Policy updates and implications for alternative fuels

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The POLITO International Dimension

- Prof. **Prussi** is EC **nominated expert** in the **ICAO/CAEP/WG5** and **co-leader** of the **Core-LCA** subgroup.
- Prof. **Chiaramonti** is Italian **nominated expert** in the **ICAO/CAEP/WG5**.

- Prof. **Prussi** is EC **nominated expert** expert for assisting the European Commission (DG-MOVE) at IMO, on alternative fuels sustainability issues.
- Prof. **Prussi** is also IMO **member** of **GESAMP** WG 46 on the Life Cycle GHG Intensity of Marine Fuels.

International Context

The IMO strategy

The IMO 2023 Strategy for the reduction of greenhouse gas (GHG) emissions represents a fundamental step toward the decarbonization of the international maritime sector.

The **main objectives include:**

- **Reduction of ships' carbon intensity.**
- **Reduction of the carbon intensity of international maritime transport:** with a minimum target of **40% reduction by 2030**, compared to **2008 levels**, with the ambition to reach **at least 70% by 2040**.
- **Adoption of low- or zero-emission technologies and fuels:** such as **green hydrogen, green ammonia, and other innovative solutions**.
- **Achieving net-zero GHG emissions around 2050.**

The IMO strategy

- With respect to the broader issue of combating climate change, the Marine Environment Protection Committee (**MEPC**) of the International Maritime Organization (**IMO**) **revised its strategy for the reduction of greenhouse gas emissions during MEPC 80**.

- The IMO's commitment **is to create a broader framework for initiatives that are already underway**.

- In October 2024, due to the opposition of some member states, **the IMO decided to postpone the discussion on the adoption of the Net-Zero Framework to 2026**.

The role of Alternative marine fuels

Enablers/barriers for alternative fuels

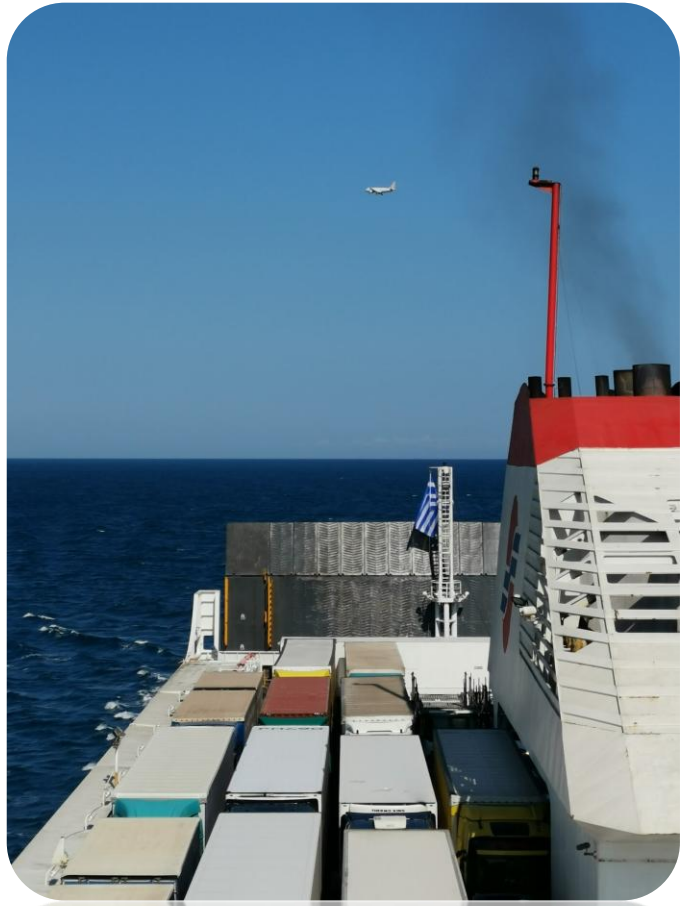
The pace at which alternative fuels will be uptaken in the maritime sector depends on several enablars/barriers:

- **GHG emissions reduction potential**
- Costs/Marginal abatement cost potential (€/t_CO2_saved)
- Sustainability
- Feedstock availability
- TRL and CRL (Commercial Readiness Level)
- Need for infrastructure and refuelling points.
- Expertise of the operators along the supply chain (e.g. this relates to safety of the handling).
- Regulation
- Expected competition with other sectors (e.g. road and aviation)

Prussi, M., Scarlat, N., Acciaro, M., & Kosmas, V. (2021). Potential and limiting factors in the use of alternative fuels in the European maritime sector. Journal of cleaner production, 291, 125849.

