ZERO-CARBON SHIPPING
THE POTENTIAL FOR ZERO-CARBON BUNKER FUEL PRODUCTION IN DEVELOPING COUNTRIES

Shipping webinar || Getting to Zero Coalition || Thu, 2 Apr 2020 || 8-9 am EST

We are going to start in few minutes. Thank you for your patience.
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Welcome – original plan

Source: Dominik Englert, 2019
Welcome – current situation

Source: Hapag-Lloyd, 2012
Welcome – short-term challenge ahead

Source: Reuters, 2020
Welcome – mid-/long-term challenge ahead

Source: Jan Hoffmann, 2016
OUTLINE

1 Intro – Planning for low-carbon development

2 Analytics – Assessing the potential of countries

3 Q&A – Asking nice or challenging questions
OUTLINE

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Why is shipping a development issue?

Figure 1.3 (a) Participation of developing countries in international maritime trade, selected years (Percentage share in total tonnage)

Source: UNCTAD, Review of Maritime Transport 2019
Why does shipping matter for developing countries?

Key enabler for developing economies

- 15 out of the 20 largest ports
- 9 of the top 10 ship registries
- 1.2 million jobs
- Shipbreaking
- Crucial lifeline for SIDS
- and more…
What scale of investment is needed?

Decarbonisation by 2070

Source: GtZ Coalition, The scale of investment needed to decarbonize international shipping, 2020
What scale of investment is needed?

Source: GtZ Coalition, The scale of investment needed to decarbonize international shipping, 2020
What does this mean for developing countries?

Source: GtZ Coalition, The scale of investment needed to decarbonize international shipping, 2020
What does this mean for developing countries?

A potential investment opportunity of $1+ trillion

Not only, but also in developing countries

Source: GtZ Coalition, The scale of investment needed to decarbonize international shipping, 2020
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Shipping’s decarbonization pathway

The IMO has committed to reducing GHG from international shipping by at least 50% by 2050 (2008 baseline)

Efficiency gains alone insufficient, zero-carbon fuels required

Typical ship operational lifespan 20-30 yrs
The ‘zero’-carbon bunker fuels options for shipping

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Production process</th>
<th>Zero-carbon fuels</th>
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2 Analytics – Assessing the potential of countries
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<td>e-hydrogen e-ammonia</td>
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<td>Haber-Bosch process</td>
<td>E-LNG e-methanol</td>
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<td>Hydrogenation for alcohols synthesis</td>
<td>Synthetic hydrocarbons</td>
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<td>Steam methane</td>
<td>Carbon capture</td>
<td>e-hydrogen</td>
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2 Analytics – Assessing the potential of countries
Top sample candidates for zero-carbon bunker fuels

- Environmental criteria:
  - GHG emissions
  - Scalability of energy sources
  - Air pollutants emissions
  - Other unintended consequence

- Economic criteria:
  - Development status and scalability of the key technologies
  - Economic competitiveness over time
  - Overall energy efficiency

- Technical criteria:
  - Physical and technical characteristic
  - Storage volume requirement
  - Toxicity to humans and aquatic life
  - Flammability

Leveraging more than 20 recent studies, ammonia and hydrogen have been selected as best exemplary technologies for this assessment.

2 Analytics – Assessing the potential of countries
Arising research questions

1. Which factors might influence the viability for production of hydrogen/ammonia?

2. Based on these factors, where could large-scale production of hydrogen/ammonia be imagined?

3. Could there be economic opportunities for developing countries?
Assessing the potential of countries to supply future low-zero carbon bunker fuels

1. Potential to leverage existing infrastructure
2. Geographic location
3. Shipping volumes
4. Potential surplus of energy required
5. Adequacy of regulatory framework

Assessment criteria
Assessing the potential of countries to supply future low-zero carbon bunker fuels

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<th>#</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>Potential to reuse existing infrastructure</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>2</td>
<td>Geographic location</td>
<td>2.5</td>
<td>13%</td>
</tr>
<tr>
<td>3</td>
<td>Shipping volumes</td>
<td>4</td>
<td>20%</td>
</tr>
<tr>
<td>4</td>
<td>Energy Resources required</td>
<td>10</td>
<td>50%</td>
</tr>
<tr>
<td>5</td>
<td>Regulatory framework</td>
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- **Existing infrastructure, 5%** Only indicative of favorable conditions. Very low importance.
- **Regulatory framework, 13%** Relevant to progress on the energy transition agenda, but it is not a necessary prerequisite. Relatively low importance.
- **Shipping volumes, 20%** Important especially at the beginning of the transition when a country would leverage its current shipping volume to serve the ships that call its ports.
- **Geographic location, 13%** It is important to have a strategic location, but it is not a necessary prerequisite for becoming a major producer/exporter. Relatively low importance.
- **Energy Resources required, 50%** The most important criteria for a Country to become a major producer is the access to large capacity of the required energy sources.
Identifying potential for ammonia/hydrogen production for shipping

Note: The identified potentials do not account for the production cost competitiveness.
Identifying potential for ammonia/hydrogen production for shipping

ng-ammonia/
nng-hydrogen

- extraordinary potential
- good potential
- limited potential

Note: The identified potentials do not account for the production cost competitiveness.
Comparing hydrogen costs with identified potential

Hydrogen costs from hybrid solar PV and onshore wind systems in the long run

Source: IEA, The Future of Hydrogen Seizing today’s opportunities, 2019

Heatmap indicating the potential for countries to produce e-ammonia/hydrogen for shipping
Conducting three cases studies

- Is there a potential for these countries to be a **key node on future supply chains**?
- What would be the **potential future demand** at country’s ports?
- What are the **energy resources required** to meet that demand?
- What would be the **investment implications**?
Example: analysis of Malaysia

Potentials in Malaysia

Photovoltaic Power Potential in Malaysia
Source: Global Solar Atlas, 2020

Oil and Gas reserves in Malaysia
Source: Coordinating Committee for Geoscience Programmes in East and Southeast Asia, 2001

Potential area for carbon dioxide sequestration in sedimentary basins of Malaysia
Source: Radzuan and Hasbollah, 2016

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Way forward
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Questions & Answers
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