İSTANBUL VE MARMARA, EGE, AKDENİZ, KARADENİZ BÖLGELERİ DENİZ TİCARET ODASI

ISTANBUL & MARMARA, AEGEAN, MEDITERRANEAN, BLACKSEA REGIONS CHAMBER OF SHIPPING

Sayı : 38591462-010.07.03-2025-482 20.02.2025
Konu : Alternatif Denizcilik Yakıtlarına Yönelik Rehberler Hk.

Sirküler No: 134

Sayın Üyemiz,

Bilindiği üzere, Uluslararası Denizcilik Örgütü (International Maritime Organization-IMO) ve Avrupa Birliği (AB) tarafından denizcilik sektöründen kaynaklanan emisyonları azaltmak için uluslararası alanda çeşitli düzenlemeler yapılmaktadır. IMO, 2030, 2040 ve 2050 yılları emisyon azaltım hedefleriyle net sıfır sera gazı emisyonuna ulaşmayı taahhüt ederken, AB'nin Avrupa Yeşil Mutabakatı kapsamında denizcilik sektörü için Emisyon Ticaret Sistemi ve yakıt vergilendirme düzenlemeleri yürürlüğe girmiştir.

Uluslararası ölçekte yaşanan bu süreçte, denizcilik sektörünün dekarbonizasyonuna yönelik çalışmalardan biri de denizcilik sektöründe teknolojik yenilik ve sıfır veya sıfıra yakın sera gazı emisyonlu teknolojilerin, yakıtların ve/veya enerji kaynaklarının oluşturulması, küresel düzeyde ticari olarak kullanılabilirliği ve sürdürülebilirliğinin artırılması ile kullanımının teşvik edilmesidir.

Bu kapsamda, sektörün alternatif yakıtlara geçişini destekleme konusundaki kararlılığının bir parçası olarak Uluslararası Bunkerciler Birliği (International Bunker Industry Association-IBIA) tarafından Biyoyakıtlar ve BiyoLNG konularında Sıkça Sorulan Sorular (SSS) kaynakları yayımlanmıştır. IBIA Geleceğin Yakıtları Çalışma Grubu tarafından hazırlanan bu kapsamlı rehberler, özellikle gemi yakıt ikmal ve denizcilik sektörlerine yönelik temel soruları, düzenleyici gelişmeleri ve pratik hususları ele almaktadır.

Gemi sahipleri, işletmecileri ve denizcilik profesyonelleri için özel olarak hazırlanan rehberler, bahse konu alternatif yakıtlar ile ilgili tanımlar, sürdürülebilirlik standartları, düzenleyici uyumluluk ve teknik özellikler hakkında bilgiler içermekte olup Ek'te yer almaktadır.

Bilgilerinize arz/rica ederim.

Saygılarımla,

e-imza
İsmet SALİHOĞLU
Genel Sekreter

Ek:
1- Biyoyakıtlar-Sıkça Sorulan Sorular (10 sayfa)
2- BiyoLNG-Sıkça Sorulan Sorular (11 sayfa)

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Ek-1

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Biofuels in the Shipping Sector

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FAQs:
Biofuels in the Shipping Sector

CONTENTS

A. Biofuel for Marine

01. What are "Biofuels"

Biofuels are renewable fuels produced from biological sources such as agricultural crops, residues or waste and are specifically designed to reduce greenhouse gas emissions. Sustainable biofuels are typically produced from waste and residue-based feedstocks that have not contributed to land use change or offer competition with food production. Definitions vary slightly, with the EU focusing on sustainability and emissions reductions, the IMO emphasising their role in decarbonising shipping, while CIMAC and ISO prioritise technical performance, engine compatibility and fuel quality standards.

02. What do "biofuels" mean for marine?

In relation to the marine sector the term "biofuel" is generally considered to be a generic term covering a range of different fuel products, containing varying concentrations of different "bio elements" that have originating from different renewable / sustainable feedstocks, which, in turn, have been subjected to different treatment processes.

These "bio elements" are subsequently blended with a "base" fuel (HSFO, VLSFO or distillate grade fuel) to give a final product which is used as a direct replacement for "traditional" marine fuels. The bio blend created will depend on the specific demand from the fuel buyer and will also depend upon price and availability of the "bio element". Additionally, due to lack of availability and price, the majority of the bio/renewables will be used for percentage blending.

03. What does the «B» stand for in B100, B30-VLSFO, B24-VLSFO and so on?

The "B" in terms of "B100", "B30-VLSFO", and "B24-VLSFO" refers to the biofuel content in the fuel blend. The number following the "B" indicates the percentage of biofuel in the blend.

For example:

- B100 is pure biodiesel, containing 100% biofuel.
- B30-VLSFO is a blend consisting of 30% biodiesel and 70% very low sulphur fuel oil (VLSFO).
- B24-VLSFO similarly contains 24% biodiesel mixed with 76% VLSFO.

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04. What options do buyers have?

In real terms buyers can choose to purchase and utilise any "bio" product provided the product in question does not breach class requirements or any regulatory requirements such as SOLAS or IMO regional / global sulphur requirements.

