A Pathway to Decarbonise the Shipping Sector by 2050

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Renewables play a key role in decarbonizing the shipping sector >60% of needed emission reductions

% of emission reduction per decarbonization measure
From ~ 800 Mt CO2 today to < 100 Mt CO2 in 2050

- 60% Indirect use of clean electricity via synthetic fuels and feedstock
- 17% Effect of reduced demand
- 20% Effect of improved energy efficiency
- 3% Employment of advanced biofuels

- Around **80–90% of global trade** is enabled by maritime shipping
- Responsible for around **3% of annual global greenhouse gas (GHG) emissions**

The future is renewables-based ‘multifuel’

- By **2050**, shipping will require a total of **46 million tonnes of green hydrogen** for e-fuels production.

- ~50% would be needed for the production of **e-ammonia**, and 20% for **e-methanol**.

- Way forward: **Methanol** needs sustainable source of carbon molecule / **Ammonia** needs engine development and address safety issues.

Need to look at the whole value chain and market – not only as fuels for shipping

- **Ammonia** spot price from 300 to **>1000 USD/t** in 2022
- **Green ammonia** today 750 – 1200 and **2050 300 – 600 USD/t**
- Fertilizers is a key market linked to **food security**

Source: https://www.irena.org/publications/2022/May/Innovation-Outlook-Renewable-Ammonia
Hydrogen trade - 30% internationally traded H2, 50/50 pipeline and shipping by 2050

- Pipeline for a few thousand kilometers
- Predominantly ammonia shipping for long distance intercontinental trade

Source: https://www.irena.org/publications/2022/Apr/Global-hydrogen-trade-Part-II
ASEAN Region captures around a quarter of bunkering fuel market for international shipping

**Figure 23** International shipping bunkering demand in ASEAN, by scenario, 2018-2050

- Current policies are not aligned with 1.5°C
- Scenario aligned with 1.5°C target

Massive green hydrogen deployment needs massive renewable electricity deployment

Key considerations

1- By 2050 more than 20,000 TWh of electricity demand for green hydrogen production – that is almost as much electricity as we consume globally today

2- From < 1 GW to 4,400 GW electrolyser capacity by 2050 -> Cautious with peak demand

3- We need a smart approach to integrate electrolyzers in power systems, synergies with renewable generation

Potential demand for green hydrogen in ASEAN

- Domestic uses will exceed 11 Mt/year, while additional fuel will be needed for international bunkering.
- Need more than 200 GW of additional RE capacity. Investments in the order of 300 billion USD are required.
- ASEAN region as a whole has further technical potential to become a hydrogen hub. It is estimated that between 40 and 400 Mt of low-cost green hydrogen (less than USD 2/kg), can be produced in the region.

Overview hydrogen projects in ASEAN countries

MAIN ACTIVITIES IN THE COUNTRY

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<th>COUNTRY</th>
<th>Activities</th>
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<tr>
<td>Brunei Darussalam</td>
<td>• Japan’s Advanced Hydrogen Energy Chain Association for Technology Development has launched a demonstration project for a supply chain of by-product hydrogen shipped using liquid organic hydrogen carriers between Brunei and Japan. The first shipment was completed in April 2020.</td>
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<td>Cambodia</td>
<td>• Cambodia’s Long-Term Strategy for Carbon Neutrality announced some hydrogen-related measures, including studies and allocation of budget for R&amp;D.</td>
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| Indonesia     | • Pertamina is looking to invest USD 11 billion to help accelerate its clean energy transition, including hydrogen developments.  
• Mitsubishi is planning a brownfield blue ammonia project, converting an existing 338 tonne per day hydrogen production plant to serve an ammonia plant in central Sulawesi. |
| Malaysia      | • Sarawak Energy has developed a pilot hydrogen electrolysis plant and refuelling station and hydrogen-fuelled buses. Sarawak also plans a fuel cell light rail transit system by 2024.  
• H2biscus is a project developed by Korean and Malaysian companies for the production of green and blue products – hydrogen, ammonia and methanol – for export to the Korean market.  
• Petronas and Eneos of Japan are developing feasibility studies for the production of blue and green hydrogen production and the transport of 50 kilotonnes (kt) year of hydrogen in toluene. |
| Singapore     | • Multiple memoranda of understanding are being signed by Singapore with governments worldwide (Australia, Chile, and New Zealand) to collaborate on hydrogen technologies. |
| Thailand      | • Under the Alternative Energy Development Plan, hydrogen is included as part of the “Alternative Fuels” category with a set target goal of 10 kt of oil equivalent (3.5 kt of hydrogen) consumed by 2036.  
• The Energy Regulatory Commission has included hydrogen in the definition of “renewable energy” to be purchased by the Provincial or Metropolitan Electricity Authorities and the Electricity Generating Authority of Thailand. |
| Viet Nam      | • Germany’s TGS Green Hydrogen is planning a green hydrogen production plant (24 kt/year hydrogen, 150 kt/year ammonia) in the Mekong Delta province with a total investment of USD 847.8 million.  
• Hydrogen is mentioned in Viet Nam’s Power Development Plan 8 as a technology to be developed. |

Philippines – Newly announced hydrogen production facility

• Hydrgène de France (HDF) plans to build a renewable-energy power plant in Zamboanga Sibugay, Philippines  
• The plant named “Hydrogen Renewstable” will be the first hydrogen power plant in the country  
• Electricity generation from water will be used as a renewable energy source  
• Initial capacity of the hybrid power plant will be 10 megawatts with future plans to expand capacity up to 45 megawatts  
• Energy storage capabilities through batteries will be incorporated

The discussions will focus on emerging solutions to **decarbonise the transport, buildings and industry sectors**, both via direct and indirect **electrification**. One session devoted to **Shipping**

- **Aims to:**
  - **Connect** industry experts and policy makers
  - **Showcase** emerging innovative solutions
  - **Inspire and inform** the energy transition

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2018 event included over 80 expert speakers & 350 participants from over 70 countries.

2020 virtual event included over 100 expert speakers & 1600 participants from over 130 countries.
Both, the supply and demand for **synthetic fuels across all end-use sectors** needs to be built, **not just shipping**.

Long term clarity on **policy and regulation** is needed.

**Harmonised certification** of green fuels and safety standards are required to further enable trade and investments.

**Collaborative instruments between ports**, green shipping corridors are emerging and help to demonstrate and scale the decarbonization of the sector.

**Future is multi-fuel** – important for development of ports and bunkering infrastructure.

**International cooperation** between governments is important, but also between public and private sectors.