

INSIGHT BRIEFING SERIES

Future biofuels for shipping

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The Getting to Zero Coalition is committed to accelerating shipping decarbonization by getting commercially viable deep sea zero emission vessels powered by zero emission fuels into operation by 2030 to put shipping on a path for full decarbonization by 2050. To unpack the different fuels and technologies options that could support the transition to zero emission fuels, the workstream on Fuels & Technologies has hosted a series of webinars, gathering perspectives from experts across the maritime value chain - shipowners, operators, charterers, financial institutions, classification societies, and NGOs. The insight briefing paper series aims to reach a broader audience and build a common understanding of the fuels, engines, and storage technologies that will enable the decarbonization transition.

The Insight Brief is based on analysis by Global Maritime Forum for the Getting to Zero Coalition, a partnership between the Global Maritime Forum and the World Economic Forum, made possible with funding from Mission Possible Partnership.

Date of the webinar: August 2021

Watch the webinar [here](#).

Panelists:

- Carolina Grassi, Policy and Innovations Manager , Roundtable for Sustainable Biomaterials
- Berit Hinnemann, Head of Decarbonisation Business Development, Maersk
- Johannes Schurmann, Innovation manager, Goodfuels
- Anne Sophie Vinther Hansen, Investment Manager, Danish Sovereign Investment Fund

Moderator: Randall Krantz, Senior Project Advisor on Shipping Decarbonization, Global Maritime Forum/Getting to Zero Coalition

Executive Summary

Synopsis: Biofuels can be considered the most 'technologically ready' of existing alternative zero emission fuel options. Currently available and being used in the form of drop-in fuels, such as HVO (hydrotreated vegetable oil) or blend-in fuels such as FAME (fatty acid methyl ester) or as alternative fuels in specialty engines such as biomethanol. While a deeper understanding of the sustainability and scalability of biofuels is still evolving, it is possible to make some assumptions about the supply availability relative to non-bio zero carbon fuel options. Availability of biofuels for shipping depends on scalability, sustainability, and demand from other industries such as the aviation sector. Sustainability criteria and certifications are key areas to address when exploring the use of biofuel in shipping's decarbonization transition.

Key takeaways:

- > Sustainability criteria and appropriate certification can ensure that potential negative impacts of biofuels are not shifted elsewhere along the supply chain.
- > There is no silver bullet for scalable zero emission shipping fuels, and biofuels can play a role in the long term transition pathway, offering the flexibility of an interim drop-in solution or as a zero emission pilot fuel for e-ammonia or e-methanol.
- > It is important to keep in mind that investment choices are fostered by the spectrum of impact along the supply chain and across industries.



Opportunities and challenges of biofuels

The opportunities:

- **Flexible transition:** Sustainable biomass can be used to create drop-in fuel options or blends as part of the fuel mix to start the transition
- **Sustainability:** The production of biofuels requires a framework with common standards in order to avoid negative environmental and social impacts upstream in production processes. Biomass-related sustainability regulations, standards and certification schemes, based on robust sustainability criteria, currently exist and are being used. Nevertheless, the different regulations, standards, and certifications can differ in terms of criteria, and there is a need for harmonised rules and certification schemes

The challenges:

- **Market response:** Biofuels have a negative impact risk in scalability, long term competition driving potential shortages in sustainable biomass availability
- **Competition:** Other industries are keen to use biomass and biofuels as part of their transition, including aviation and energy sectors, likely leading to price increases as demand outstrips supply
- **Lifecycle emissions:** A majority of available biofuels are sourced from biomass, biowaste, or recycled vegetable oils, and although categorised as a zero or near-zero emission fuel option, differentiation should be made including the full emission lifecycle upstream in the supply chain and during the combustion process

Detailed Summary

About biofuels

Biofuels are transportation fuels such as ethanol and bio-based fuels that are made from biomass materials. In many uses, these fuels are usually blended with fossil fuels (gasoline and distillate/diesel fuel and heating oil), but they can also be used on their own. The Getting to Zero Coalition's definition of "zero carbon energy sources"¹ is intended to be inclusive for fuels produced from biomass, with zero carbon electricity, or from fossil fuels with carbon capture and sequestration technology.