That said careful attention is needed to ensure that the "bio" element is viewed as being "sustainable" in light of the regulatory framework that governs its use – failure to do so could lead to the product being allocated a carbon intensity in line with the fossil equivalent.

Looking at the practicalities of standardised commercial transactions ISO 8217 provides specific guidance in relation to the nature and quality of "bio" elements for consideration.

ISO 8217, from 2010 onward cites regulated FAME as being in accordance with the EN 14214 - Automotive fuels. Fatty acid methyl esters (FAME) for diesel engines. Requirements and test methods or ASTM D 6751- Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels.

It also cites paraffinic / synthetic diesel in accordance with the EN 15940 - Automotive fuels. Paraffinic diesel fuel from synthesis or hydrotreatment. Requirements and test methods.

Work has already been undertaken by certain national standards bodies to look at extending the scope of biomass-based products for use in the marine sector. The recently published NEN standard – NEN 7427 - Fatty acid methyl esters (FAME) and related products for use as blending component in residual marine fuels - Part 1: Fatty acid methyl esters for marine fuel (M-FAME) is one such initiative.

When considering alternative bio products an evaluation should be carried out looking at the differences between such products and established quality specifications and a risk assessment carried out in conjunction with all relevant parties – it may be that approval from the relevant authorities may be required.

05. Are there provisions for bio in marine currently?

The ISO 8217 specification has covered provisions for bio in marine fuel since the Fourth Edition which was published in 2010.

The aspect of "De minimis" in relation to FAME content was introduced in the 2010 revision at approx. 0.10% ("de minimis" being an amount that does not render the fuel unacceptable for use in marine applications that are not designed or suited to handling fuels containing FAME). The "de minimis" value was re-evaluated in the sixth edition (published in 2017) and increased to approx. 0.50% by volume.

The 2017 revision also saw the inclusion of three "DF" grades (Distillate Marine containing FAME) in Table 1 with an allowance of up to 7% FAME by volume.

The seventh edition of ISO 8217 published in 2024 saw a substantial overhaul of all considerations relating to bio including new tables, test methods and revised annexes to address allowances for the use of FAME up to 100% FAME (by volume or mass).

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B. Environmental regulations and requirements

06.
Which regulatory regimes necessitate the use of "low carbon" fuel products such as biofuels?

The IMO regulations cover the energy efficiency design index (EEDI) of applicable new vessels built since 2013. The EEDI provides a specific figure for an individual ship design, expressed in grams of carbon dioxide (CO2) per ship's capacity-mile (the smaller the EEDI, the more energy efficient the ship design) and is calculated by a formula based on the technical design parameters for a given ship. The same regulation also required all ships to have an individual Ship Energy Efficiency Management Plan (SEEMP) which is an operational mechanism to improve the energy efficiency of a ship in a cost-effective manner. These requirements were supplemented by the existing ships energy efficiency index (EEXI) to ensure that applicable vessels built prior to 2015 had reached a specific level of efficiency in order to continue to operate (this had to be verified by the first special survey after 1st January 2023).

IMO requires all vessels of 5,000 gross tonnage and above to submit fuel consumption and voyage data to the IMO data collection system (DCS) and from which, for applicable ships, their Carbon Intensity index (CII) will be calculated.

The CII has a target value, and that target reduces, year on year, to ensure continuous improvement. The attained CII will get a grade, annually from A to E with corrective action to be taken on any vessel rated D for three consecutive years or rated E in any year.

The EU has two different mechanisms. The EU Emission Trading System (EU ETS) is a cap-and-trade system market-based-measure (MBM) for reducing greenhouse gas emissions (GHG). It is part of the EU "Fit for 55" programme. Operators have to purchase allowances to cover their emissions as reported to the EU under the monitoring, reporting and verification (MRV) data of the previous year.

The second EU regulation is FuelEU Maritime which sets maximum limits for the yearly average greenhouse gas (GHG) intensity of the energy used by ships above 5,000 gross tonnage calling at European ports, regardless of their flag. Targets will ensure that the greenhouse gas intensity of fuels used in the sector will gradually decrease over time, starting with a 2% decrease by 2025 and reaching up to an 80% reduction by 2050. Those targets will become more ambitious over time to stimulate and reflect the necessary developments in technology and the uptake in production of renewable and low-carbon fuels. The targets cover not only CO_2 but also methane and nitrous oxide emissions over the full lifecycle of the fuels used onboard, on a Well-to-Wake (WtW) basis. It should be noted that in the EU-ETS ship emissions are calculated on a Tank-to-Wake (TtW) basis only.

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07.
Are they the same?

Both EU and IMO regimes have slightly different requirements on vessel size and vessel type related to the application and very different ways of calculating the level of emissions, especially with non-conventional fuels.

The EU regulations cover the emissions of applicable vessels, irrespective of flag when sailing between EU or EEA ports. They also cover 50% of the emissions of applicable vessels on voyages from a non-EU – EEA port to a port in the EU or EEA. EU-ETS is being phased in over 3 years with 40% of emissions in 2024 requiring the purchase of allowances, 70% for emissions in 2025 and 100% in 2026.

The impact on vessels of the IMO CII ratings is not so easy to quantify but it is likely to impact the commercial returns of vessels, those with low ratings finding it more difficult to attract employment and those with high ratings seeing preferential employment and possibly incentives on port dues etc.

