AUGUST 2022

SINGAPORE SHIPPING ASSOCIATION

FAQ ON BUNKERING OF BIOFUELS FOR OCEAN-GOING VESSELS IN THE PORT OF SINGAPORE

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PREAMBLE

The Singapore Shipping Association SSA recognises that biofuels are being promoted as a low-carbon alternative to fossil fuels, to help to reduce greenhouse gas (GHG) emissions and the related climate change impact from shipping. As such, it is important to support information pertaining to local requirements when bunkering biofuel, in this case, within the Port of Singapore.

The Port of Singapore is currently conducting bunkering trials of biofuels for ocean-going vessels and only allows licensed bunker suppliers to support such trials by ocean-going vessels under a commercial agreement. This must include approval from the vessel owner(s) respective flag Administration for such trials.

This FAQ document will provide the basic questionnaires for the shipping community interested to start trialing with biofuels.

CONTENTS

ABOUT THIS DOCUMENT

The information provided in this report is for general informational purposes only. The intention of this document is to provide support to the industry in terms of international shipping; guidance of use of biofuel. The biofuel that we are focusing on are FAME-based biofuels that can be both bio-diesel and bio-residual range. Readers are strongly advised to consult their vendors, engine manufacturers, service providers and other stakeholders for more information.

Singapore Shipping Association (SSA) has made every attempt to ensure that all the information provided are accurate. SSA is not liable for the accuracy, content, completeness, legality or reliability of the information in this report.

The Working Group who are responsible for the preparation of this FAQ document, consists of the following Members:

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Vice-Chairman	Capt. Samir Fernandez	Maersk Oil Trading Singapore Pte. Ltd
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	Mr. Sanjay Kumar Sinha	BP Singapore Pte. Ltd
	Mr. Adrian Sim	Kenoil Marine Serves Pte. Ltd
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SSA would also like to acknowledge the following organisations who had provided their feedback and input in the preparation of the FAQs:

-Global Maritime Transportation Pte. Ltd-GoodFuels-PS Energy Pte. Ltd-
-Shell Eastern Trading Pte. Ltd-TFG Marine Pte. Ltd-Victory Pte. Ltd-Vitol Bunkers-

TECHNICAL

FAQ 1: WHAT ARE BIOFUELS?

Bio-derived fuels and blends of bio-derived fuels with petroleum products are included within the range of potential alternative energy sources being considered by some sections of marine industry since they are renewable and can result in reduced greenhouse gases (GHGs) and Sulphur emissions (SOx).

There is no official definition of different types/generation of biofuels. However, it is commonly classified based on different feedstocks and production technology which reflects to different CO2 reduction possibilities as follows:

