

# Webinar

## Transitioning to Biofuels on board: Technical considerations



15 04 2024

Latitude  
N 55°30'23.8458"  
Longitude  
E 9°43'44.7468"

# Agenda

## 1. Introduction:

- *Speakers*

- *Practicalities*

## 02. Introduction of the Green COE

## 03. Role of Biofuels

## 04. Technical discussions

## 08. Why Dan-Bunkering is the preferred partner

## 09. Q/A

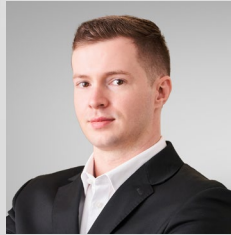


# Welcome

● **Host & Presenter:**

**James Shiller**

*Global Lead of New Fuels,  
Dan-Bunkering*



● **Speakers:**

**Manja Ostertag**

*Head of Biofuels,  
Bunker Holding*



**Gunnar Kjeldsen**

*Biofuels Development Manager,  
Bunker Holding*



● **Practicalities** ▷

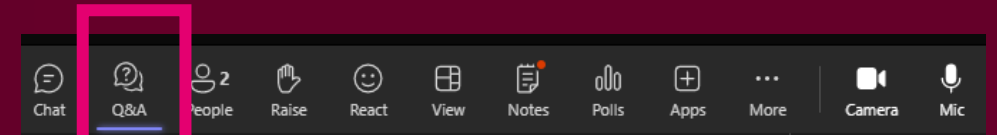


# Instructions

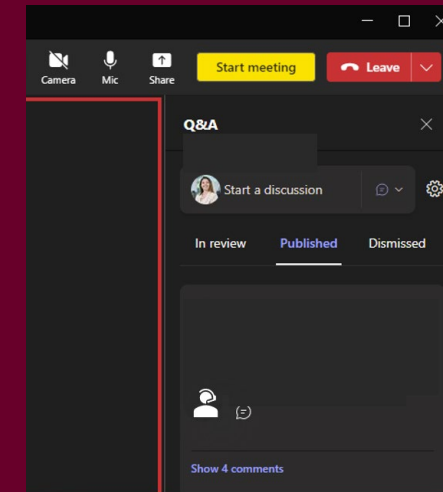


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2. Recording: This webinar will be **recorded** and shared with you next week through email.
3. Polls: We will have a couple of polls during the webinar (*remember to press 'done' to close the poll*).
4. Questions: Ask questions via the **Q&A function** throughout the presentations or after the presentations by **unmuting yourself** and asking your questions.
5. Follow-up: Every attendee will receive a link to this presentation and recording next week.