1. The challenges of producing biofuels without shifting negative impact somewhere else in the supply chain

a. The challenges for scalability

Several barriers to scaling sustainable biofuels were highlighted in the webinar to ensure that fuel production can demonstrate real greenhouse gas emission reductions without creating negative impacts upstream as environmental and social issues due to the production process. Performing a life-cycle analysis is needed to

1 [Getting to Zero Coalition \(2019\). Definition of zero carbon energy sources.](#)



identify how a bio-based feedstock is sustainable and scalable.

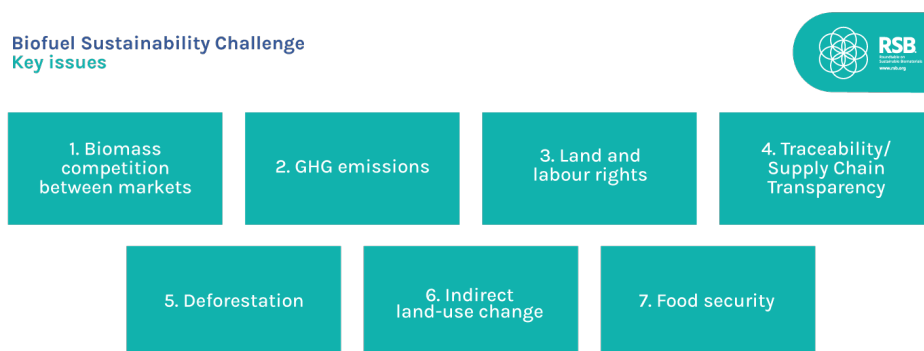
b. Sustainability criteria

Carolina Grassi, Policy and Innovations Manager at the [Roundtable for Sustainable Biomaterials \(RSB\)](#), highlighted that to overcome the challenges [Exhibit 1], sustainability principles and criteria can guide the development of truly sustainable biofuels. Credible and robust sustainability criteria should meet technical and economic requirements while avoiding negative environmental and social impact – and to advance positive impacts. RSB, with stakeholders from different sectors and regions, has developed a sustainability framework grounded in 12 Principles that describe how to produce fuel, biomass and material products from bio-based and recycled carbon in an environmentally, socially, and economically appropriate manner. The 12 Principles contribute to food security, rural development and ecological conservation, mitigating a range of potential impacts, such as climate impacts (GHG reductions), environmental issues (conservation, soil, water, air pollution), and social issues (human rights, rural and social development, local food security, land rights).² [The 12 RSB Principles & Criteria for sustainability can be found here.](#)

2 Roundtable for Sustainable Biomaterials (2022). The RSB principles

Exhibit 1: Biofuel Sustainability Challenge - Key Issues

Source: Roundtable for Sustainable Biomaterials (2021)



c. Assessment of sustainable biofuels

While voluntary (RSB, ISO, ISCC) sustainability frameworks are developed and constantly updated, organisations provide certifications to meet criteria specified by professional associations, standards organisations, and government agencies. Market demand for certification will help drive the adoption and uptake of voluntary standards. Sustainability certification enables and restricts potential supply of feedstocks and biofuels. Sustainability-related ISO standards set, in principle, frameworks for sustainability developed by experts, consensus-based market relevant International Standards that support innovation and provide solutions to global challenges. In this context, public policy is important regarding the type of mandate for supply of blends and to be produced in a sustainable way and from sustainable sources.

Indeed, greenhouse gases are produced during the combustion process as well as in the energy used in processing and transport,



meaning that biofuels do not automatically have lower emissions. Biofuels can help mitigate climate change by significantly reducing lifecycle GHG emissions as compared to fossil fuels, though innovation and decarbonization is necessary across the biofuel production process and supply chains.

