JTTRI's Research for Carbon Neutrality in Maritime Sector

～ *Scenarios for 2050 Carbon Neutrality in Shipping Sector* ～

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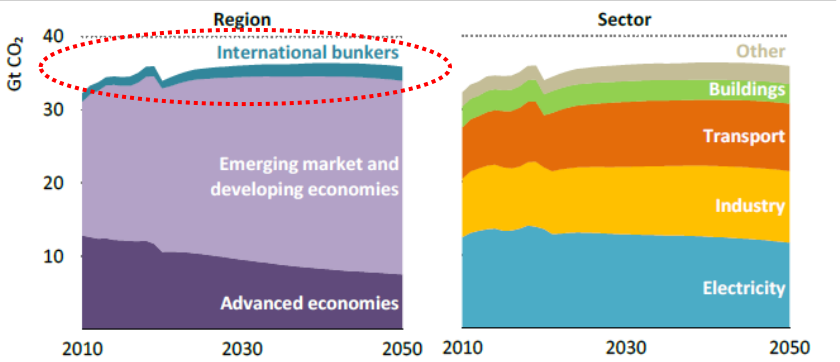
【Introduction】
Estimation of Future CO_2 Emissions by IEA Stated Policies Scenario (STEPS)

The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases・・・from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively.
(Kyoto Protocol Article 2.2.)

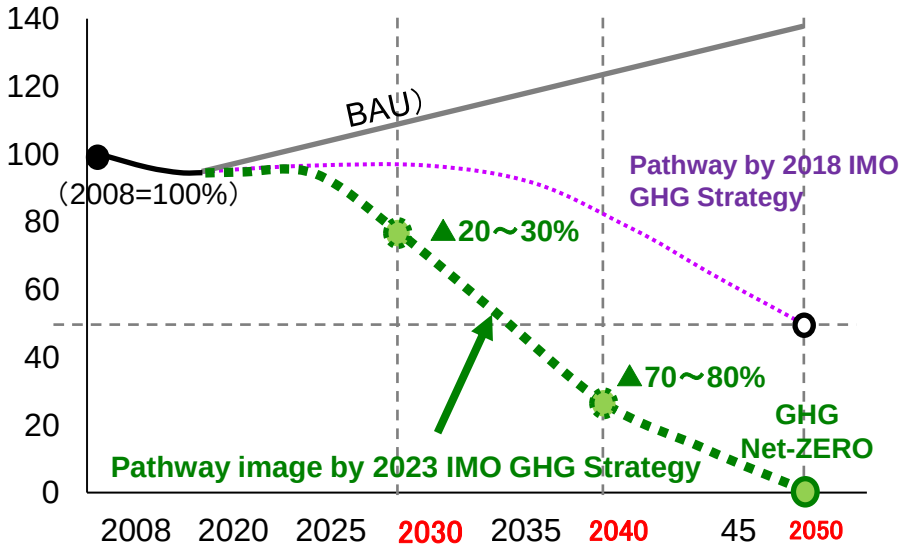
Figure 1.5 ▷ Energy-related and industrial process CO_2 emissions by region and sector in the STEPS



Global CO_2 emissions rebound quickly after 2020 and then plateau, with declines in advanced economies offset by increases elsewhere

Note: Other = agriculture and own use in the energy sector.

(Net Zero by 2050 A Roadmap for the Global Energy Sector, IEA 2021)



IMO GHG Strategy (adopted in 2023)