Find all instructions in the Q&A section



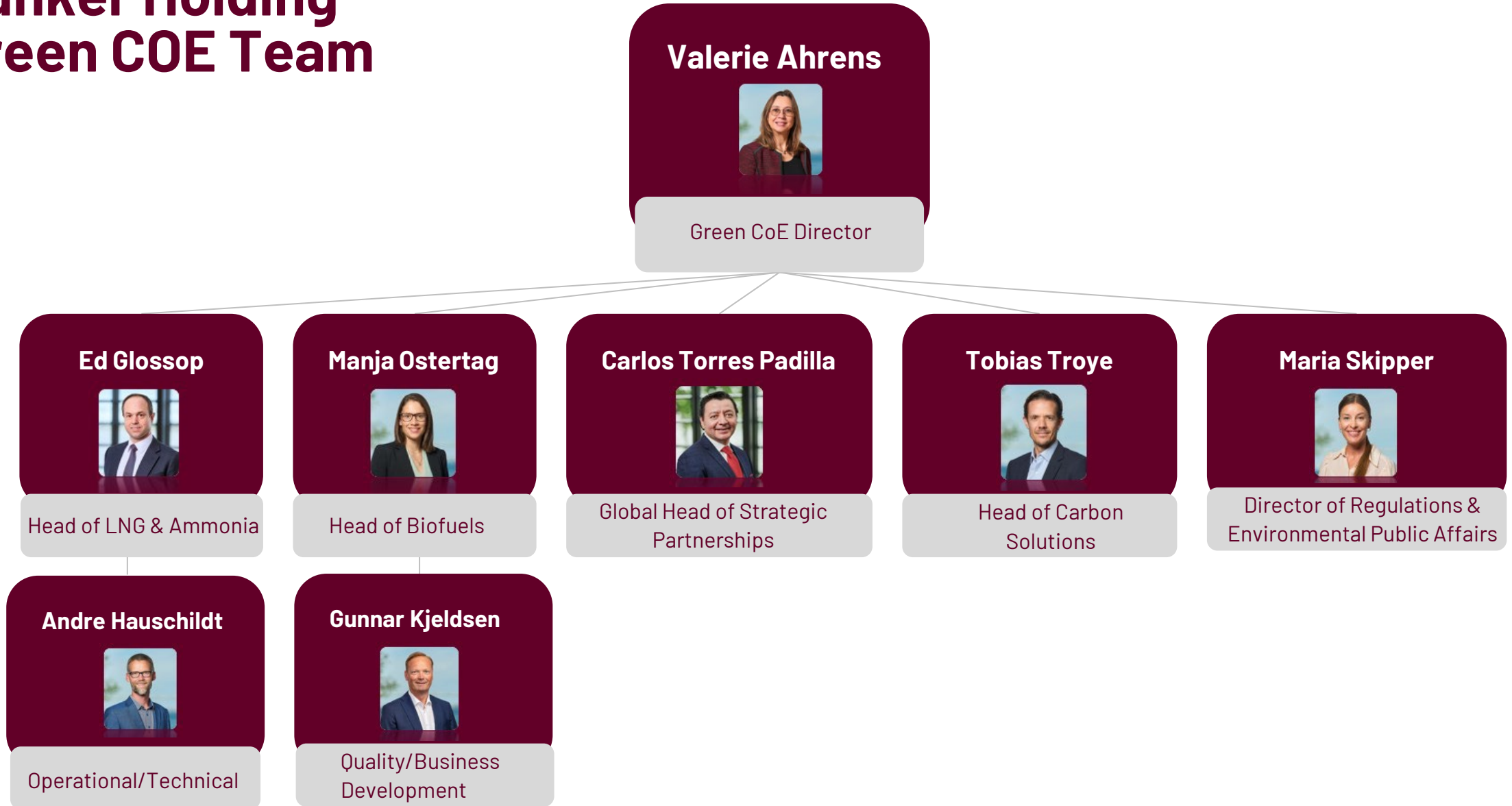
The Q&A will show on the right side of your screen.



After the presentations, the microphone will be enabled.



# Bunker Holding Green COE Team



# Biofuels

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# The maritime industry is facing a new reality

The energy transition in shipping is already underway, with logical pathways towards the decarbonization of all ship types and engine choices.

## Short term

Conventional fossil-based bunker fuels continue as the most dominant products. These begin to be augmented with biofuels.

LNG is an available lower carbon alternative with a positive pathway to decarbonization.

Moreover, focus is on improving energy efficiencies.

## Medium term

LNG & biofuel will begin to take a larger share of the fuel mix.

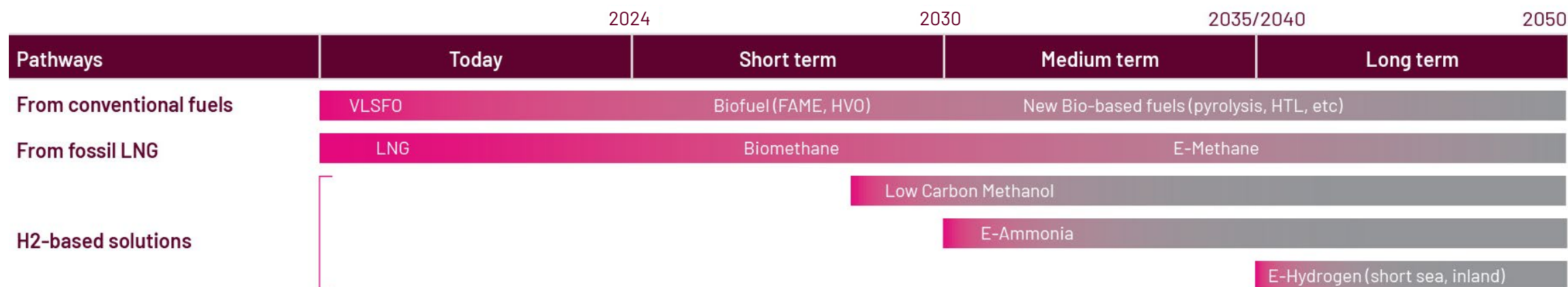
Low carbon methanol becomes available in multiple locations.