IMO strategy revision and CG

- **Currently,** with respect to the sector **decarbonisation** we may **talk of "policy driven"** scenario.
- Among the short-term measures**, IMO Strategy** calls for the **development** of "**robust life cycle GHG guidelines** for all types of **fuels**, in order to prepare for an implementation programme for effective uptake of alternative low-carbon and zero-carbon fuels".

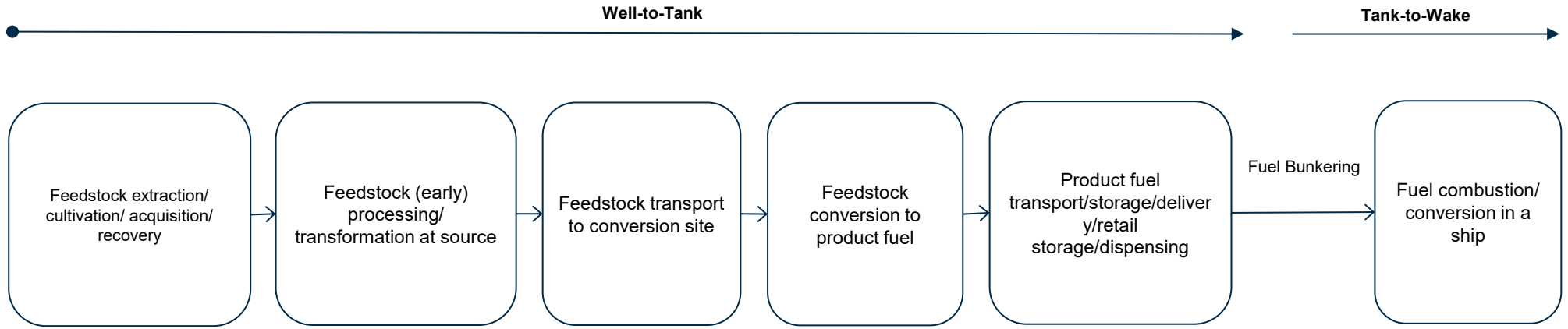


Relevant methodological choices

In Well-To-Wake:

WTT: emissions related to feedstock supply, conversion and fuel transport.

TTW: emissions related to fuel use: distribution up to the engine and fuel combustion.



Alternative fuel emissions – WTT

Tipo di fuel	Well-To-Tank			
	(gCO_{2e}/MJ)			Reference
	REDII	Min	Max	
BioLNG/Biomethane	14,6	*13,8*	*25,5*	JEC V5 WTT - pathway codes: • OWLG1 • OWLG5
BioMethanol	-	*10,5*	*14,2*	JEC V5 WTT - pathway codes: • WW/ME
BioDiesel	50,1	*8,3*	*32,9*	JEC V5 WTT - pathway codes: • WOFA3 • SOFA (limited to min 65% GHG saving as per REDII)
e-LH2	0	-		EU Delegated Act on RFNBOs and RCF and REDII Art.27
e-LNG/e-methane				
e-methanol				
e-diesel				
e-ammonia				