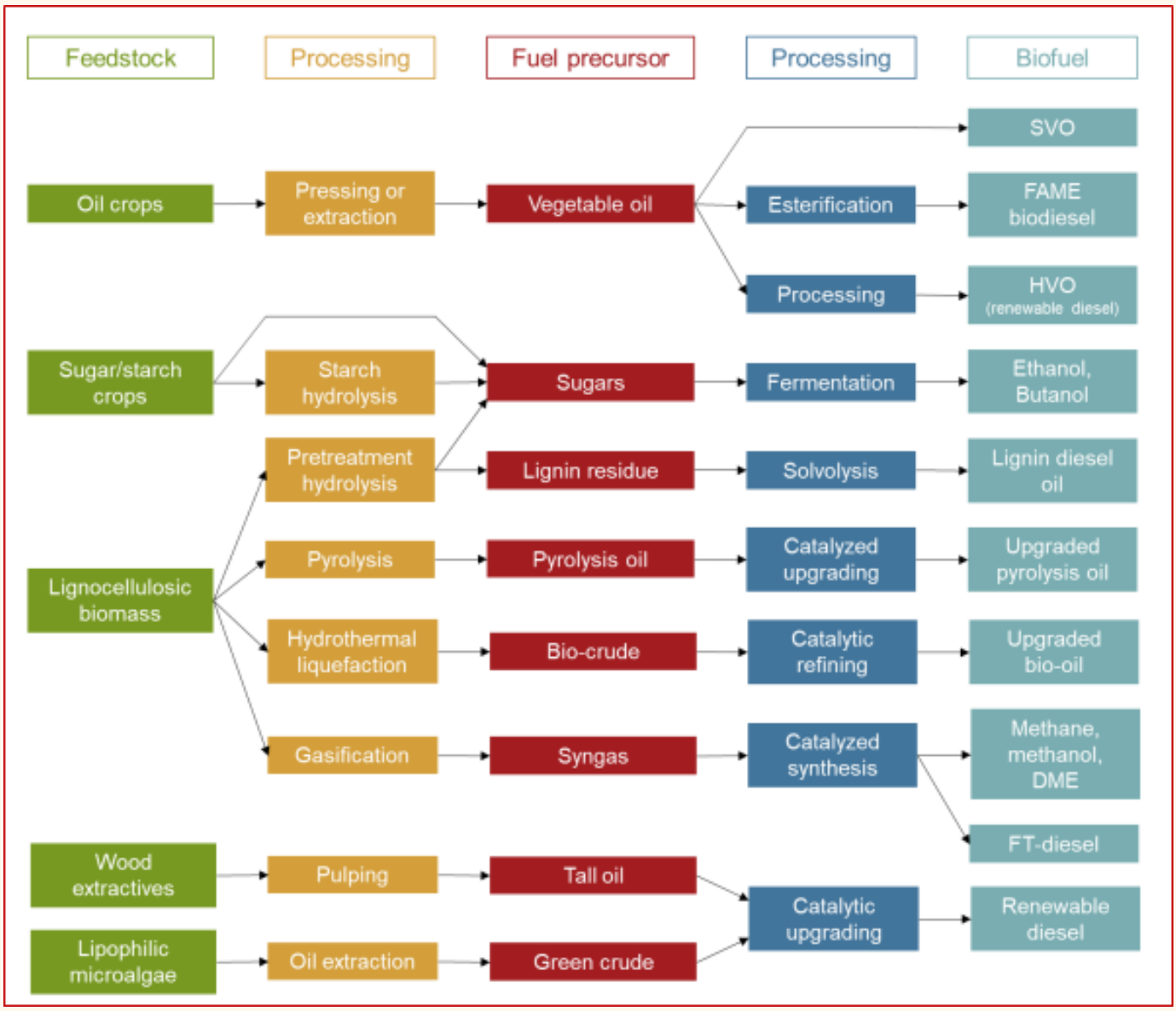
First generation biofuel is produced from conventional feedstock, i.e. food crops, sugar/starch and vegetable oils using conventional processing technologies. - FAME (Fatty Acid Methyl Ester) - Typical CO2 reduction 36-62 %

a. First generation biofuel is produced from conventional feedstock, i.e. food crops, sugar/starch and vegetable oils using conventional processing technologies. - FAME (Fatty Acid Methyl Ester) - Typical CO2 reduction 36-62 %
    - FAME – Can be derived from Crops, Rapeseed, Palm, Soyabean and Sunflowers, waste Oil and Fats or animal fats using transesterification method

b. Second generation biofuel is typically produced from waste, residues and non-food crop feedstocks, including used cooking oil using hydrogenation process. - HVO/HEFA (Hydrogenated Vegetable Oil/Hydro-processed Esters and Fatty Acids) – Typical CO2 reduction 88%
    - HVO/HEFA – Similar range of feedstocks as FAME but production makes it a full hydrogen (No oxygen)

c. Third generation is a specially designed engineered crops such as by farming algae.

d. Fourth Generation: Uses genetically modified (GM) algae to enhance biofuel production.



(Feedstock conversion routes to marine biofuels including both conventional and advanced biofuels. Adapted from the 2017 IEA Task 39 Marine Biofuels Report)

TECHNICAL

FAQ 2: WHAT ARE THE BENEFITS OF BIOFUELS?

Biofuels can provide an advantage to ship owners, operators and managers.

a. Biofuels can be used on existing engines without significant engine modifications.

b. It meets IMO Sulphur requirements.

c. It is a convenient drop-in fuel.

d. It reduces CO2 emissions depending on FAME content.

e. It offers a mid-term solution by its simple and safe utilization on board due to characteristic close to the existing marine fuel oil and flashpoint point above 60°C.

f. Ship trials have so far showed good operating results.

g. It will support and helps the ship-owner to target more stringent challenges such as IMO 2050.

TECHNICAL

FAQ 3: WHAT IS THE CO2 REDUCTION QUANTUM FOR BIOFUELS ON A WELL-TO-WAKE BASIS?

Currently, there are no existing standards for the verification of biofuels content.