Challenges around scale of supply of low and zero carbon fuels will persist.

## Long term

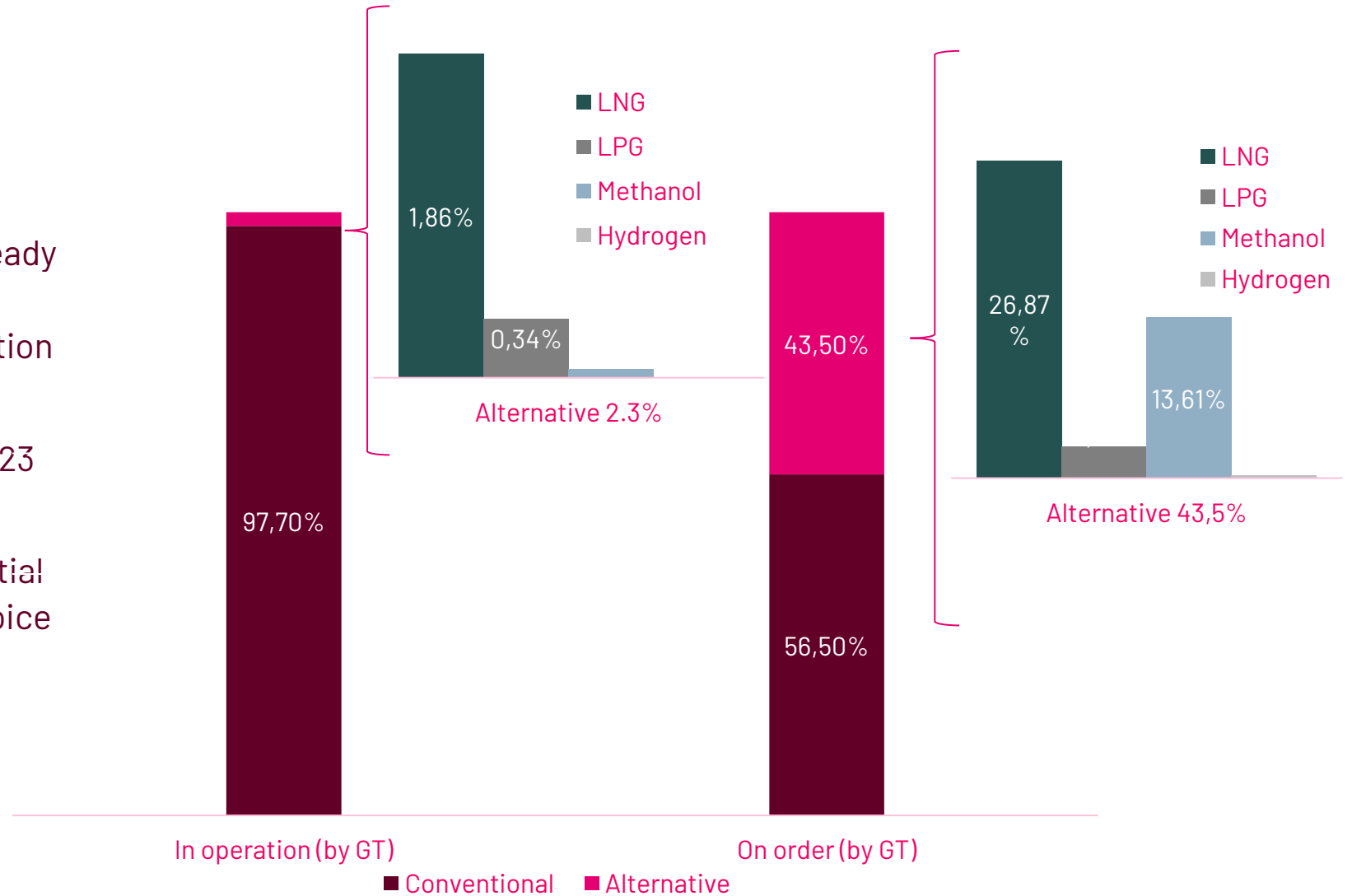
An uptake of carbon-neutral fuels will take place, once a clear and robust regulatory framework is in place.

Further development of blue and green sources of supply will facilitate the uptake of hydrogen-based fuels.



# Vessel Orderbook

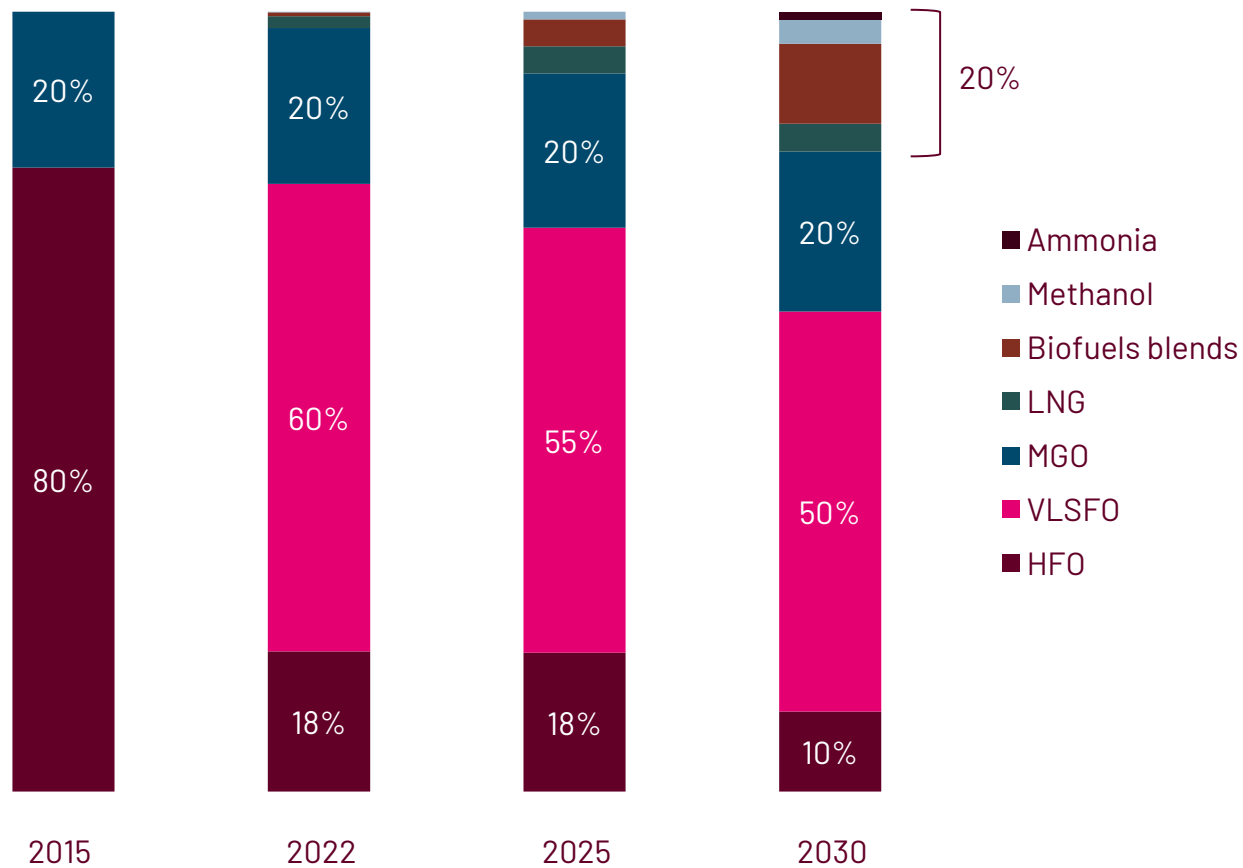
- LNG-fuelled ships continue “at a steady pace” and remains the dominant alternative fuel for vessels in operation and on order
- The majority of new contracts in 2023 consist of methanol-powered ships
- Conventional fuel, and hence potential biofuel blends, is still the fuel of choice for the global fleet





# Fuel mix trend

Note: Estimates based on internal study



We expect that ~20% of the fuel mix will be new fuels in 2030.

We believe biofuels will play a key role in reaching decarbonization targets for 2030 and beyond.

# Relevant biofuels for the marine industry

## 3 categories of feedstocks



### 1<sup>st</sup> generation:

Vegetable oil crops: e.g. soybean, rapeseed or palm oil, sugar cane, starch (food vs. fuel, iLUC)



### 2<sup>nd</sup> generation:

Waste feedstocks: e.g. used cooking oil, tallow (cat I and II), damaged crops and cover crops (for marine)  
Processable with existing technologies



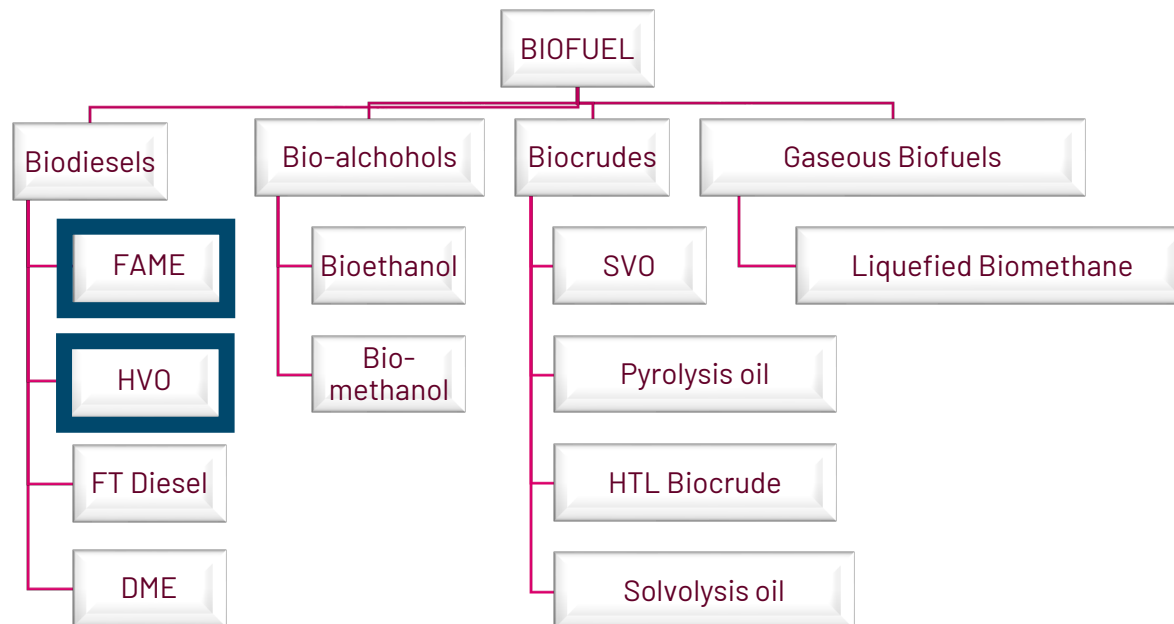
### 3<sup>rd</sup> generation:

Waste feedstocks: e.g. algae, pome, tall oil, fatty acids, acid oils, SBEO  
Require new technologies and processing methods

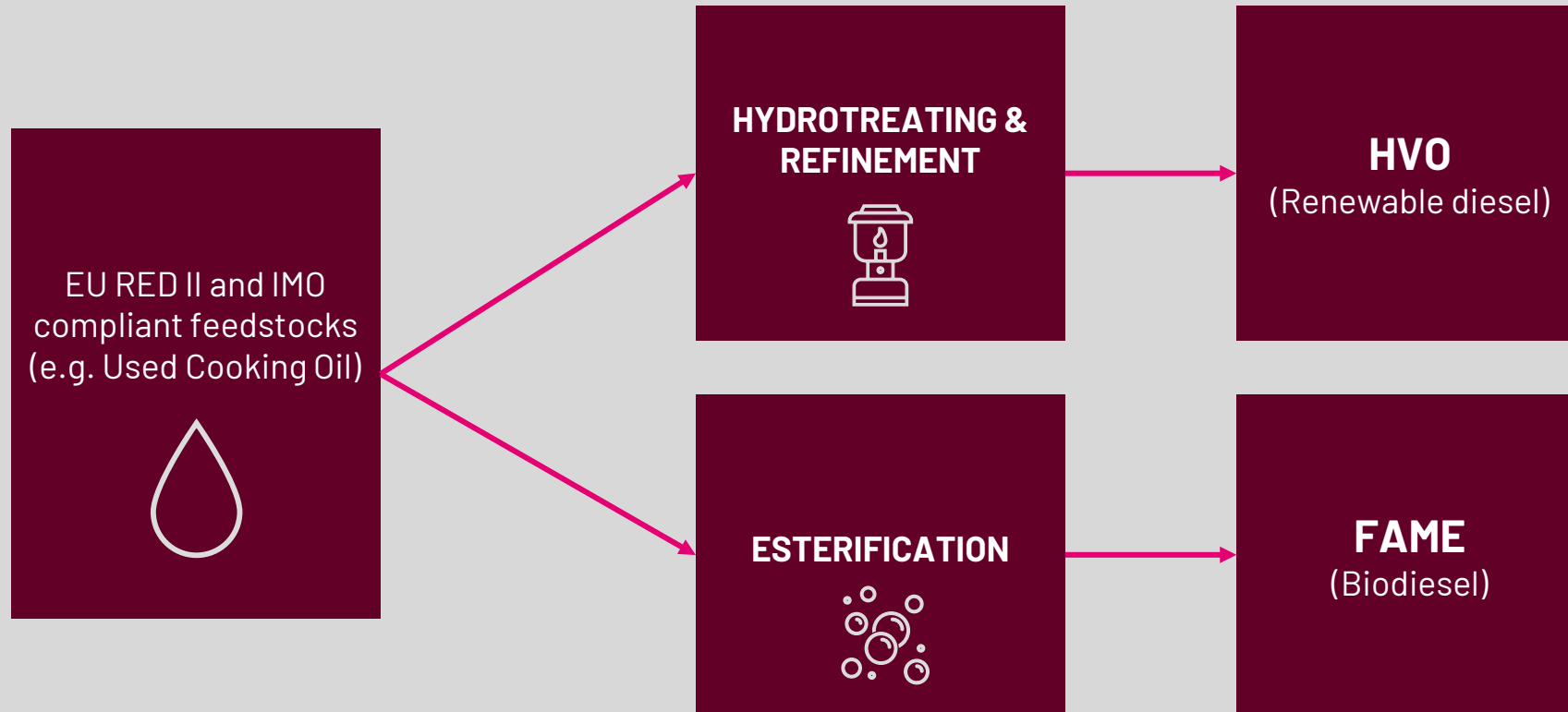
Most relevant feedstock for Marine.  
Fuel EU Maritime excludes 1<sup>st</sup> generation feedstocks.  
IMO requires min. 65% GHG savings of biofuel basis full LCA.

