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A Pathway to Decarbonise the Shipping Sector by 2050

Green Shipping Conference
Manila, 16 May 2023

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

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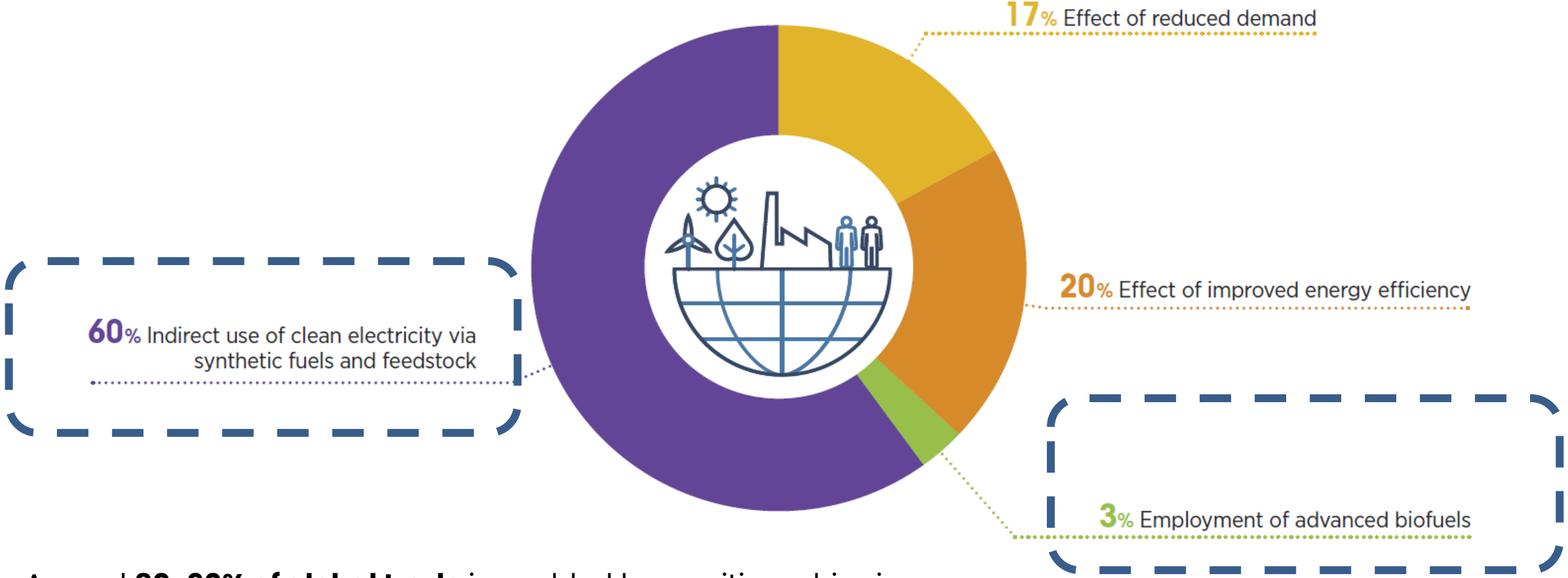
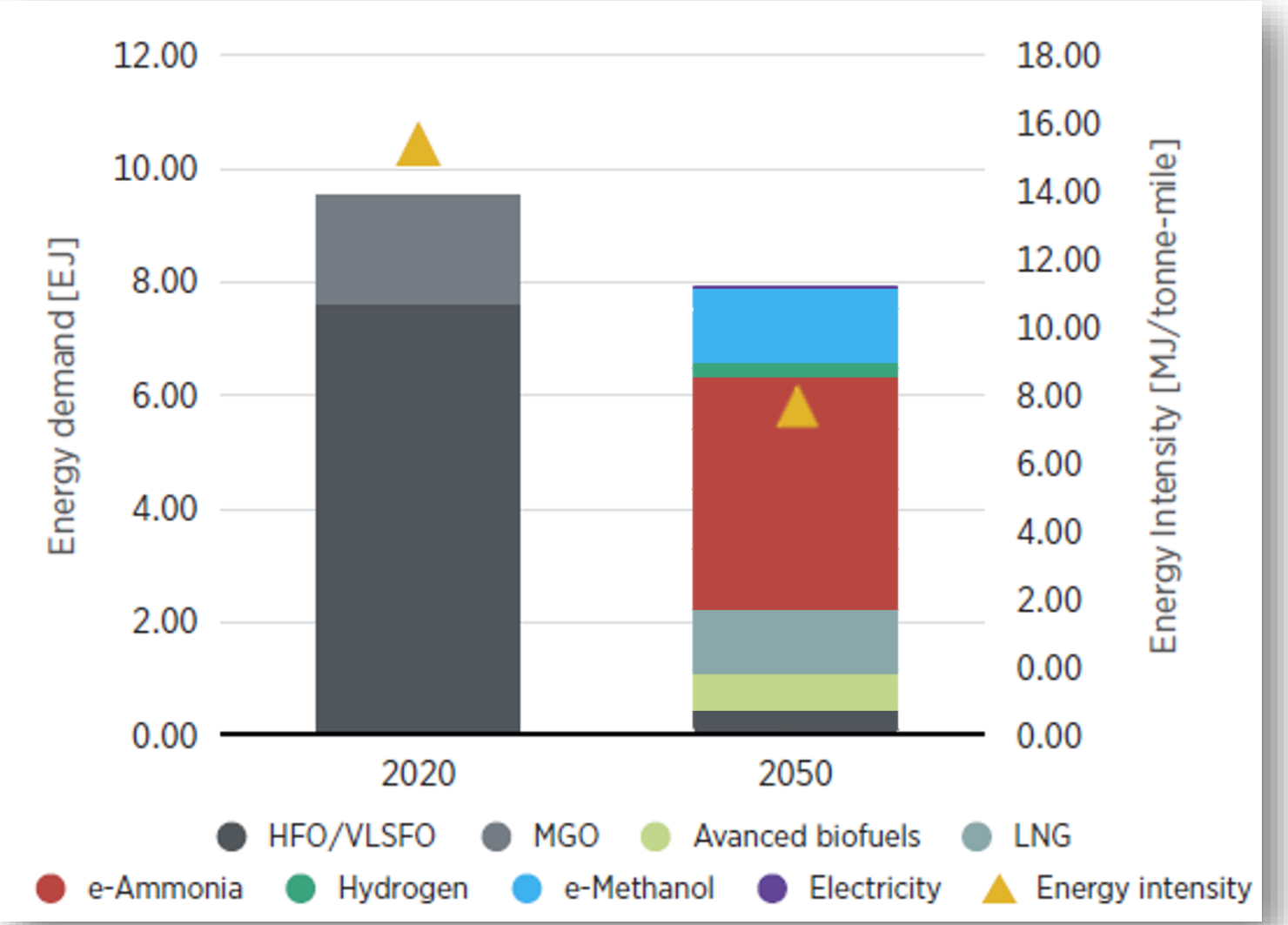
% of emission reduction per decarbonization measure
From ~ 800 Mt CO2 today to < 100 Mt CO2 in 2050