One of the key advantage of biofuel is its carbon neutral nature. IMO has adopted the Carbon Intensity Indicator (CII) regulation, requiring ships to reduce their operational emissions based on annual targets. Carbon footprint of fuels are currently based on tank-to-wake basis. While there are discussions for considering well-to-wake CO2 footprint, it is unclear on current direct benefits for switching to biofuel for complying with CII requirements.

As such, it is important for organisations to carefully monitor their supply chains for quality, reliability and sustainability. With global move towards renewable, low-carbon sources of energy such as biofuels and biomass, governments worldwide are setting ambitious targets for recycling, use of non-virgin materials and renewable energy, and offering tax incentives to companies that meet or exceed sustainability goals.

There are voluntary schemes for biofuels management allowing companies prove compliance with EU directives (e.g., the Renewable Energy Directive [RED]) and local legislation, and become eligible for fiscal incentives. By certifying renewable biofuels schemes like 2BSvs, ISCC, and REDCert, and emerging schemes like KZR INiG, businesses can demonstrate their commitment to sustainable biofuels production and biomass processing and purchasing. However, there is currently no globally accepted standard or certification available to verify the green production of biofuels from end to end.

TECHNICAL

FAQ 4: WHAT ARE THE TECHNICAL CHALLENGES?

Biofuels poses the following challenges (non-exhaustive):

a. Biofuel storage due to degradation and sludge formation if not used within a specific timeframe. Please refer to CIMAC document section 5.2 (Appendix B)

b. Risk of microbial growth

c. Issue of compatibility with other fuels.

d. Risk of corrosion with engine components.

e. Consumption onboard vessels needs to be addressed such as oxidation stability and cold flow properties. Also, for certain types of engines, ship managers may need to choose a different lube oil.

f. Ensuring ISO 8217 Fuel Quality parameters are met such as cold flow properties.

g. Possible degeneration of rubber sealings, gaskets and hoses. It is important to verify that these components in the fuel system are endurable and can be used together with the biofuel.

h. Filter clogging: Biodiesel has shown to have a solvent property, so when switching from diesel to biofuel, it is expected that deposits in the fuel system will be flushed, thus clogging the fuel filters. It is recommended to flush the system and/or to monitor filters during this period.

Note: Engine makers need to be consulted beforehand to verify what type of blends can be used with specific type of the engine to minimise item (g) and (h). Shipowners are urged to get confirmation letter from the engine makers, their dealer or supplier explicitly providing specification of biofuels, which may be used in those engines.

TECHNICAL

FAQ 5: WHAT ARE THE OPERATIONAL GUIDELINES/BEST PRACTICE FOR BIOFUELS FROM THE ENGINE MAKERS?

Guidance from the various engine makers have been compiled. These guidances can be found in Annex A.

TECHNICAL

FAQ 6: WHAT WILL BE THE NOx CONSIDERATIONS FOR BIOFUELS?

As studies are ongoing with regards to NOx emissions from the operation of biofuels, shipowner/operator is strongly recommended to seek the advice from their Flag States to ensure compliance with Regulation 13 of MARPOL Annex VI.

IMO MEPC 77 has now approved a Unified Interpretation (UI) of MARPOL Annex VI Reg 18.3 allowing the use of biofuel blends up to 30% & that verification of NOx emissions is not required. The UI also allows the use of B30 to B100 biofuels for "engines certified in accordance with regulation 13 of MARPOL Annex VI which can operate on a biofuel or a biofuel blend without changes to its NOx critical components or settings/operating values outside those as given by that engine's approved Technical File". The UI has been issued as MEPC.1/Circ.795/Rev.6, replacing MEPC.1/Circ.795/Rev.5.

Flag State may issue a trial permit, or an exemption based on individual's Flag State conditions. Flag States may require owners/operators to develop risk assessment and guidance for the ship crew to use as fuel.

Owners/operators of Singapore-Registered Ships (SRS) may reach out to MPA (Flag State) for approval to trial biofuels bunkering onboard their ships.

For more information about NOx issues, a technical publication from LR with regards to NOx from marine diesel engines using biofuels, have been issued. The document can be found in Annex C.

TESTING METHODS

FAQ 7: WHAT ARE THE ADDITIONAL TESTS TO BE UNDERTAKEN?