At the moment the IMO regulations are built around the "Tank to Wake" concept (TtW), for example, IMO 2020 0.5% sulphur limit, but a future Global Fuel Standard (GFS) for marine fuel GHG intensity and a maritime GHG emissions pricing mechanism are expected to take into account "Well to Wake" emissions. WtW is frequently referred to as Life Cycle Assessment or LCA. Declaration of a fuel's sustainability and WtW emissions will be required through the presentation of additional instruments, e.g., Proof of Sustainability (PoS). For example, reference is made to use of PoS for biofuels by IMO in Interim Guidance on the use of biofuels under regulations 26, 27 and 28 of MARPOL Annex VI (DCS and CII) (MEPC.1/Circ.905).

IMO LCA

The 2023 IMO GHG Strategy indicates that it "should take into account the well-to-wake GHG emissions of marine fuels with the overall objective of reducing GHG emissions within the boundaries of the energy system of international shipping and preventing a shift of emissions to other sectors". This is to ensure that in undertaking shipping's transition to "net zero" the IMO does not take action that leads to emissions from the shipping sector being transferred to other sectors of the global economy, for example, production of "zero-carbon emitted" fuels from fossil fuels so negating the efforts to reduce those GHG emissions from shipping.

IMO has therefore prepared Guidelines on life cycle GHG intensity of marine fuels (LCA guidelines) that identifies different pathways for all current and likely future alternative marine fuels with a view providing default emission values for those fuel pathways and enabling the calculation of actual emission values. Emission values can be determined on both a Well-to-Wake (WtW) and Tank-to-Wake (TtW) basis as their specific use will be determined by the regulatory framework that is still to be agreed. The 2024 LCA Guidelines are set out in resolution MEPC.391(81).

EU "sustainability" requirements for fuels produced and supplied to be in compliance with FuelEU Maritime are set out in the EU's Renewable Energy Directive (RED III).

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B. Environmental regulations and requirements

08. What is a renewable feedstock?

A renewable feedstock is one that is considered to be derived from a resource that can replenish itself / be replenished through natural processes.

This is one of the key differentiators that is applied to the identification of different types of biofuel products and is specifically scrutinized when looking at the "sustainability" of a biofuel.

Regulatory regimes pay specific attention to the nature of feedstocks used to create biofuels such that they do not compete directly with the food chain or promote indirect / direct land use change.

09. Are any specific tests or trials required before biofuel use, in relation to Marpol Annex VI regulation, specifically relating to NOx and SOx emissions?

a. SOx: Biofuels must meet the sulphur limit requirements as given in regulation 14 in the same way as any other marine fuel.
b. NOx: Biofuel with up to 30% of bio product (it can be FAME but not limited to only FAME) blended with 70% residual or distillate fuel can be considered a petroleum fuel meeting regulation 18.3.1. (i.e. no further testing requirement). Biofuel with greater than 30% bio-product can be considered non-petroleum and should meet the requirements of regulation 18.3.2. A marine diesel engine which can operate on a biofuel without changes to its NOx critical components or settings/operating values outside those as given by that engine's approved Technical File, should be permitted to use such a fuel oil without having to undertake the assessment as given by regulation 18.3.2.2. (i.e. biofuel up to 100% bio-product can be used without further tests/trials if no NOx critical engine operation changes are required.)

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C. Practical Considerations for use...

10. "Drop in Fuel"... what is a drop in fuel?

A drop-in fuel is defined as:

"An alternative fuel that is completely interchangeable and compatible with conventional fuel and can be used in an engine without any adaptation of the engine or fuel system."

11. Are all biofuels considered "drop-in fuels"?

That's a bit of a tricky question...

Some sources, such as the IEA, have very specifically stated that FAME biofuels are not considered to be a "drop in" fuel given the requisite considerations for use and the potential risks surrounding the use of FAME biofuel products with incompatible materials within onboard systems.

The IEA specifically noted that...

"FAME biodiesel cannot be blended with diesel fuel in high concentrations without substantial risks for fuel quality, engine operation, exhaust emissions and infrastructure. FAME is not so called "drop-in" fuel."

Renewable or Synthetic diesel [which is a paraffinic product which is chemically indistinguishable from fossil diesel (i.e. it consists of the same molecules)] is considered to be a "drop in fuel".

That said the thinking behind FAME products has changed as experience has been gained and it's become more apparent that FAME Biodiesel can be / and is being used as a direct substitute for traditional fossil fuels with some fuel buyers purchasing and directly using FAME biodiesel as a drop-in fuel. However, in line with current best practice recommendations it is prudent to consult with OEMs regarding different characteristics of FAME products in relation to the specific handling and treatment requirements and the different range of materials used by the OEMs in the construction of the equipment they provide.

12. What do the OEMs say?

Practical guidance has been provided by a range of equipment manufacturers relating to their specific experiences when utilizing a range of different biofuels with their products – service letters and technical updates are available from individual companies via their websites or through direct contact. As has already been noted when considering the use of a bio product an evaluation should be undertaken in conjunction with the different OEMs such that a risk-based assessment can be carried out with a view to conducting trials and / or tests with appropriate product(s) prior to putting into use on board the vessel.

13. CIMAC can help

The discussions surrounding different biofuels, the practical implications of use and some of the associated challenges can appear to be quite complex, however, a series of industry published, best practice, guidance documents have been developed to offer support in these areas. Both CIMAC and ISO have featured prominently in these conversations and as a result CIMAC has contributed a range of documents which can be accessed free of charge via the Fuel Working Group (WG7) web page:
https://www.cimac.com/working-groups/wg7-fuels/index.html

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14. Are there limits to onboard storage time?

Given the wide, and up to point unknown, variety of biofuels' feedstocks It is not advisable and certainly not fully reliable to provide a set amount of time for recommended storage onboard, in weeks or months, as there is no prior knowledge of how the different biofuels are going to be handled, especially as there is no set info for all types of biofuels.

Ship operators are strongly advised to be aware and cautious of extended storage time and of the required management of on-board conditions, including strict quality control which is essential. In any case, long term onboard storage of most biofuels is not advised, however the requirements and risks will vary depending on the specific type of biofuel product in question. Prior knowledge of the production date and quality characteristics of the product will also offer guidance about appropriate fuel management protocols. Furthermore, additional and appropriate fuel lab testing can be used in some cases to better understand the fuel's stability and identify any degradation over time.

Specifically for FAME based biofuels existing industry guidance is available in the form of the CIMAC Guideline Marine-fuels containing FAME, "A guideline for shipowners & operators, which provides recommendations for the management of such products and advises that consumption of such fuels be conducted in a reasonable timeframe, adopting a "first-in first-out" mindset.

In any case, procurement of at least FAME based biofuel products should be carried out based on a procurement strategy which takes into account individual vessel's on-board storage capacity and fuel management capabilities – particularly with a view to limiting the on-board retention time of FAME based bio products.

15. Why can't I bunker ISCC-certified biofuel in the Netherlands?

Dutch biofuel bunker suppliers need to show a Proof of Sustainability (PoS) document to the Dutch Emissions Authority to verify that they have sold sustainable biofuels. A PoS is coincidentally also the document shipowners need to show to the EU to verify that they have bought sustainable biofuels.

Emission reductions listed on a PoS cannot be double-counted because this runs a risk of fraud. This being the case, once a Dutch bunker supplier has retired a PoS with Dutch authorities, this PoS cannot be passed onto a bunker buyer.

A PoS is a document that was created by the International Sustainability & Carbon Certification (ISCC) and it follows a batch of biofuel from all the way through its supply chain. When a PoS is not passed onto a shipowner, the chain of sustainability is broken, and the stem can't be ISCC-certified.

16. How can you confirm the validity of the biofuel to be bunkered?

When placing an order or checking biofuel availability, it is essential to request a copy of the Proof of Sustainability (POS). The POS contains a unique identification number and the issuance date. To verify the validity of the biofuel batch, access the relevant certification platform e.g., ISCC, RSB, etc., input this data, and receive confirmation of the biofuel's authenticity.

In the Port of Singapore, The Maritime & Port Authority (MPA) has issued a Marine Port Circular No. 11 of 2023 on 16th October 2023 that requires all suppliers to provide such a POS with the Bunker Delivery Note (BDN). Such required documentation can be a useful criteria for biofuel validity.

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D. Other considerations...

17.
We hear a lot about "B24" what is the relevance of "B24"?

The relevance of "B24" as a biofuel blend comes solely from the requirements relating to the transportation of FAME in accordance with current MARPOL regulations.

It is not a "limit" for the maximum quantity for FAME permitted in a blend given the revised ISO 8217 permits the blending of FAME up to 100%.

MARPOL Annex II outlines the Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk with Chapter 17 of the IBC Code listing the specific products.

If a biofuel blend has 75% or greater of a MARPOL Annex I cargo it is subject to the requirements covered in MARPOL Annex I.

Biofuel blends containing >1% but <75% of a MARPOL Annex I cargo are subject to MARPOL Annex II, with the carriage requirements set out in chapter 17 of the IBC Code;

Biofuels blended with ≤1% of a MARPOL Annex I cargo are not considered as blends and are therefore to be shipped in accordance with MARPOL Annex II, under the appropriate product entry in the IBC Code.

This being the case transportation of any blend that contains in excess of 25% FAME needs to be undertaken using a class 2 chemical tanker. Currently, this requirement is under review by IMO and for bunker vessels specifically may be extended to 30% FAME in Spring 2025.

18.
Will there be enough biofuel to go around for bunkering when emission regulations tighten?

As emission regulations tighten, biofuels are expected to play a crucial role in shipping's decarbonisation. But there are concerns about whether enough biofuel will be available for marine bunkering, especially in competition with the aviation and road fuels.

DNV estimates that global production of advanced biofuels will rise to 23 million metric tonnes of oil equivalent (Mtoe) by 2026, but this still falls short of the volumes needed by shipping alone. And if shipping were to decarbonise primarily using biofuels and energy efficiency measures, it would require up to 250 Mtoe annually by 2050, which would represent a significant portion of the global supply.

Significant investments in biofuel production and infrastructure, and in other alternative fuels like ammonia and hydrogen will be necessary to meet growing demand.

19.
Are biofuels priced in different ways than conventional fuels?

Like conventional HSFO, VLSFO and LSMGO, biofuels are typically priced in US dollars per metric tonne ($/mt). Biofuels come from different feedstocks than oil-based fuels, and these feedstock commodities respond to other market factors. Biofuels can therefore be priced in a variety of ways.

In the ARA it has been common to use Argus UCOME and Argus Advanced FAME price indexes in combination with a fossil index like ICE Low Sulphur Gasoil, or Platts FOB Rotterdam VLSFO barge.

Pricing formulas can vary in Singapore, the other major biofuel bunker market. Common formulas seen have been Platts FOB Singapore VLSFO cargo + premium and delivered Singapore bunker VLSFO + premium.

Getting familiar with bio price indexes is key to manage price risks that cannot be mitigated through fossil indexes only.

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FAQs

Biomethane (bioLNG) in the Shipping Sector

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FAQs:
Biomethane (bioLNG) in the Shipping Sector

CONTENTS

A. General FAQ

01.
a) What is bioLNG?

BioLNG is liquified biomethane, which is essentially purified biogas generated from the anaerobic digestion of a broad spectrum of biodegradable organic waste sources, such as food waste, municipal waste, manure and other agro-processing residues. Biogas goes through a purification process to remove impurities such as CO_2, H_2S and water vapour to achieve typically 95% methane purity levels.

01.
b) How does it differ from conventional LNG?

BioLNG is produced primarily from renewable biomass and considered a low carbon alternative to LNG, which is made from fossil fuel sources. Both fuels are similarly high in methane, which is a potent contributor to global warming. However, the production of bioLNG captures and utilises the methane from decaying biomass that would otherwise have been released into the atmosphere. Saunak: Conventional LNG has a CI (Carbon Intensity) range of 70-90 gCO_2eq/MJ, while Bio-methane depending on the raw material used and the process can have a CI range of –141 to 60 gCO_2eq/MJ.

02.
What are the environmental benefits of using bioLNG in the shipping industry?

The use of bioLNG as a marine fuel has significant Green House Gas (GHG) emission benefits because of the prerequisite capture and use of methane to produce biogas in a bioLNG production cycle.

On a broader environmental sustainability scale, the production of bioLNG and indeed all bio-based fuels is a powerful driver for more effective resource and waste management in several industries.

03.
Is bioLNG compatible with existing ship engines?

Yes, bioLNG is compatible with existing engines, though as it has a high methane content and therefore methane number.

04.
What are the key considerations for ship owners looking to transition to bioLNG?

Shipowners and operators who already run their vessels on conventional LNG require little or no modifications to their vessels and can rely on the accessibility of existing LNG infrastructure, if they make the switch to bioLNG or an LNG/bioLNG blend.

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B. Bunkering Process and Supply Chain Logistics

01. What is the bunkering process for bioLNG in the shipping sector?

BioLNG bunkering follows a similar process to conventional LNG bunkering. It typically involves the transfer of bioLNG from storage facilities to the ship's storage tanks using bunkering vessels, trucks, or onshore facilities. The ship's crew then manages the transfer of bioLNG into the ship's fuel tanks, ensuring safety protocols are followed throughout the process.

02. How is bioLNG produced and distributed for bunkering purposes?

BioLNG is produced through the liquefaction of biogas, which is primarily composed of methane. Biogas is obtained from the anaerobic digestion of organic waste materials such as agricultural residues, municipal solid waste, and wastewater sludge. Once biogas is purified and liquefied, it becomes bioLNG. Distribution for bunkering purposes involves transportation via specialised tankers or pipelines to bunkering terminals located at ports or other strategic locations along shipping routes.

Biomethane can have a lower methane content than regular LNG, resulting in an additional purification step before it can be burnt in a marine engine.

Biomethane can be distributed for bunkering purposes in three ways:

a) Physical dedicated bioLNG delivery: Biomass is collected and brought to a centralised/decentralised biomethane plant, produced biomethane is then liquified in a centralised/decentralised liquefaction and storage plant, thereafter it is moved to an LNG terminal to be supplied directly or through trucks/ LNG bunker vessels to the receiving vessels.

b) BioLNG delivery through mass balancing: Biomass is collected and brought to a centralised/decentralised biomethane plant, produced biomethane is then supplied into a gas grid. The gas grid is connected to an existing liquefaction and storage plant or an LNG receiving terminal (virtual reliquification) thereafter it is moved to an LNG terminal to be supplied directly or through trucks/ LNG bunker vessels to the receiving vessels.

c) Virtual bioLNG delivery through book and claim: For book and claim there is no physical link between the injection and extraction of the biogas. This is solely done by certificates. This mechanism is not recognised yet as being compliant.

03. What are the key considerations for establishing bioLNG bunkering infrastructure?

Establishing bioLNG bunkering infrastructure requires careful planning and consideration of various factors, including:

- Identifying suitable locations for bunkering terminals, considering proximity to shipping routes and availability of bioLNG production facilities.
- Investing in the construction of storage tanks, loading equipment, and safety systems compliant with relevant regulations and standards.
- Ensuring sufficient supply of bioLNG through partnerships with biogas producers and waste management facilities.
- Developing logistical arrangements for the efficient distribution of bioLNG to bunkering terminals and ultimately to ships.
- Addressing regulatory and permitting requirements related to environmental impact, safety, and operational standards.

