GWh per day**

Average daily electricity consumption in 2017: 92 GWh***

Sources:
* Sailing on Solar
*** IEA (2020) "Key Energy Statistics – Morocco"
The investment potential is about $100 bn in Morocco alone.

**Estimated investment potential for green ammonia plants and renewable electricity plants in Morocco**

- **High capital cost**
  - Renewable electricity plants
  - Green ammonia plants

- **Low capital cost**
  - Renewable electricity plants
  - Green ammonia plants
Policy solutions for zero-carbon shipping

Aoife O’Leary
Funding green shipping
Driven by the industry

Marine Environment Protection Committee
75th Session
Agenda Item 7

MEPC 75/7/4
18 December 2019
Original: ENGLISH
Pre-session public release: ☑

REDUCTION OF GHG EMISSIONS FROM SHIPS

Proposal to establish an
International Maritime Research and Development Board (IMRB)

Submitted by
BIMCO, CLIA, ICS, INTERCARGO, INTERFERRY, INTERTANKO, ITPA, and WSC

SUMMARY

Executive Summary: This document proposes the establishment of an IMO GHG reduction research and development programme to accelerate the introduction of low-carbon and zero-carbon technologies and fuels as identified in paragraph 4.7.9 of the IMO Initial Strategy on the Reduction of GHG Emissions from Ships. The proposed action is considered critical to achieving the levels of ambition for 2050 and beyond set forth in the IMO GHG Strategy. The co-sponsors propose that core funding would be provided via a mandatory R&D contribution per tonne of fuel oil purchased for consumption which will be necessary to maintain an appropriate level of funding and to maintain fair competition between shipping companies. The co-sponsors propose that core funding of approximately five billion US dollars over the life of the programme would fundamentally alter the current level of investment in maritime R&D focused on the development of low-carbon and zero-carbon technologies. An effort of this scale is expected to be successful in identifying one or more technical pathways that can lead to the introduction of zero-emission vessels across the maritime sector by 2030 and beyond.

Source: https://www.ics-shipping.org/docs/default-source/Submissions/IMO/final-imrb-submission-to-mepc-75.pdf?sfvrsn=6
Cost vs opportunity

$2 /t fuel

$200 /t fuel

Earth with windmills and solar panels
Ambitious enough for Europe?
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H.E. Juan Carlos Jobet, Minister of Energy, Chile
Chile as a Supplier of Green Fuels for the Maritime Industry
Renewables Success Story in Chile

Attractive for clean energy investments

- Renewables energies are developing at an accelerated pace in Chile
  - During 2019, 44% of electricity was generated using renewable energy sources.
  - 14% of this generation was wind and solar energy.
  - Government target is to reach 70% of renewable energy generation by 2030.
- The Country has a huge renewable potential of more than 1.7 TW, 70 times Chile’s installed capacity.
- More than 70% of the investment pipeline is wind and solar generation.

Wind & Solar reached 14% of total generation in 2019

Large renewable energy potential yet untapped

<table>
<thead>
<tr>
<th>Technology</th>
<th>Potential (GW)</th>
</tr>
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<tbody>
<tr>
<td>Wind</td>
<td>37</td>
</tr>
<tr>
<td>Solar - PV</td>
<td>1,194</td>
</tr>
<tr>
<td>Solar - CSP</td>
<td>510</td>
</tr>
<tr>
<td>Total</td>
<td>1,741</td>
</tr>
</tbody>
</table>

>70x Chile’s installed capacity
>8 times Germany’s capacity

Investment pipeline (MUS$)

- Wind: 33%
- Solar: 8%
- Transmission: 8%
- Hydro: 40%
- Under Construction: 47%
- Environmental Approved: 2%
- Under Qualification: 4%
- Preliminary: 19%
- Others: 2%
Green hydrogen: Key for the carbon-neutrality 2050 strategy

Measures to reach carbon neutrality by 2050

Cost-effective measures for carbon-neutrality by 2050
- Sustainable industry (25%)
- Green hydrogen (21%)
- Electromobility (17%)
- Sustainable building (17%)
- Coal plant phase out (13%)
- Energy efficiency (7%)
- Forestation
- Existing forest sinks
Two key opportunities to be harnessed by Chile

Enable carbon-neutrality

- Between 17 and 27% of the required mitigations to achieve carbon-neutrality

Generate growth and value

- Green hydrogen production cost estimates 2030, IEA
- 1 trillion US$ H₂ sales market by 2050 (Hydrogen Council, 2019)
- 160 Mton potential production of green H₂ in Chile (IEA, 2019)

National Green Hydrogen Strategy in development

to enable and promote

A national and export industry for green H₂ and its derivatives as clean fuels for the global energy transition
24.04.2020

Chile as a Supplier of Green Fuels for the Maritime Industry
You might be interested in further information, which can be found by clicking the icons below:

Sailing on Solar report and webinar recording:

Electrofuels for Shipping report and webinar recording: