Bunker Holding Group

BIOFUELS – THE PERFECT LOW CARBON FUEL SOLUTION FOR THE MARITIME INDUSTRY

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Fortes Future of Biofuels Conference, Copenhagen 2023

AGENDA

1. CHARACTERISTICS OF BIOFUELS AND BLENDS
2. WHAT IS AVAILABLE AND WHERE
3. WHAT SHOULD BE DONE ONBOARD (STORAGE AND HANDLING)

CONNECTING THE DOTS

DEFINING OUR CLIENT'S FUEL NEEDS.
LOCATING THE OPTIMAL PHYSICAL SUPPLIER.
MANAGING RISK AND VOLATILITY IN FUEL PRICES.
HANDLING ALL TRADES AND LOGISTICS.

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BUNKER HOLDING GROUP IN NUMBERS

OFFICES
66

COUNTRIES
34

ENQUIRIES
111,398

PORTS
1,764

NATIONALITIES
53

EMPLOYEES
1,500+

OUR OFFICES AND PHYSICAL SUPPLY LOCATIONS

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CHARACTERISTICS OF BIOFUELS AND BLENDS

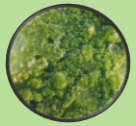
1

BIOFUELS FEEDSTOCKS AND RELEVANT PRODUCTS FOR MARINE

BBD Feedstocks can be categorized into 3 generations:

1st generation:
Vegetable oil crops such as soybean, rapeseed or palm oil, sugar cane, starch (food vs. fuel, iLUC)

2nd generation:
Waste (Annex IX B) Feedstock: Used cooking oil, Tallow (cat I and II)



3rd generation:
Waste (Annex IX A) Feedstock: Algae, POME, Tall oil, Tall oil pitch

Current non-viable feedstocks:

- Biomass fraction of mixed municipal waste
- Bio-waste
- Crude glycerin
- Biomass fraction of industrial waste
- Straw
- Nut shells
- Algae Biomass
- Animal manure
- Sewage sludge
- Bagasse
- Grape marcs and wine lees
- Cobs cleaned of kernels of corn
- Biomass fraction of forestry wastes
- Other non-food cellulosic material
- Other lignocellulosic material

Biodiesel (FAME):
Through transesterification glycerine is separated from the feedstock, which creates methyl esters (FAME). Through distillation impurities are removed from the Biodiesel.

HVO (RENEWABLE DIESEL):
Produced by hydrogenation and hydrocracking of vegetable oils and waste oils using hydrogen and catalysts at high temperatures and pressures

CO-PROCESSED MARINE GASOIL:
Refining through co-processing of sustainable feedstock together with fossil feeds. Turned into co-processed marine fuel through cracking, distillation and hydrotreating

BLENDED PRODUCTS (BIOFUELS/MARINE)
Covered by marine ISO standards for biofuels blends up to 7%
All blends from B8, B10, B20, B30 and up to B100 are acceptable by MARPOL (for B31 to B100 it is advised to apply for a non-objective letter from flag state wrt NOx)

Most relevant feedstock for Marine.
Fuel EU Maritime excludes 1st generation feedstocks.
IMO requires min. 65% GHG savings of biofuel basis full LCA.

HVO VS FAME

	HVO (Renewable diesel)	FAME (Biodiesel B100)
Process	Hydrotreatment	Transesterification
Oxygen content	0% (Paraffic diesel)	10%
Density @ 15°C (kg/m^3)	780	880
Energy/ Heating Value - LCV (MJ/kg)	44	37
Energy/ Heating Value - LCV (MJ/l)	34	33
Storage time / Stability	≥ 12 months	≈6 months*
Cold flow properties	Excellent	Good
Ignition/Combustion properties	Superior	Excellent

*Storage can exceed 6 months for B100 as long as good housekeeping is in place

Storage of B24, B30 etc will depend on the fossil fuel (VLSFO, MGO, etc) as well

BIOFUEL BLENDS

Conventional fuel oil blending

Aromatics:

- ✓ Improves stability
- ✓ Keeps asphaltenes dispersed
- ✓ Negative impact on Ignition/combustion properties

Paraffines:

- ✓ Wax
- ✓ Does not improve stability
- ✓ Excellent ignition/combustion properties

GOAL:

The balance between asphaltenes, aromatics and paraffines must be right to get a stable blend

Biofuel blends with distillate and residual fuels

FAME with MGO:

- ✓ B100 to meet EN14214 specification
- ✓ MGO to meet ISO 8217 DMA specification
- ✓ MGO to have good cold flow properties
- ✓ Blend to meet ISO 8217 DMA specification (except de minimis level of FAME)
  - ✓ EN 14112 should be used for oxidation stability test

FAME with HFO:

- ✓ B100 to meet EN14214 specification
- ✓ HFO and final blend to meet ISO 8217 RMA to RMK specification
- ✓ Additional stability tests to be performed

FAME BLENDED WITH MGO

B30 MGO

Property	Result
Viscosity @ 40°C	2.5 to 5.0
Density @ 15°C	850 to 890
Cetane Number	>44
Lower Calorific Value	40 to 42
Sulphur content	0.05 to 0.07
Lubricity	<420
CFPP	<5
Pour Point	<0
Flash Point	>60
Acid Number	<0.5
Strong Acid Number	Nil
Ash content	<0.010
Calcium + Magnesium	<5
Phosphorous	<5
Potassium	<5
Water content	<0.02

CFPP should be low (<5°C) since most vessels do not have heating in their MGO storage tanks.

Acid number should not be above 0.5% as it may indicate degradation of the fuel. SAN should always be Nil.

Ash content should always be less than 0.01% since MGO is already a clean product.

No water, no growth. The final blend should also be Clear & Bright or contain a maximum water content of 0.02% in order to avoid any microbial growth onbord.

FAME BLENDED WITH VLSFO

B30 VLSFO

Property	Result
Viscosity @ 50°C	30 to 200
Density @ 15°C	910 to 945
Lower Calorific Value	38 to 39
Total Sediment Aged*	<0.05
Sulphur content	<0.50
Pour Point	<24
Flash Point	>60
Acid Number	<0.9
Strong Acid Number	Nil
Carbon Residue – Micro	2 to 6
Ash content	0.01 to 0.03
Vanadium	<50
Sodium	<30
Aluminium + Silicon	<40
Calcium	<30
Zinc	<15
Phosphorous	<15
Potassium	<10
Water content	<0.3

The lower the viscosity, the more important stability tests come into play. TSA and TSP should be below 0.05% m/m

If the acid number is elevated (higher than 1%), it should come from an even higher acid number from the VSLFO. SAN should always be Nil.