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

Source: https://www.irena.org/publications/2021/Oct/A-Pathway-to-Decarbonise-the-Shipping-Sector-by-2050

The future is renewables-based 'multifuel'

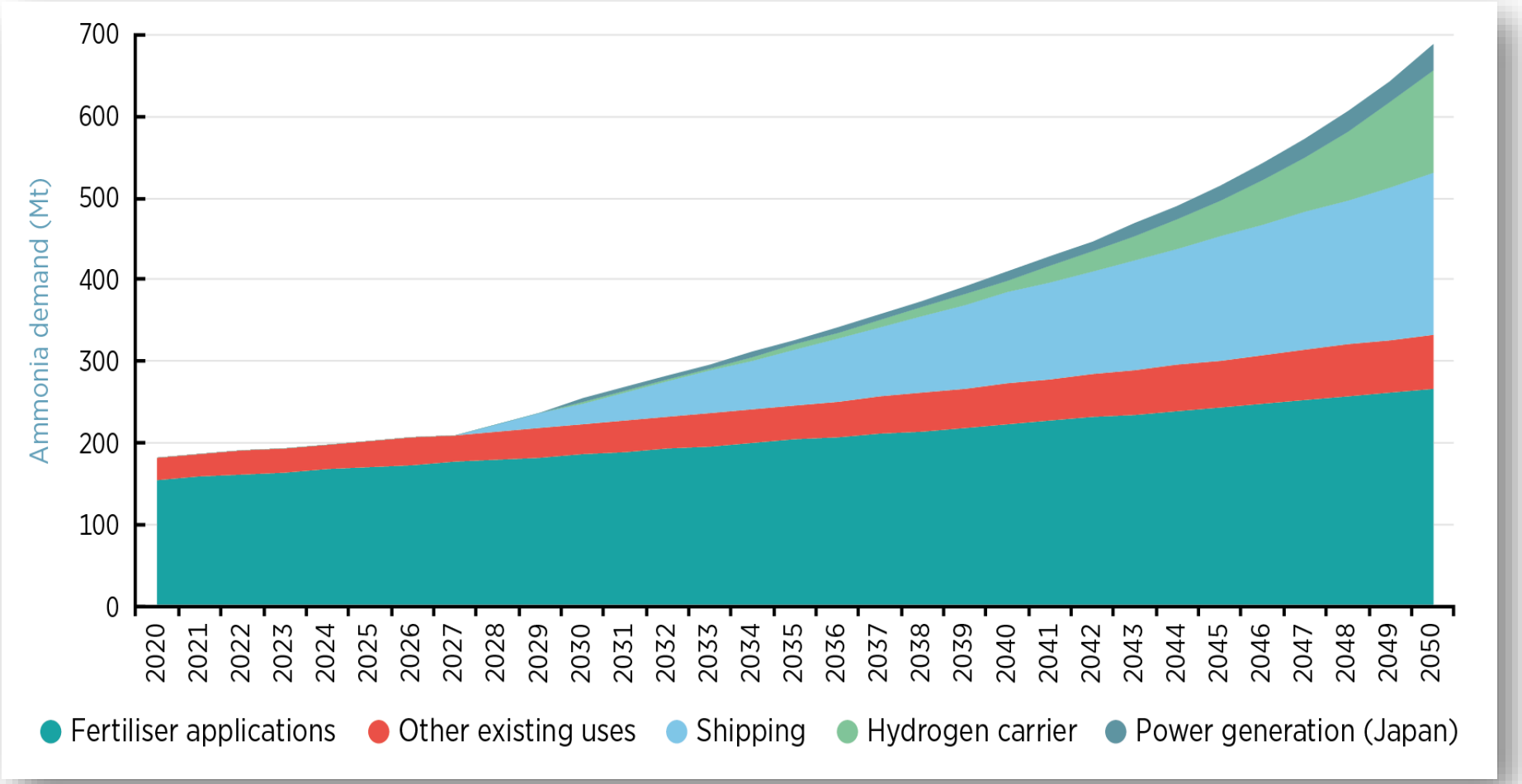


- By **2050**, shipping will require a total of **46 million tonnes of green hydrogen** for e-fuels production.
- `50% would be needed for the production of **e-ammonia**, and 20% for **e-methanol**
- Way forward: **Methanol** needs sustainable source of carbon molecule / **Ammonia** needs engine development and address safety issues

Source: https://www.irena.org/publications/2021/Oct/A-Pathway-to-Decarbonise-the-Shipping-Sector-by-2050