The following additional tests to the ISO 8217:2017 Fuel Quality Standard are recommended, especially when trialing new products:

RESIDUAL BLEND

i. FAME (Fatty Acid Methyl Ester)
ii. Reserve Stability Number
iii Total sediment Existent
iv. Total sediment Accelerated
v. Wax Appearance Temperature
vi. Copper Strip Corrosion
vii. Steel Corrosion
viii. Fuel Combustion & Ignition Analysis (FCA)
ix. GC/MS Acid Extract plus quantification
x. Gross Calorific Value by Bomb calorimeter
xi. Carbon, Hydrogen, Nitrogen & oxygen

DISTILLATE BLEND

i. Cloud Point
ii. Cold Filter Plugging Point
iii Lubricity (if Sulphur is below 500 ppm)
iv. Copper Strip Corrosion
v. Steel Corrosion
vi. Fuel Combustion & Ignition Analysis (FCA)
vii. GC/MS Acid Extraction plus quantification
viii. Gross Calorific Value by Bomb Calorimeter
ix. Carbon, Hydrogen, Nitrogen & Oxygen
x. Bacteria/Yeast/Fungi
xi. Oxidation Stability

Classification Societies and Testing Laboratories, have done extensive trials with biofuels and can recommend their version of recommended list of tests. Owner/Operators are encouraged to also consult their class societies and testing laboratories for such advisory.

STANDARDS

FAQ 8: ARE BIOFUELS COMPATIBLE WITH ISO 8217:2017?

The ISO Standard 8217: 2017, "Specifications of marine fuels", is widely accepted as the technical specification for marine fuels by all industry participants: owners, operators, fuel suppliers and engine OEMs.

The latest update (2017 Edition) to the ISO standard includes FAME biodiesel blends up to 7.0% v/v in distillates.

Currently, the ISO 8217:2017 Fuel Quality Standard is undergoing revision by the respective Working Groups & the issue of Biofuels is being addressed for inclusion in the next Edition.

Whilst the biofuel meets the ISO8217 fuel quality standard, with the exception of FAME, parties need to come to an agreement for the use of higher FAME product.

STANDARDS

FAQ 9: WHAT TYPES OF QUALITY ISSUES BIOFUELS CAUSES?

a. Energy Content:
Heating value of biofuels can be lower than common petroleum-based fuel oils. This will depend on the FAME content. Lower caloric value can be a challenge for the mechanically controlled engines as they are unable to adjust intended injection timing at a given engine load. It is recommended to measure the heating value using bomb calorie meter.

b. Corrosion:
Acid degradation products of FAME are suspected of causing damage to fuel pumps, injectors, and piston rings, leading to an acid number limit in marine fuel specifications. This needs further evaluation over time to establish the impact to ship structure and equipment.

c. Degradation:
The presence of water can increase the risk of microbial contamination, accelerating the formation of biofilms and microbial colonies which can damage fuel system components.

d. Cold Flow:
Fuel gelling occurs when molecules aggregate and form crystals at low temperature, leading the fuel to become cloudy. With further cooling, these crystals become larger, increasing fuel viscosity and forming a gel followed by a solid. Gelling complications arise during fuel bunkering and delivery, limiting its use in cold conditions.

e. Oxidation Stability:
Higher oxygen content in biofuels as compared to conventional fuels also can lead to lower oxidation stability, where it is more prone to degrade over time.

COMMERCIAL

FAQ 10: WHICH ARE THE COMPANIES PROVIDING BIOFUELS IN SINGAPORE?

The following are the list of companies that are commercially and operationally ready to supply biofuels in the Port of Singapore:

Company	Contact Details		Remarks
BP Marine	Alex Pattisson Masaki Low	alex.pattison@sel.bp.com masaki.low@sel.bp.com	Based on customer's demand
GoodFuels	Jin Xieng JX Han	hanjx@goodfuels.com	
PS Energy Pte Ltd	Patrick Ng	patrick.ng@pseg.com.sg	
Vitol Bunkers		xsinenq@vitol.com	

In addition, the following companies are providing and/or conducting trials using biofuels:

Company	Contact Details	
Global Maritime Transportation Pte Ltd	Aaron Tan	aaron@globalmarinetpt.com
Kenoil Marine Services Pte Ltd	Jennifer Lu	sflu@kenoil.com
Shell Eastern Trading Pte Ltd		GXSIETCOBunkerSales@shell.com
TFG Marine Pte Ltd	Koo Soo Yong	SooYong.Koo@trafigura.com
Victory Pte Ltd	Ong Zhenzhi	zhenzhi@vpt.com.sg

Note: Details are correct as of 15th June 2022.