# What is biofuel

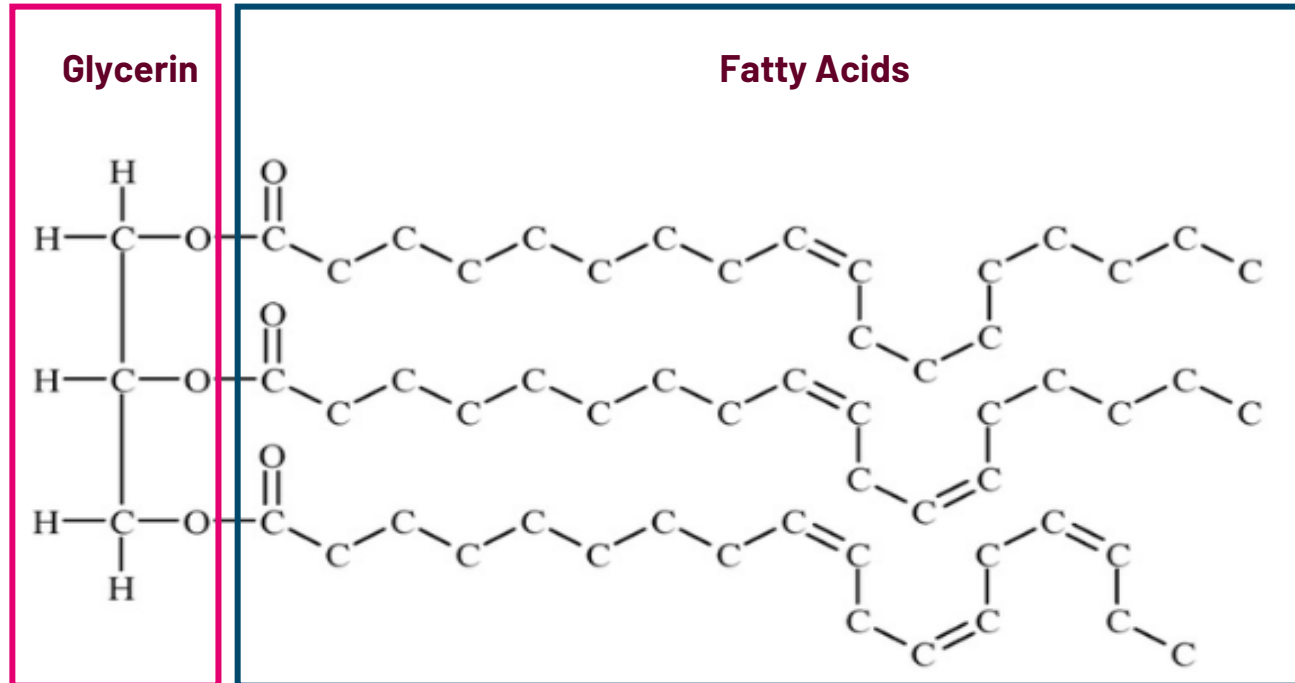
- A “drop-in” fuel that can replace MGO or HFO
- Looks and behaves like MGO
- A fuel that can be blended with a MGO or HFO
- Produced from sustainable feedstocks