- International bunkers (maritime and aviation) will continuously increase

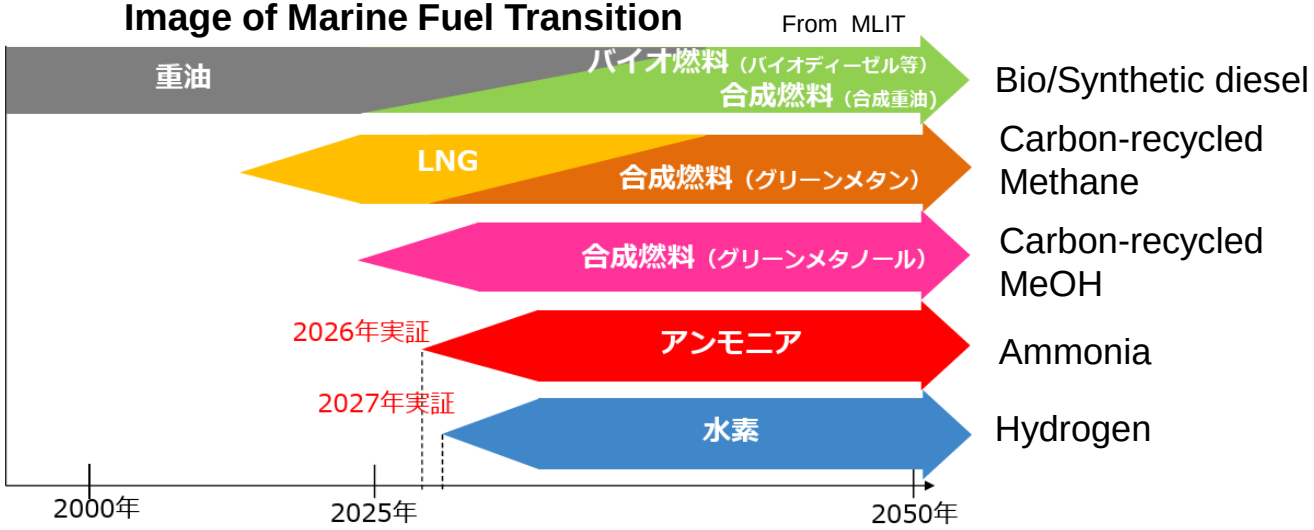
In 2023 July, the IMO adopted a new GHG Strategy for 2050 Net Zero Emissions, revising the original strategy adopted in 2018 with the aim of halving GHG emission from international shipping by 2050

【Introduction】 Fuel Shift and R&D projects for Low/Zero-Emission Ships

- In order to achieve carbon neutrality in maritime sector, it is essential to shift maritime fuels from heavy fuel oil to zero-emission fuels such as Hydrogen, Methanol, Ammonia, etc.
- In readiness for the coming era of a major fuel shift, comparable to the shift from coal to oil in the past, R&D projects on low- or zero-carbon-fueled vessels are under way.

Image of Marine Fuel Transition

From MLIT



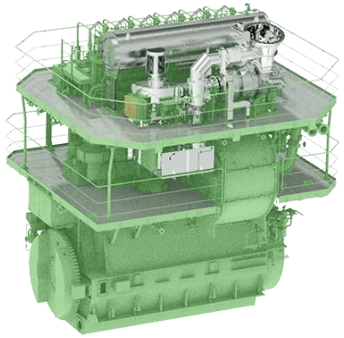
Bio/Synthetic diesel

Carbon-recycled Methane

Carbon-recycled MeOH

Ammonia

Hydrogen



Hydrogen marine engine (image)
（Japan Engine Corporation）

Ammonia-ready LNG-fueled bulk carrier
(Planning and Design Center for Greener Ships website)

Ammonia-fueled vessel
（NYK website)

Liquified hydrogen carrier（Kawasaki Heavy Industries website）

JTTRI's Recent Activities related to Carbon Neutrality in Transport Sector

Area	Theme	Duration
International Aviation	Estimation of Potential of SAF Production in Japan based on availability of raw material	2020-2021
	Simulation on Long-Term CO2 emissions from Japan's Aviation Sector	2021-2022
International Shipping	Life Cycle Assessment of New Maritime Fuels (regarding IMO-LCA Guidelines)	2020-2021
	Possible Fuel Carbon Intensity Regulations	2022-2023
Domestic Transport - Public Transport -Freight Transport	Integrated Roadmap for Green Transition toward 2050 Carbon Neutrality	2023-
	Supply Chain of Hydrogen based Fuels for Transport Sector	2023-