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B. Bunkering Process and Supply Chain Logistics

04.
What Safety Measures are in place for handling and storing bioLNG?

The safety measures for bioLNG are identical to the safety measures in place for fossil LNG and eventually synthetic methane. The material specifications are identical, and it is only in origin that they differ.

05.
Are there any challenges or limitations in the supply chain logistics of biomethane for shipping?

Despite its environmental benefits, bioLNG faces several challenges in its supply chain logistics:

- Limited availability of feedstock - the production of bioLNG relies on the availability of organic waste materials, which may be inconsistent or insufficient in certain regions.
- High production costs - the production process for bioLNG, including biogas capture, purification, and liquefaction, can be expensive compared to conventional LNG production, though still much cheaper than other alternative fuels e.g., green methanol, green ammonia etc.
- Infrastructure development – establishing a comprehensive bunkering infrastructure for bioLNG requires significant investments in storage facilities, transportation networks, and regulatory compliance.
- Market acceptance and demand – bioLNG is still relatively new in the shipping industry, and its adoption may be hindered by uncertainties regarding performance, availability, and cost compared to other alternative fuels.
- High production costs - the production process for bioLNG, including biogas capture, purification, and liquefaction, can be expensive compared to conventional LNG production.

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C. Regulations and Regulatory Environment

01.
What regulations govern the use of bioLNG as a marine fuel?

IGF Code of Seagoing vessels and ADN regulations for inland waterway vessels regulate the use of methane/ LNG, independent of its origin. For using it as a compliance fuel, then the applicable regulations are ETS/ FuelEU Maritime and RED II/III.

02.
Are there any specific incentives or subsidies provided to encourage the adoption of bioLNG in shipping?

Globally, the subsidies for bioLNG production are mostly tied to broader renewable energy and carbon-reduction policies, with varying levels of direct support depending on the country. While bioLNG is still a niche product, the increasing emphasis on reducing greenhouse gas emissions and promoting clean energy is expected to drive more targeted incentives in the future.

1. European Union (EU):

The EU has a range of policies and financial instruments aimed at promoting renewable energy and reducing carbon emissions, many of which indirectly support bioLNG production.

- **Renewable Energy Directive (RED II):** This directive sets a binding renewable energy target for 2030, aiming for 32% of the EU's energy mix to come from renewable sources. BioLNG qualifies as a renewable fuel under this directive.
- **EU Emissions Trading System (EU ETS):** BioLNG producers can benefit from the carbon market, where they can earn credits by reducing emissions compared to fossil fuels.
- **Horizon Europe and Connecting Europe Facility (CEF):** These are EU funding programmes that support innovative renewable energy projects, including bioenergy and Bio-LNG production.
- **National Support Mechanisms:** Countries like Germany, the Netherlands, and the UK offer subsidies or tax incentives for biogas production, which can be upgraded to bioLNG. For example, Germany provides feed-in tariffs for biogas plants that generate renewable gas.

2. United Kingdom:

The UK has implemented several financial incentives to support the development of bioLNG.

- **Renewable Transport Fuel Obligation (RTFO):** This programme incentivises the use of renewable fuels, including bioLNG, in the transport sector (the maritime sector is excluded). Producers of bioLNG receive credits based on the volume of renewable fuel produced, which can be traded or sold.
- **Green Gas Support Scheme:** The UK government offers a subsidy scheme for biogas producers, encouraging the injection of renewable gas into the national grid. This indirectly supports the growth of the bioLNG sector.
- **Carbon Price Floor:** The UK's carbon price floor, which sets a minimum carbon price for the power sector, increases the attractiveness of low-carbon fuels like bioLNG.

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3. United States:

In the U.S., subsidies for bioLNG are often linked to broader bioenergy and biogas incentives.

- **Renewable Fuel Standard (RFS):** Administered by the U.S. Environmental Protection Agency (EPA), the RFS programme mandates the blending of renewable fuels, including bioLNG, with conventional fuels. It provides economic incentives through the Renewable Identification Numbers (RINs) that can be traded.
- **Investment Tax Credit (ITC) and Production Tax Credit (PTC):** These tax credits are available for renewable energy projects, including those related to biogas production. BioLNG facilities can benefit from these incentives.
- **State-Level Incentives:** Some U.S. states, such as California, offer additional incentives, including subsidies, grants, and low-interest loans for bioLNG and biogas projects. California's Low Carbon Fuel Standard (LCFS) is a key programme that incentivises the use of bioLNG in transport.
- **Agricultural Incentives:** U.S. agricultural policies support biogas production from farm waste, which can be upgraded to bioLNG, with subsidies for waste-to-energy projects.

03.
How do international regulations impact the global adoption of bioLNG as a marine fuel?

Mass Balance, GHG emission factor.

BioLNG can be blended with fossil LNG in relatively small amounts to reach the 2030 International Maritime Organization (IMO) targets and the Biofuel proportion in the mix can be increased to meet 2050 target[1].