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

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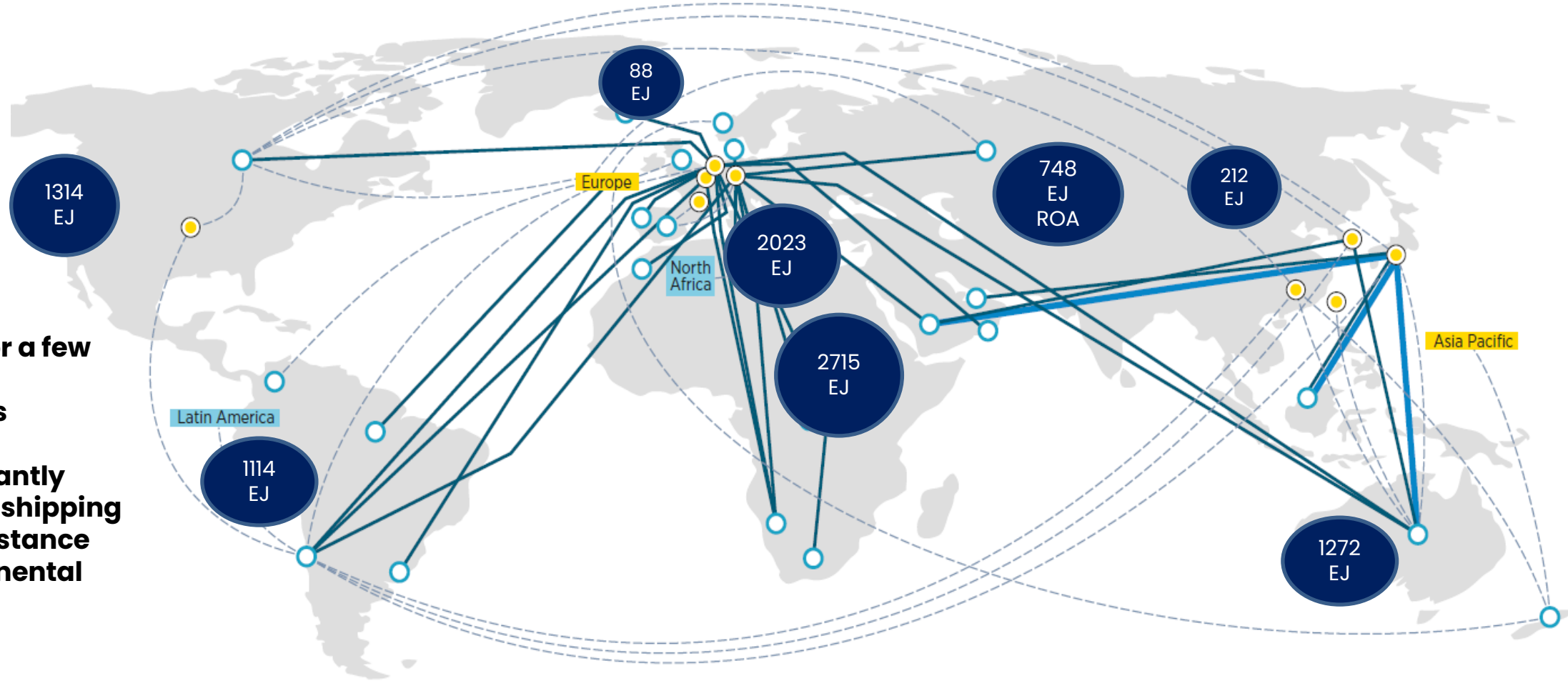
- **Pipeline for a few thousand kilometers**
- **Predominantly ammonia shipping for long distance intercontinental trade**