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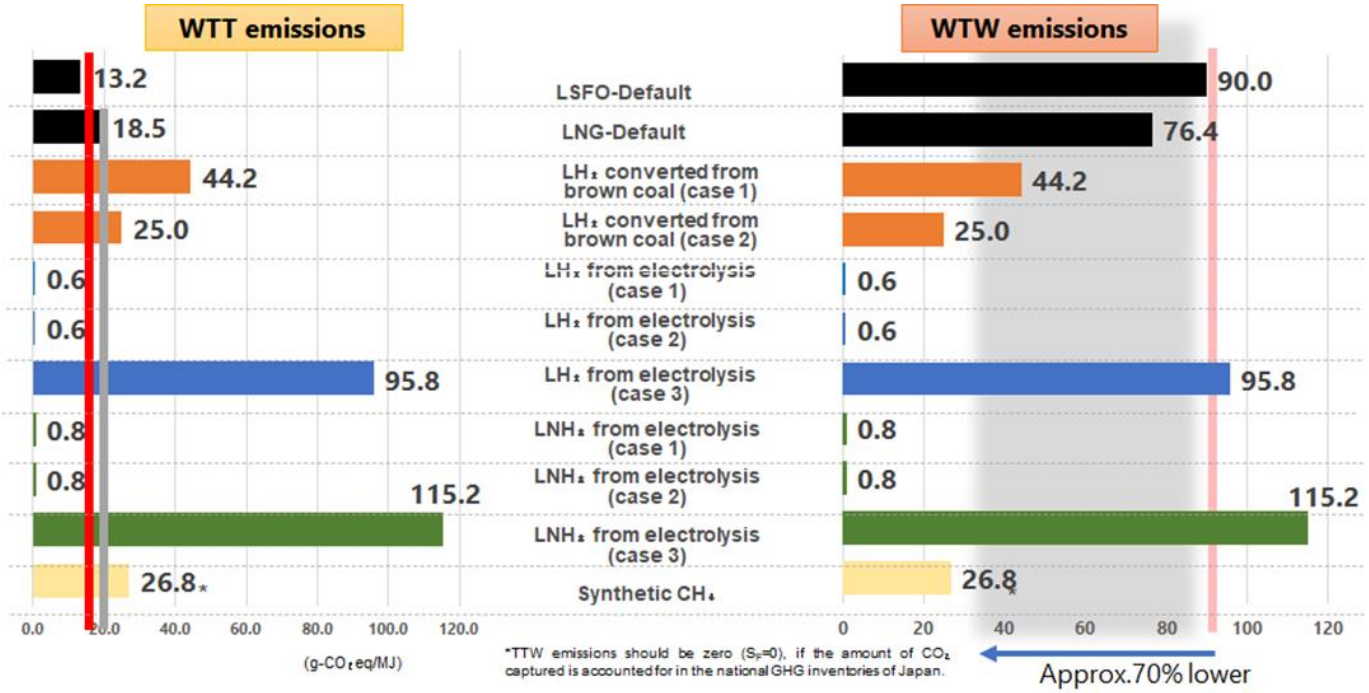
【Maritime】 Research on the framework for decarbonization of international shipping

Life Cycle Assessment of New Maritime Fuels 2020-2021

- Analyze and estimate of WTT Emissions and WTW Emissions of Alternative Fuels (LH2, NH3, CH4) based on their projected supply chain
- Consider the default value of alternative fuels and certification systems