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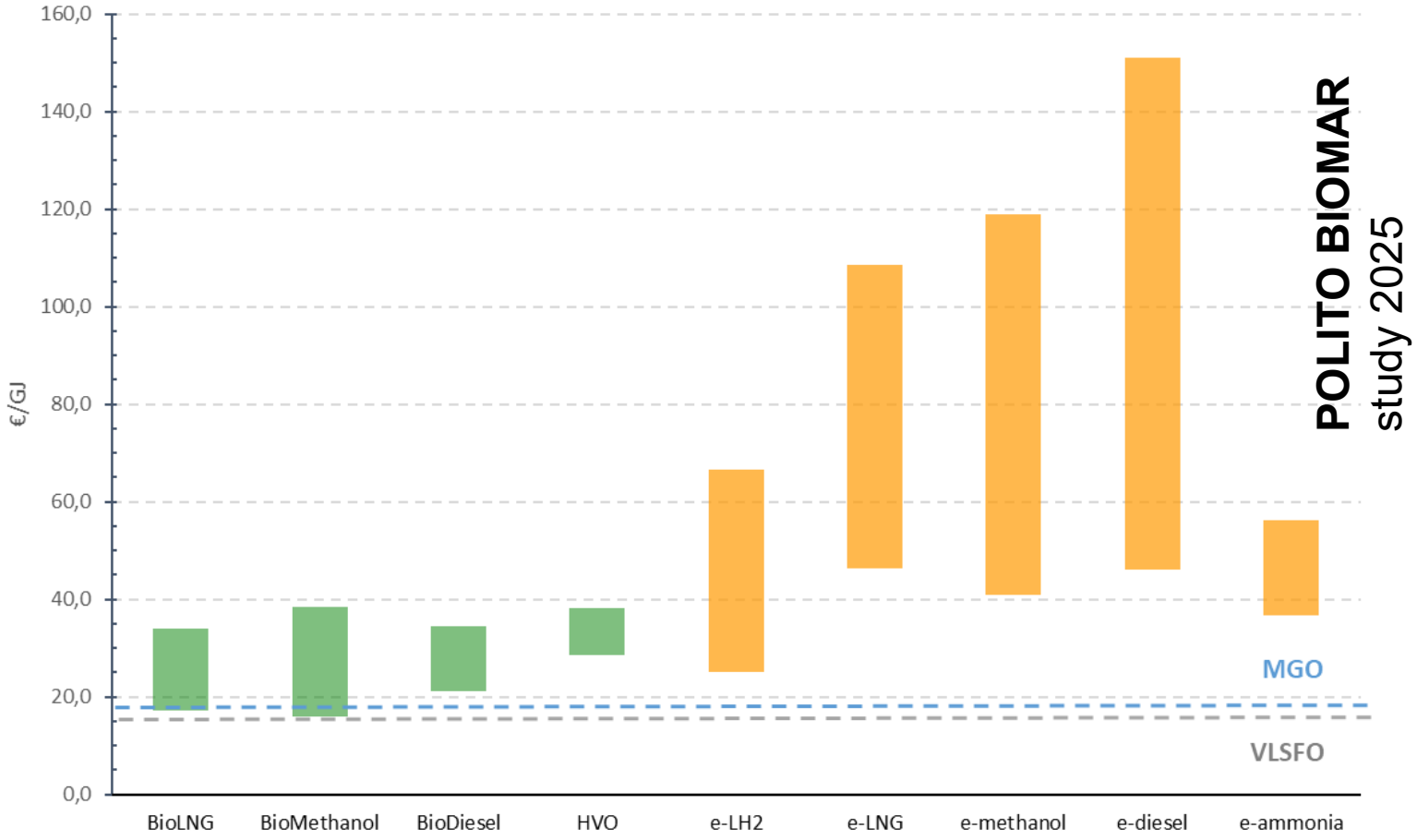
Comparison of alternative fuel costs

Comparison with Conventional Fossil Fuels (MGO and VLSFO)

The dashed lines represent the cost of the reference fossil fuels:

- **VLSFO** (Very Low Sulphur Fuel Oil) has the lowest cost, below €20 per GJ.
- **MGO** (Marine Gas Oil) is slightly more expensive, yet remains cheaper than all the biofuels and e-fuels analyzed.



Marginal Abetment Cost – MAC

GHG

- Definition of the GHG saving per fuel and engine/converter
  - $g_{CO2e\ saving}/g_{fuel}$

€

- Cost data
  - €/MJ_{fuel} -> €/kg_{fuel}

€/CO2

- Elaboration of WTW data to obtain the cost of saving a unit (tonne) of CO_{2e} for the considered solutions
  - €/t_$CO_{2e\ saved}$

The MAC is a widely used concept aimed at comparing different options for reducing a fixed amount of CO_2.