COMMERCIAL

FAQ 11: WHAT ARE THE CONCERNS ON BIOFUELS DEMAND AND AVAILABILITY?

This is a very wide topic of discussion in the industry The RED II has kicked in with EU now requiring member states to supply minimum of 14% of the energy consumed in Road and rail transportation by 2030 which is an increase from RED I. In terms of supply, we do see an increase in supply of 2nd generation FAME waste materials last two years but the price of biofuels has moved significantly higher. The supply and demand fundamentals are constantly evolving.

Demand for FAME is typically influenced by its use by the on-road transportation sector. Additional use of FAME in the shipping sector will require increase in production capacity and feedstock availability. The higher the national bio-based diesel mandate, the lesser capacity can be utilized by the marine sector. The table below summarizes Asia's bio-based diesel production capacity as of January 2022.

Summary of Asia's bio-based diesel production capacity and mandate in the on-road sector can be seen in page 16.

At the moment, demand is currently muted possibly due to the price differential between biofuels and conventional fossil fuels. Unless there is a change in port and international regulations, there will be no shift in the demand and thus, not sustainable.

Country	Biodiesel type	Capacity	Unit	Feedstock	National mandate
China	Fatty acid methyl ester (FAME)	1.29	Million tonnes/year	Used cooking oil (UCO)	No mandate
	Advanced biodiesel (hydrogenated vegetable oil/HVO)	896,500	Tonnes/year	UCO, palm oil mills effluent, animal fats	
	HVO (proposed)	709,600	Tonnes/year		
India	FAME	670	Million liters/year	UCO	No current mandate. Indicative target of 5% v/v in 2030
Indonesia	FAME	15.49	Billion liters/year	Palm oil	B30
	Co-processed bio-based diesel (end of 2022)	174	Million liters/year	Palm oil	
Japan	FAME	15	Million liters/year	UCO	No mandate
Malaysia	FAME	2.5	Billion liters/year	Palm oil	B10
Philippines	FAME	985.55	Million liters/year	Coconut oil	B2
Republic of Korea	FAME	974	Million liters/year	UCO, animal fat, palm oil, soy oil	B3.5
	HVO (2024)	300,000	Tonnes/year		
Singapore	HVO	1.3	Million tonnes/year	UCO, vegetable oils, animal fats, palm oil wastes	No mandate
	HVO (end of 2023)	1.3	Million tonnes/year		
Thailand	FAME	2.59	Billion liters/year	Palm oil	B10

(Source: compiled by SGS INSPIRE, 2022)

COMMERCIAL

FAQ 12: HOW ARE BIOFUELS PRICED COMPARED TO VLSFO?

Biofuels blends are priced at a premium to VLSFO. Pricing of biofuel blends are a factor of feedstock component prices and pure biofuel feedstock is more expensive than regular VLSFO.

As on 13 April 2022, prevailing biofuels prices quoted for UCOME B10 to B24 commands a 20-40% premium compared to conventional fuels.

COMMERCIAL

FAQ 13: ARE THERE ANY INCENTIVES IN SINGAPORE FOR AN OWNER TO BUY BIOFUELS?

With global move towards renewable, low-carbon sources of energy such as biofuels and biomass, governments worldwide are setting ambitious targets for recycling, use of non-virgin materials and renewable energy, and offering tax incentives to companies that meet or exceed sustainability goals.

In Singapore, Maritime and Port Authority of Singapore (MPA) has introduced Green Ship Programme (GSP) to encourage Singapore flagged ships to reduce greenhouse gas (GHG) emissions[2].

MPA's Green Port Programme (GPP) encourage ocean going vessels calling in Port of Singapore to adopt solutions to reduce the emission of pollutants.

MPA also administers other schemes to the maritime and related companies to grow and develop their business in Singapore.

The GCMD (Global Centre for Maritime Decarbonization) in Singapore has initiated an extensive biofuel study[3]. SSA is a working partner with GCMD.

There has been an increase uptake of biofuels in Europe, especially in the Port of Rotterdam driven by local incentives.

[2] https://www.mpa.gov.sg/singapore-registry-of-ships/register-with-srs/incentives-schemes

[3] https://www.gcformd.org/press-release-dropin-biofuel

ANNEX A

ANNEX B

CIMAC guideline for ship owners and operators on managing distillate fuels up to 7.0% v/v FAME (Biodiesel)

ANNEX C

LR Technical Report on NOx from marine diesel engines using biofuels.

SINGAPORE SHIPPING ASSOCIATION

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