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

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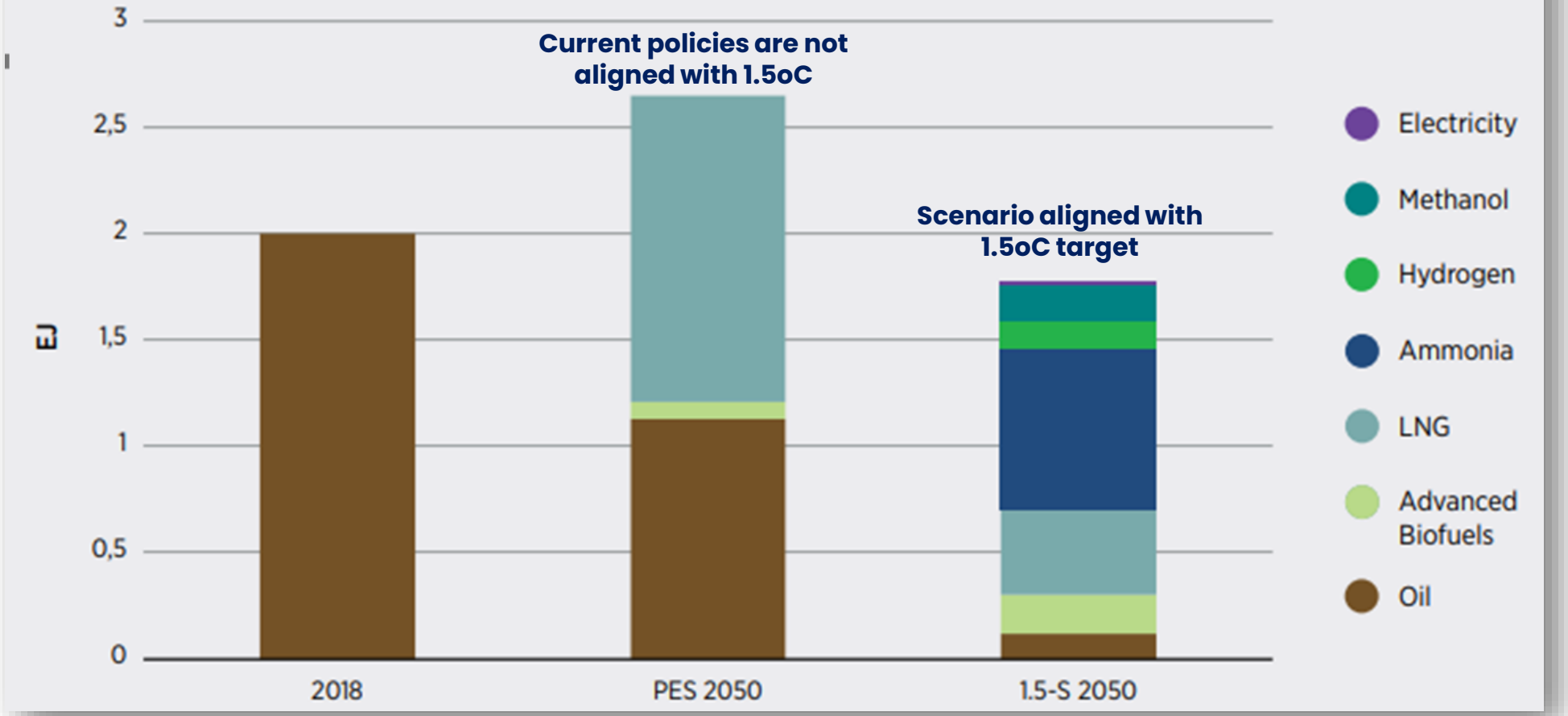