WHAT IS AVAILABLE AND WHERE

2

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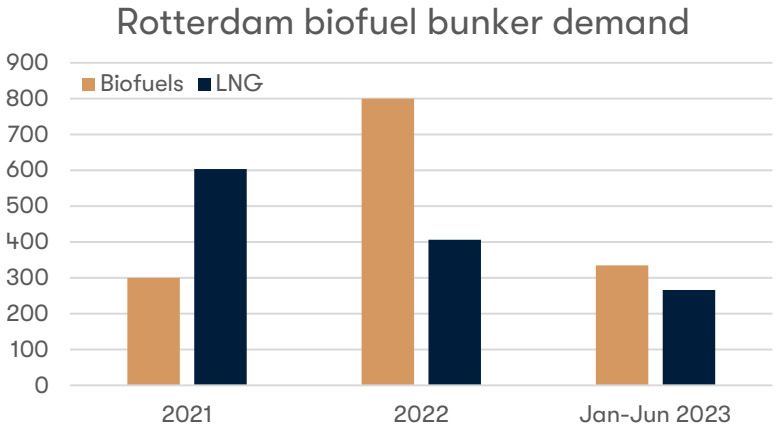
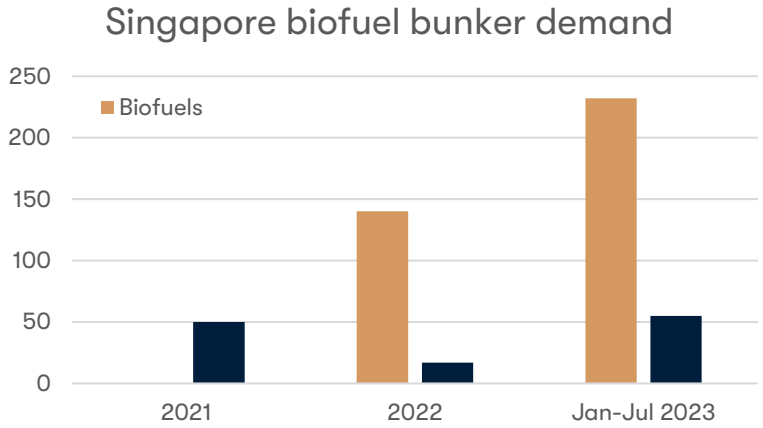
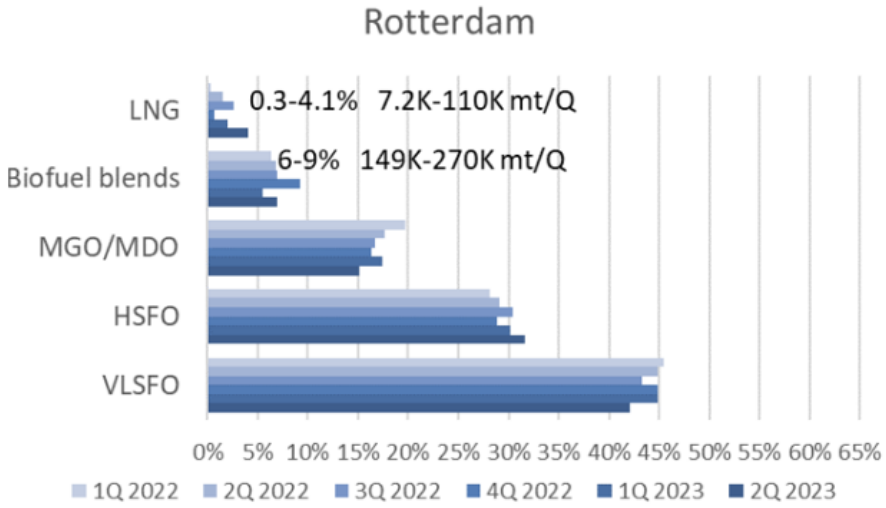
BIOFUEL BUNKERS IN FLOW PORTS

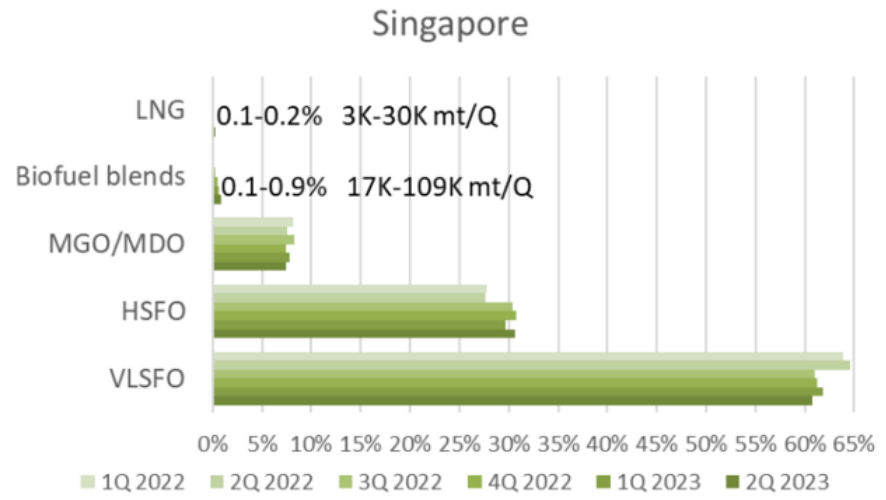


Source: Bunker sales Port of Rotterdam



Source: Bunker sales Port of Singapore





- Biofuel bunker demand is growing rapidly in Rotterdam and Singapore
- The share of biofuel bunker demand in Rotterdam rose to 7% in 2022 from 3% in 2021
- Biofuel for bunkering in Singapore surpassed LNG in 2022

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BUNKER HOLDING'S BIOFUELS SUPPLY LOCATIONS

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STORAGE AND HANDLING

3

B100, HVO AND BIODIESEL WITH MGO

Storage

- To be stored in MGO tanks since B100 and HVO have similar fuel characteristics as MGO
- Fuel temperature to be kept 10°C above the Pour Point and at least 5°C above CFPP during transfer.
- If stored in fuel oil tanks, the solvancy of biodiesel can dislodge fuel debris and other contaminants that have accumulated over time.