Life Cycle Assessments (LCAs) can be made using a robust methodology for comparison with different methodologies applied to various biofuels and feedstocks, mapped across the full supply chain. The LCA aims to make sure that the right measures are in place and that they will enable a scalable environment. In addition to the criteria, during the assessment process, biomass competition between markets must be considered. The use of waste and residues as well as innovation solutions and blockchain can be a tool for this purpose.

Grassi of RSB mentioned the work they are doing on “Book and Claim”. The book and claim model is a common practice where a sustainability claim made by a company is decoupled from the physical traceability of a product (or fuel). The most notable example is green electricity, which cannot be tracked along the grid since it is all combined and relies on an accounting system to ensure that the customer paying a premium for a sustainable product has a verifiable certification.

2. Transition pathway

a. The roadmap

Berit Hinnemann, Head of Decarbonization Business Development at **Maersk**, mentioned that having a decarbonization roadmap is a strategic imperative in order to decarbonize the global supply chain. In her presentation, she highlighted the need to decarbonize the entire operation as fast as possible, to meet customer expectations from a technical and commercial perspective.

Maersk is working on implementing efficiency measures, and will transition from fossil oil and gas feedstock to renewables such as biomass and renewable electricity to reach net zero emission by 2050. According to Hinnemann, the company believes that both biomass feedstocks and renewable electricity [exhibit 2] will open the pathways of biodiesel (advanced biofuels), methanol (bio-methanol and e-methanol), ammonia (green ammonia) or lignin fuels (in research and development stage based on lignin-alcohol blends). It was also noted that hybrid methods of producing methanol may be used in which the carbon atom comes from a biogenic source while the hydrogen atom comes from an e-source. Maersk already uses biodiesel and recognizes its availability and scalability issues. The e-fuels have the advantage of long-term scalability, while biofuels have the advantage of nearer term availability, cost, and technological readiness. Given the need for rapid decarbonisation, Maersk intends to use both biofuels and e-fuels in their transition pathway. In short, the use of biofuels allows Maersk to accelerate decarbonisation in this decade.

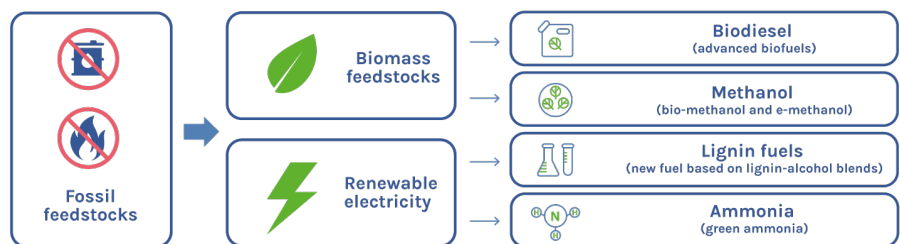


Recently, Maersk has ordered eight vessels to run on Methanol, the first of which are already under construction. The fleet is able to run on biomethanol and e-methanol, both considered as the most scalable option in the long-term. In the short and medium term, the company is considering using a fuel mix of biodiesel and methanol. The first carbon-neutral dual fuel engine container vessel running on methanol will be put into the water in 2023 while 8 additional vessels will follow in 2024. Hinnemann concluded by mentioning the key challenge will be the sourcing of the zero emission fuels to power these vessels.

Exhibit 2: Biomass feedstock and Renewable Electricity to transition from fossil oil and gas feedstock

Source: MAERSK (2021)

We need to make the transition from fossil oil and gas feedstocks to renewables - biomass and renewable electricity



b. Biofuel as a transition fuel

In 2018, **Goodfuels** launched biofuel oil bunkering, and in 2021 the company launched the first biofuel trial for an ocean vessel. As mentioned by Johannes Schurmann, Innovation Manager at Goodfuels, the company’s wish is to offer a solution which is sustainable, affordable, available and technically viable to customers right now. For this reason, the company has different options in their portfolio as there are no silver bullets and the needs are different depending on the vessels. Schurmann highlighted the need for incentives to foster investments and reduce the costs and increase scalability of biofuels through research and innovation in new processes, such as the lignin-based fuels. While Schurmann acknowledged the limited scalability of biofuels for shipping given restricted feedstock supply and inter-sectoral competition, he expressed the view that biomass is available to start the transition pending a further transition to e-fuels when sufficient green electricity becomes available.