04.
What are the potential future regulatory developments that may affect the use of bioLNG in shipping?

Methane slip from engines is a central concern, and addressing this will be crucial to secure the LNG pathway.

1. https://sea-lng.org/wp-content/uploads/2022/10/SEA-LNG_BioLNG-Study-Key-Findings-Document_October-2022_amended.pdf

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D. Progress of Green Maritime Corridors

01.
a) What are Green Maritime Corridors?

Green Maritime Corridors are shipping routes on which commercially operating ships use low carbon or carbon neutral fuels exclusively.

01.
b) How do they promote the use of alternative fuels like bioLNG?

Green Maritime Corridors initiate end-to-end decarbonisation within a supply chain linking two or multiple ports/regions. It is an approach that de-risks the production of alternative fuels by addressing the commercial gaps such as the higher costs of production, the supply and demand imbalance, the regulatory and policy bottlenecks that affect biomethane production, storage and distribution.

02.
What progress has been made in establishing Green Maritime Corridors for the transportation of goods using bioLNG?

The predominant alternative fuel choices underpinning green corridor developments have been hydrogen, ammonia, and fully electric solutions; however, there are one or two notable projects in conception touting the possible use of bioLNG, such as the LA-Shanghai Green Corridor and the Pacific Northwest Green Corridor.

03.
What regions or countries are leading the development of Green Maritime Corridors for Biomethane powered vessels?

The European Green Corridor Network is leading the possible use of biofuels in the establishment of several possible green shipping networks in Northern Europe and the Baltics, though the Pacific Northwest Green Corridor initiative, which sprang from the Clydebank Declaration[2] has made certain strides and narrowed the focus of their efforts to cruise liner operations from British Columbia to Alaska.

04.
How do Green Maritime Corridors contribute to the overall decarbonisation of the shipping industry?

By connecting all the stakeholders in a marine fuel value chain, dedicated to one specific trade route, the supply chain and demand can be more balanced. In addition, potential producers can secure their offtake by taking part in the Green Maritime Corridor.

2. https://www.gov.uk/government/publications/cop-26-clydebank-declaration-for-green-shipping-corridors/cop-26-clydebank-declaration-for-green-shipping-corridors

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E. Commercial Considerations

01.
What volume of bioLNG can we expect to come into the market in the short-term?

Findings from the SeaLNG report[3] suggest that bioLNG has the potential to meet up to 3% of the total energy demand for shipping fuels in 2030 and up to 13% in 2050. If it is considered as a drop in fuel blended with fossil LNG, bioLNG could cover up to 16% and 63% of the total energy demand in 2030 and 2050 respectively, assuming a 20% blending ratio.

In the long term, shipowners who have invested in the LNG pathway will need to shift to renewable synthetic LNG (e-LNG).

02.
How does the pricing model of biomethane compare to traditional LNG?

Biomethane/ LNG is mostly priced as a premium over the fossil version.

03.
Can Mass Balance be used for implementing biomethane?

Yes, it can, if the biomethane is certified according to the applicable rules and regulations.

3. https://sea-lng.org/wp-content/uploads/2022/10/SEA-LNG_BioLNG-Study-Key-Findings-Document_October-2022_amended.pdf

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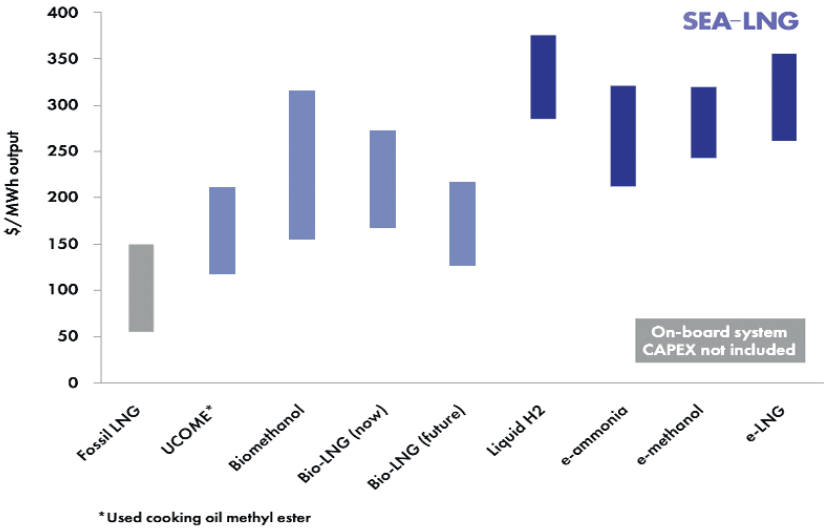
F. Impact on the Sector at Large

01.
What are the potential economic benefits of transitioning to bioLNG in the shipping sector?



Alternative fuels energy cost comparison, per unit of output energy from the engine. It includes transport and bunkering costs (bio-LNG and e-LNG transport cost is based on fossil LNG, thus implying the use of existing infrastructure). Assumed engine conversion efficiency 45% (50% for liquid hydrogen used in a fuel cell) (Note, the higher and lower ends of the spectrum represent 2030 and 2050 costs, respectively.)