Fuel Treatment

- Same procedures as with a MGO
- If a separator is used, water washing / conditioning washing is not recommended. If used, it could;
  - create soap during separation
  - cause bacterial growth in fuel treatment plant

DMA 0.10% Averages

Port	Quarter	Visc @ 40°C (cSt)	Dens @ 15°C (kg/m3)	Sulphur (% m/m)	Cetane Index	Acid Number (mg KOH/g)	CFPP (°C)
Global	Q2, 2022	3.57	855.6	0.06	48	0.03	-5
	Q3, 2022	3.73	856.9	0.06	48	0.03	-4
	Q4, 2022	3.78	856.6	0.06	49	0.05	-4
	Q1, 2023	3.82	856.0	0.06	49	0.06	-3
	Q2, 2023	**3.82**	**858.3**	**0.06**	**48**	**0.05**	**-3**

Source – Bureau Veritas, VeriFuel

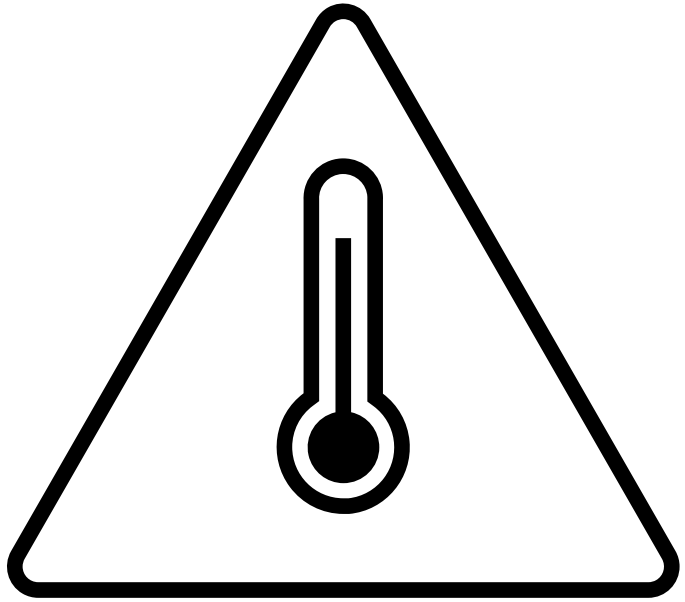
BIODIESEL WITH HFO

Storage

- To be stored in heated fuel oil tanks
  - Fuel temperature to be kept as low as possible but always 10°C above the Pour Point
  - Drain regularly to remove water
  - Do not mix with another fuel

Fuel Treatment

- Same procedures as with a Fuel Oil
  - Do not overheat, esp. with a VLSFO.
- If a separator is used, water washing / conditioning washing is not recommended. If used, it could;
  - create soap during separation which can cause operational issues
  - cause additional sludge formation



FUEL CONSUMPTION

Fuel consumption depends on two main factors:

1. Lower Heating Value / Lower Calorific Value (LCV)
2. Density

The higher the LCV and density, the lower the fuel consumption

Fuel	Lower Calorific Value (MJ/kg)	Density @ 15°C (kg/m^3)	LCV (MJ/l)	%diff from MGO	%diff from VLSFO
MGO	43	860	37	-	-5%
VLSFO	41.5	940	39	+5%	-
HVO	44	780	34.3	-8%	-13.5%
B100 Netherlands	37	880	32.6	-13.5%	-19.5%
B30 MGO	41	870	35.7	-3.5%	-9%
B24 VLSFO Singapore	40	930	37.2	0%	-5%

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