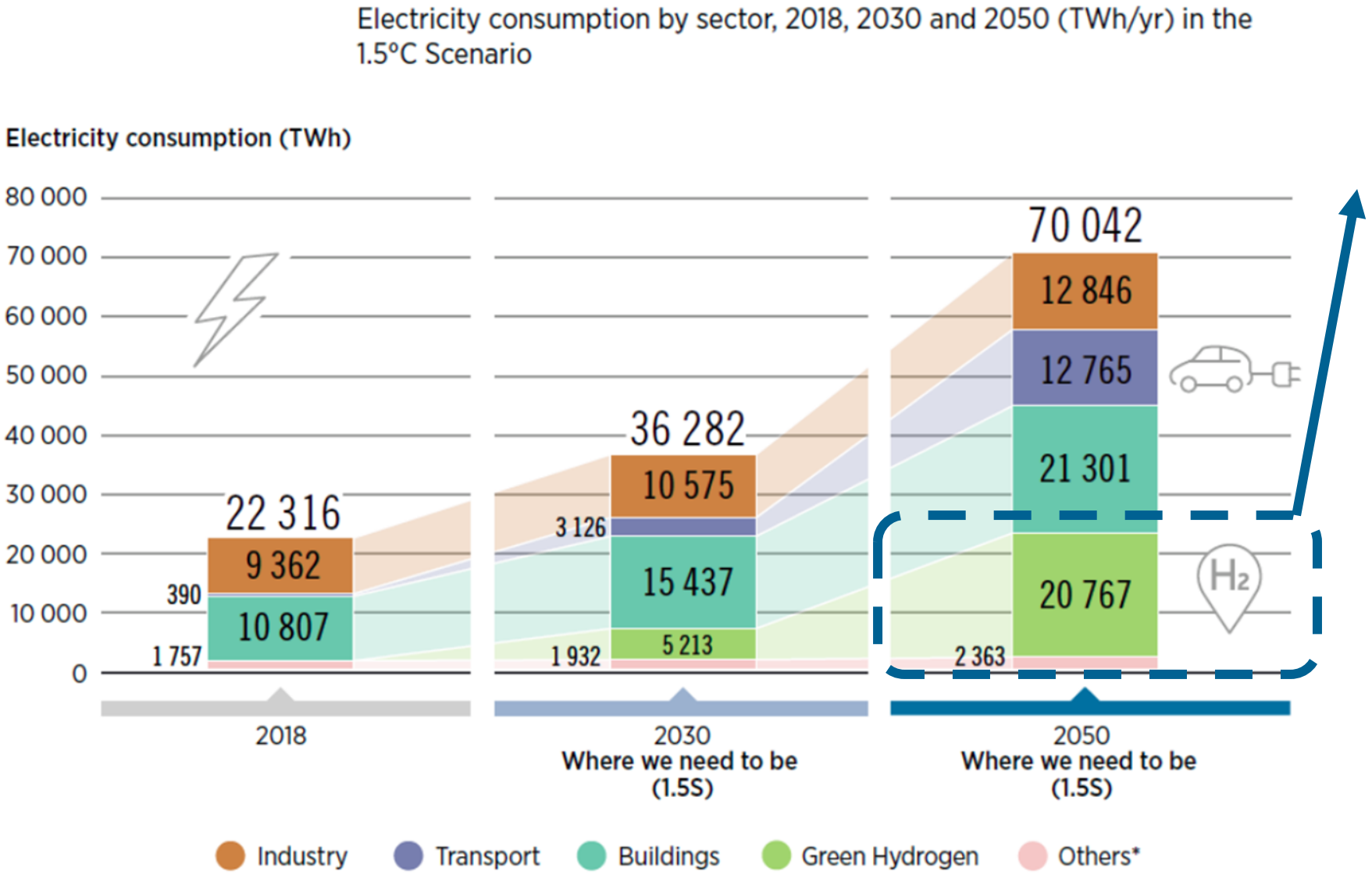
International bunkering for shipping will need to shift from oil to a broader mix of fuels.