Marginal Abetment Cost – MAC

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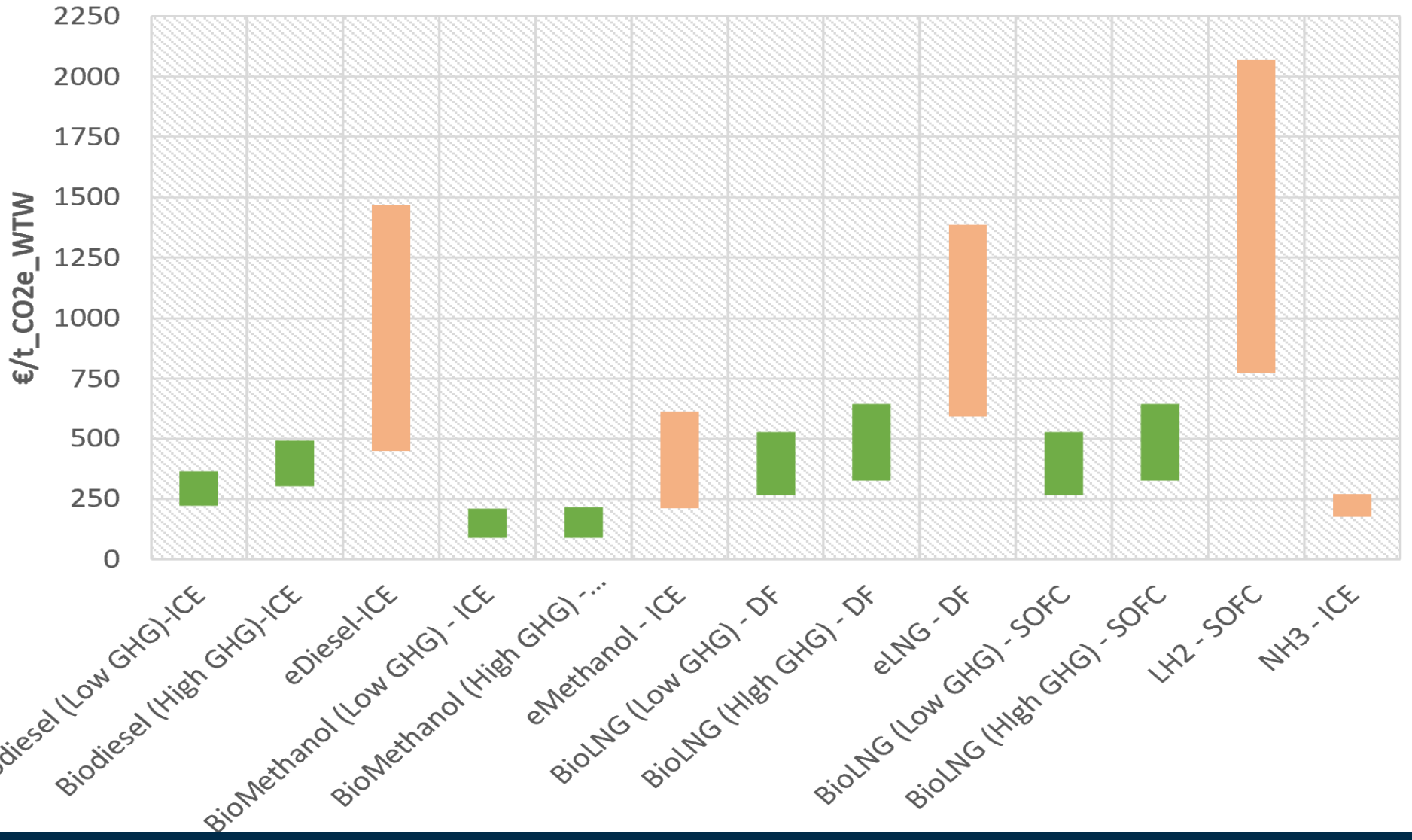

Marginal Abetment Cost – MAC

Among the proposed solutions, the **lowest costs for reducing one unit of CO_2eq** are associated with the use of **biofuels**. Although **RFNBOs (Renewable Fuels of Non-Biological Origin)** offer a higher greenhouse gas reduction potential, their **extremely high production costs** currently make them **less economically efficient**. Clearly, the expected **cost reductions** could significantly help **close the existing gap**.

Among the **e-fuels**, it is worth noting that **e-Methanol** and **e-Ammonia** currently appear to be the **most promising options**. However, this result is closely related to the fact that **the higher costs associated with the construction of ships** (adapted for their use) are **not considered** in the present analysis.

Take home messages

- Both at the **international** and at the **EU level**, the **role** of **alternative fuels** in supporting the decarbonization of hard-to-abate sectors **is clear**.

- **New technologies** and **conversion processes** will be **required** to **close the existing gap** between installed **capacity** and expected **demand**.

- **Policies supporting** the use of alternative fuels are **in place**.
- However, **cost remains a key factor** for the **large-scale deployment of these technologies**.

- Additionally, at **international** level there is still a **significant** degree of **incertitude,** which may hinder new investments.

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Thank you

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