Figure 1: SEA-LNG, October 2022

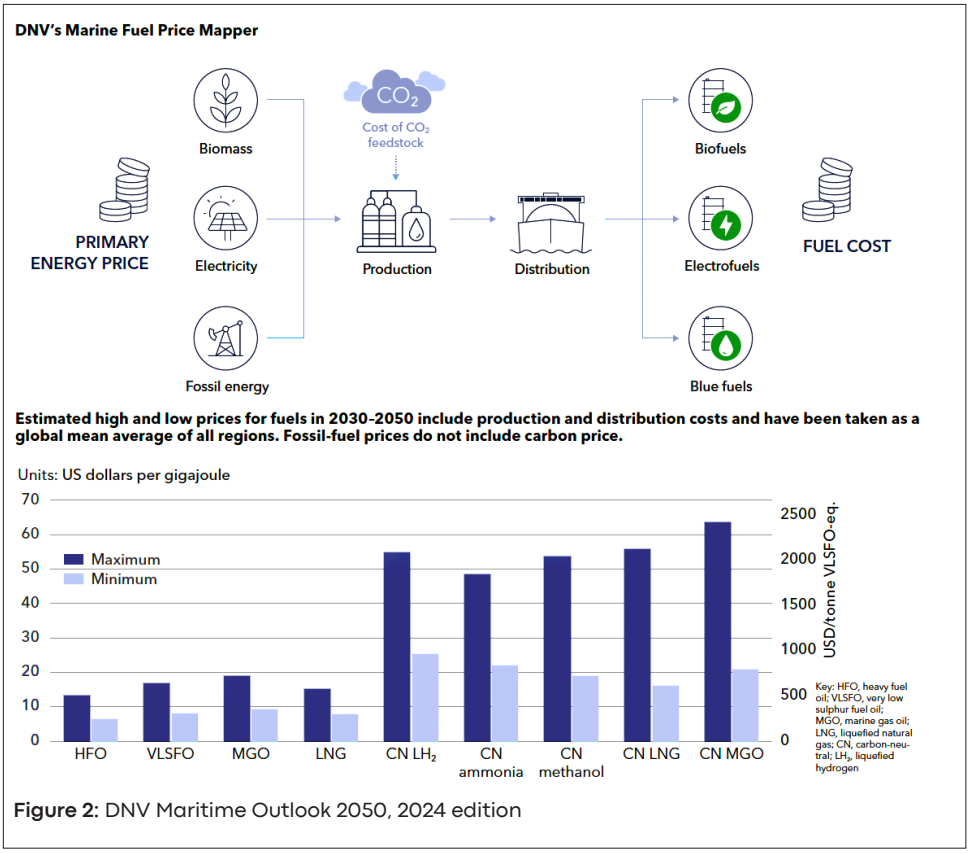


Figure 2: DNV Maritime Outlook 2050, 2024 edition

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F. Impact on the Sector at Large

02.
What is the expected difference in price between LNG and bioLNG?

The majority of the cost increase for ship owners and operators switching to bioLNG would be the higher costs of the fuel itself, as vessels will require little or no modifications.

Distinctions however need to be made between physical biomethane molecules and mass balance; as with physical molecules, the costs of transportation (last mile) can be higher as production location is typically not in the bunkering location/port.

03.
What are the expected costs of adoption of bioLNG for shipowners over the next five (5) years?

Apart from the difference in cost of molecules and certification, there is no additional costs expected for shipowners to use bioLNG, as the bioLNG received on board is physically not different from the fossil LNG being used as fuel. Depending on the infrastructure or logistics mode, there can be a slightly higher price, when one decides to use physical bioLNG molecules as these are normally not produced in the port (place of bunkering).

04.
What are the switching costs of bioLNG and how does it affect future fleet operations and management?

- BioLNG requires the same specialised storage and handling infrastructure as LNG. Receiving Ships retrofitted to burn LNG or be built specifically for it, are able to use bioLNG as fuel without any additional switching costs.
- BioLNG is not yet widely available; it is available in very few ports. Additionally, we have the possibility of bunkering bioLNG in well-connected ports using sustainability certificates, but this is also limited. Therefore, shipping companies may be reluctant to make the switch if they are unsure of fuel availability in key shipping routes.
- In the ARA region and for most vessel owners, the only practical way is to take mass-balanced bioLNG currently.
- To ensure that bioLNG is sustainable, we need to follow a certification process, same as for other biofuels, which might add complexity to the process.
- We know that Rotterdam currently subsidises certain biofuels and might do the same with bioLNG as time progresses, which may make it a bit more attractive. However, for the time being, it is expensive and with limited availability, which doesn't make it a desirable and viable option for most shipowners.
- Overall, assuming that as time progresses and the regulations tighten, fuel availability increases and price becomes more attractive, with more and more LNG-fueled ships being built/retrofitted, we will see more ships burning bioLNG.

05.
How does the widespread adoption of bioLNG impact the broader energy and transportation sectors?

BioLNG for road transport is subject to different incentive schemes (maut exemption Germany and RIN's in the US for example) which make the use of Renewable Natural Gas, which is the starting point for biomethane, very attractive to use in these sectors. This is potential competition for the maritime industry.

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