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



https://www.irena.org/publications/2022/Sep/Renewable-Energy-Outlook-for-ASEAN-2nd-edition

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

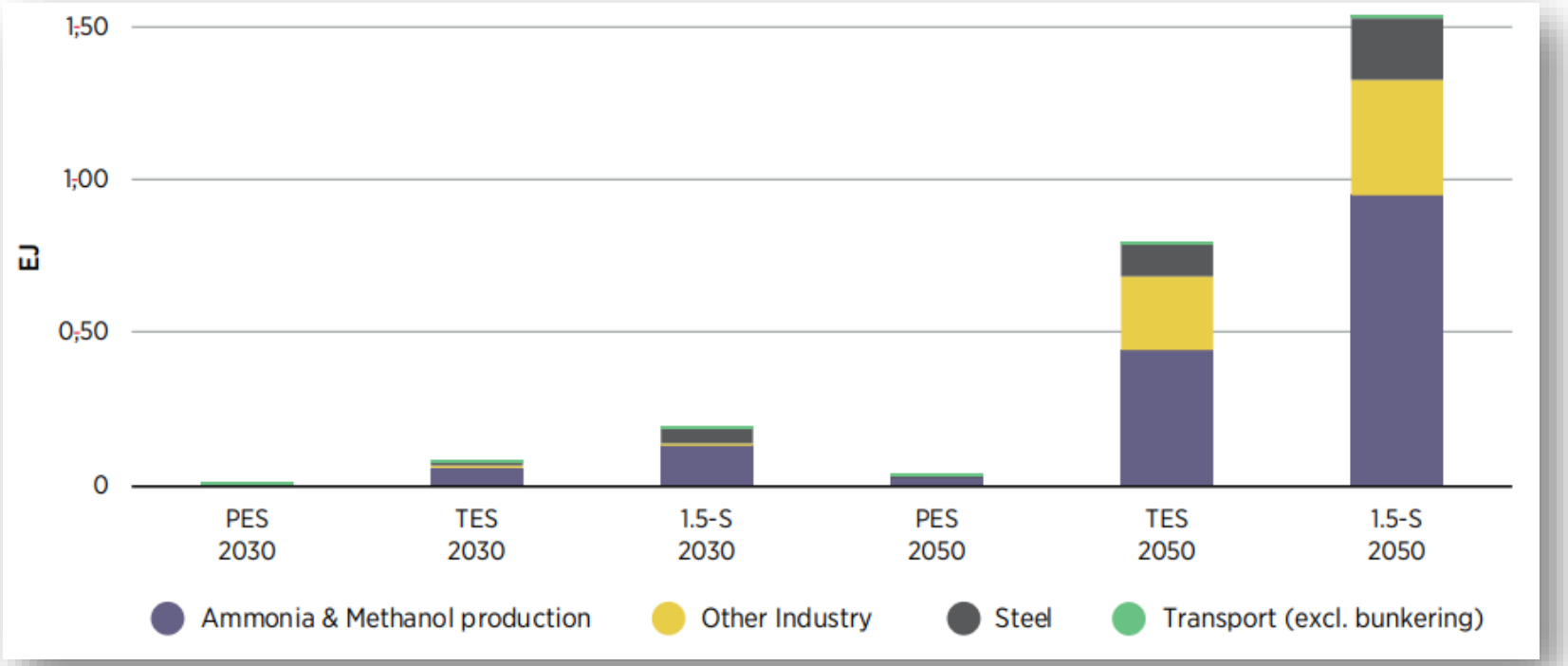
2- From < 1 GW to 4,400 GW electrolyser capacity by 2050 -> Cautious with peak demand