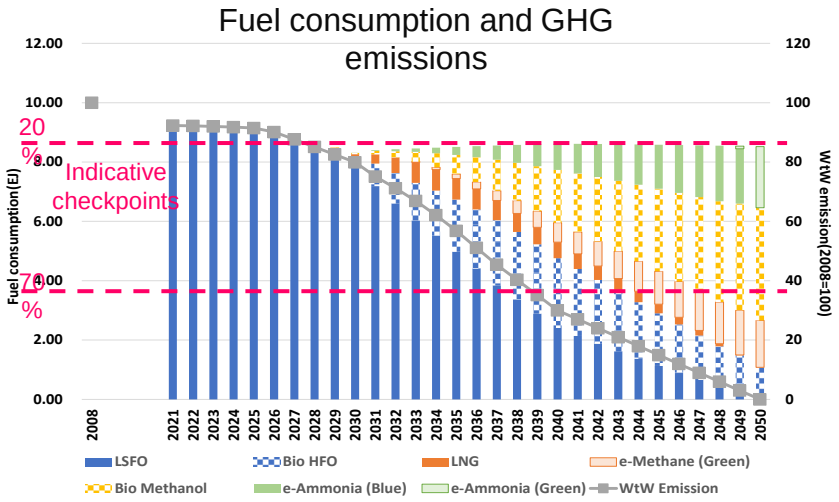


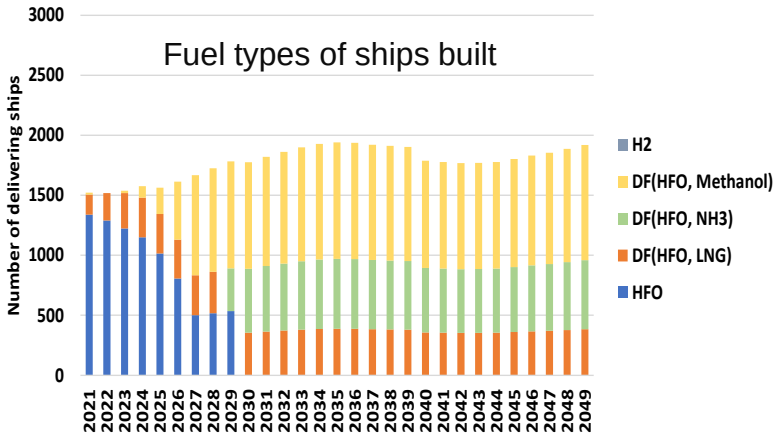
- this result contributed to the discussion on the IMO's LCA guidelines
- 2022.2 International Seminar with EU, Norway, Australia and the IMO

【Maritime】 Research on the framework for decarbonization of international shipping

Possible Fuel Carbon Intensity Regulations for international shipping 2022-2023

- Analyze and assess quantitively the impact of fuel transition by possible GHG fuel intensity (GFI) regulations
- Consider the pathway of fuel transition in order to achieve IMO GHG Strategy for the international maritime industry, including deployment and procure fuels
- Total 24 cases are simulated by combining several scenarios such as shipping demand, alternative fuels supply and hypothetical GFI lines.





This result was submitted to the IMO as an Information Paper for consideration in the drafting of the GHG Fuel Standard.

【Domestic Transport： New Research Projects (2023~2024)】

Green Transition toward Carbon Neutrality by 2050

Integrated Roadmap of Green Transition toward 2050 Carbon Neutrality

Challenges and issues

- ✓ Slow progress in decarbonizing the transport sector, especially freight transport
- ✓ Investment risks due to uncertainty about **possible alternative fuels** and the lack of financial resources for the green transition (99% of domestic transport operators are SMEs)
- ✓ Low demand-side commitment to alternative fuels leads to low supply-side commitment and creates stalemate (chicken-and-egg situation)
- ✓ Assessing the impact of decarbonization costs, including those of future carbon pricing, on the transport sector and the impact on society and the economy
- ✓ Building consensus among stakeholders and society

Supply Chain of Hydrogen based Fuels for Transport Sector

Challenges and Issues

- ✓ Shortage of supply resources of bio-based fuels in Japan
- ✓ Delay in considering the use of hydrogen fuels for domestic transport other than light duty vehicles
- ✓ High cost and technical challenges, including safety issues and public acceptance

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Thank you!

The Pathways and Conditions towards Realizing Carbon Neutrality in Japan's Shipping Sector

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