3. The investment perspective

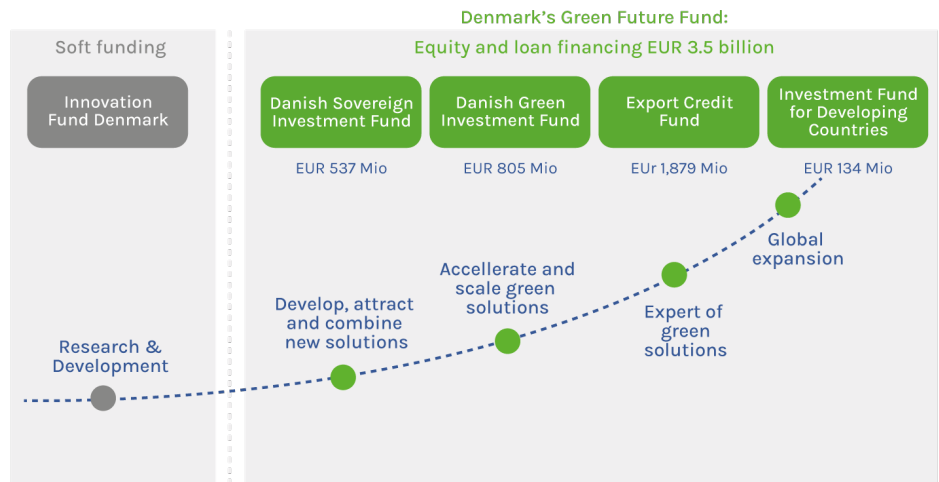
Anne Sophie Vinther Hansen, Investment Manager from the **Danish Sovereign Investment Fund**, noted that it is important to take a broader value chain perspective. Vinther Hansen explained the purpose of the Danish Sovereign Investment Fund is to develop the companies Denmark cannot afford to miss out on. As part of the Danish growth and innovation ecosystem, the Danish Sovereign Investment Fund has EUR 2,2 billion under management. Additionally, the Fund is party to Denmark’s Green Future Fund, a EUR 3.5 billion national equity and loan programme for green investments contributing to the transition, building platforms, networks and long-term partnerships creating returns and socio-economic impact.



Exhibit 3: Building a coherent ecosystem to secure Denmark as a sustainable global lighthouse

Source: The Danish Sovereign Investment Fund (2021)

Building a coherent ecosystem to secure Denmark as a sustainable global lighthouse



According to Vinther Hansen, for shipping to attract investments, the industry needs to work actively with legislators on approval of new fuel standards, as well as standards for sustainability. In part, because investors in this space are likely to rely on broadly accepted sustainability criteria. E.g., investing in accordance with the EU Taxonomy. Finally, it is important to keep in mind that investment decisions are prioritised between different products, services, and technologies. This includes evaluating their business potential, financial return, final application within industries, their growth and development potentials, as well as relevant economic, technical, and environmental drivers.

Conclusion

The future of biofuels is one option to take action this decade to meet the short-term CO2 reduction targets on the pathway of shipping decarbonization. As biofuels scale, they create a negative impact risk due to potential shortages in sustainable biomass availability from long-term competition. For this risk to be managed, global common standards and sustainability criteria are necessary to prevent shifting negative impacts up the supply chain. While there is no silver bullet for scalable zero emission shipping fuel, currently available biofuels can offer the flexibility of an interim drop-in solution or as a zero-emission pilot fuel for other zero emission fuels under development.