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

Source: https://irena.org/publications/2022/Mar/World-Energy-Transitions-Outlook-2022

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



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Overview hydrogen projects in ASEAN countries

COUNTRY	MAIN ACTIVITIES IN THE COUNTRY
Brunei Darussalam	• 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.
Cambodia	• Cambodia's Long-Term Strategy for Carbon Neutrality announced some hydrogen-related measures, including studies and allocation of budget for R&D.
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

- Hydrogène 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 usd 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 corporated

https://www.irena.org/publications/2022/Sep/Renewable-Energy-Outlook-for-ASEAN-2nd-edition

IRENA INNOVATION WEEK 2023

Renewable solutions to decarbonise end-use sectors

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25 – 28 September 2023 • Bonn, Germany

Join us at Innovation Week 2023, which builds upon previous editions of IRENA Innovation Weeks in 2016 and 2018, and the virtual edition in 2020.

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

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.

IRENA Ministerial Roundtable in January 2023 – Decarbonising Shipping

- Both, the supply and demand for **synthetic fuels across all end-use sectors** needs to be build, **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.

Thank You

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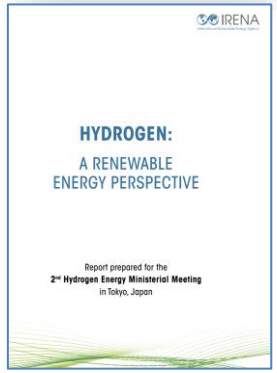
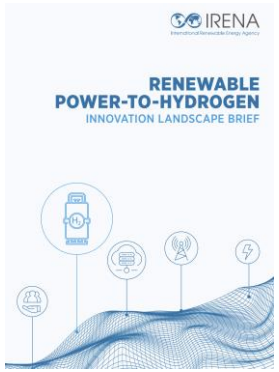
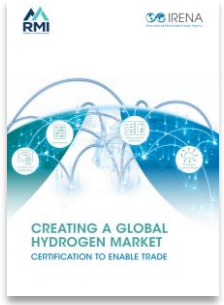
Supply

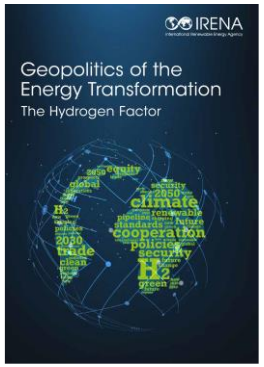
Sector coupling

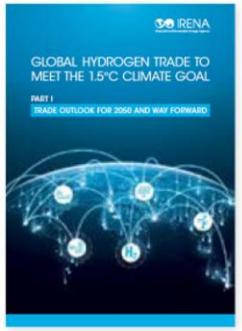


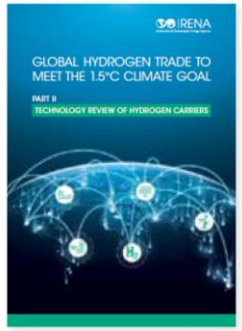


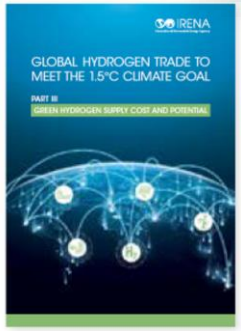
Trade



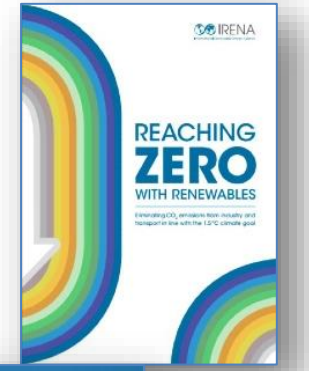


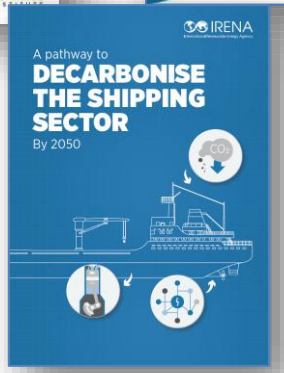






Demand





Cross cutting