# Biofuels available for maritime



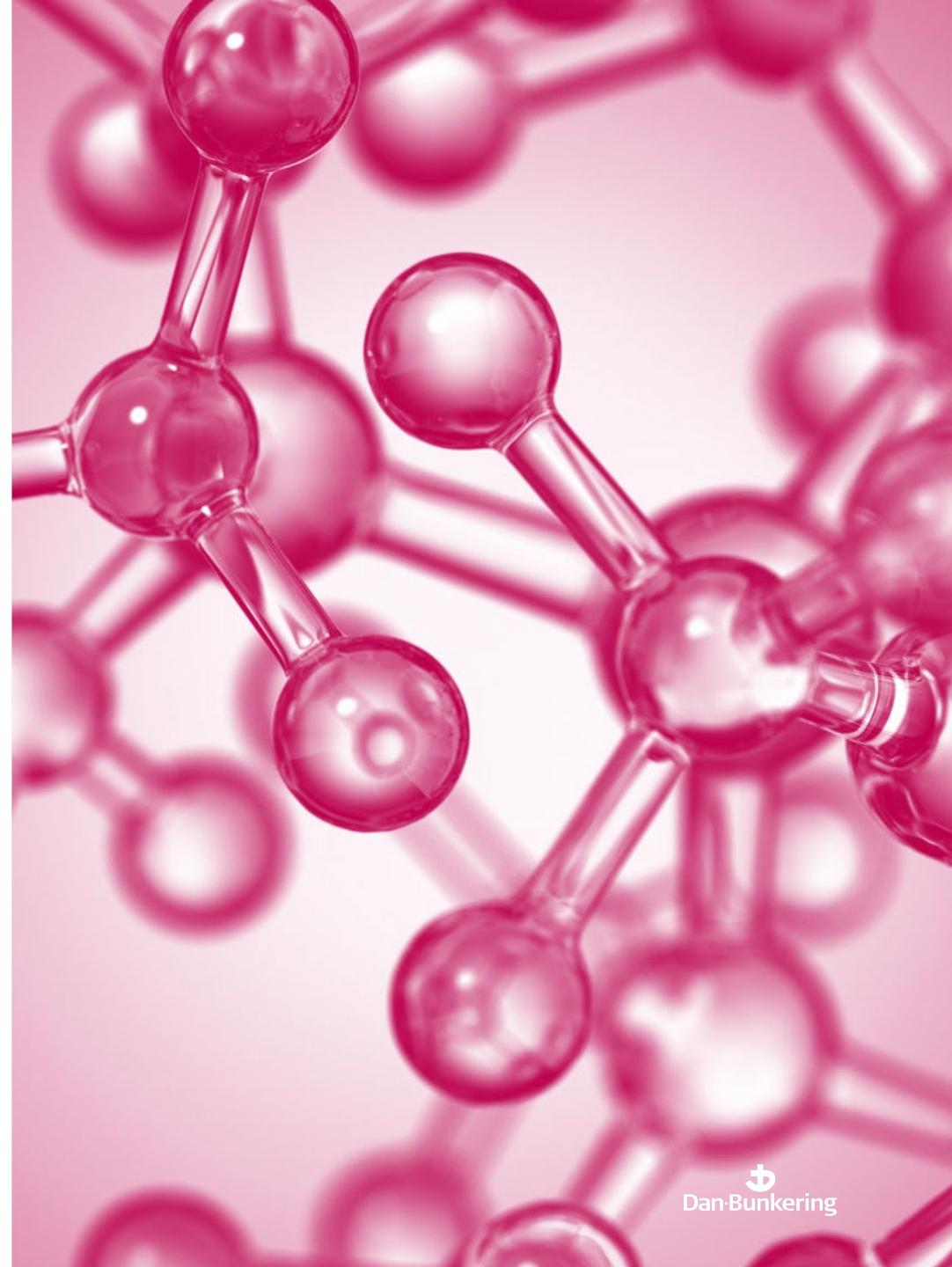
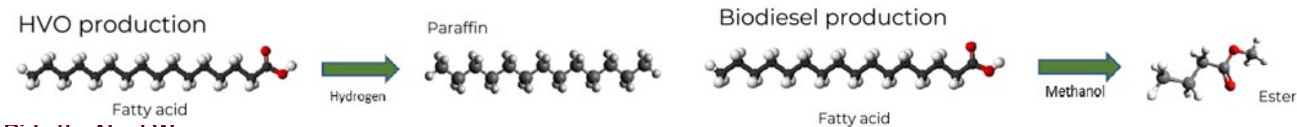
# Carbon chain in vegetable oils



Used Cooking Oil, vegetable oils and animal fats are made from Triglycerides

**Chemical formula for Rapeseed Oil = C<sub>57</sub>H<sub>105</sub>O<sub>6</sub>**

**Chemical formula for typical MGO = C<sub>16</sub>H<sub>34</sub>**



# HVO vs FAME

	HVO (Renewable diesel)	FAME (Biodiesel, B100)
Process	Hydrotreatment	Transesterification
Oxygen content	0%	10%
Density @ 150C (kg/m <sup>3</sup> )	780	880
Energy/ Heating Value - LCV (MJ/kg)	44	37
Energy/ Heating Value - LCV (MJ/l)	34	33
Storage time/ Stability	≥ 6 months	≈ 6 months*
Cold Flow properties	Excellent (DMX)	Good (DMA summer)
Ignition/ Combustion properties (CN)	80	57

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

# Biofuel Quality

1.

**EN 15940 specification** (Automotive fuels - Paraffinic diesel fuel with excellent cold flow properties)

2.

**EN 14214 specification** (Diesel Engine spec)

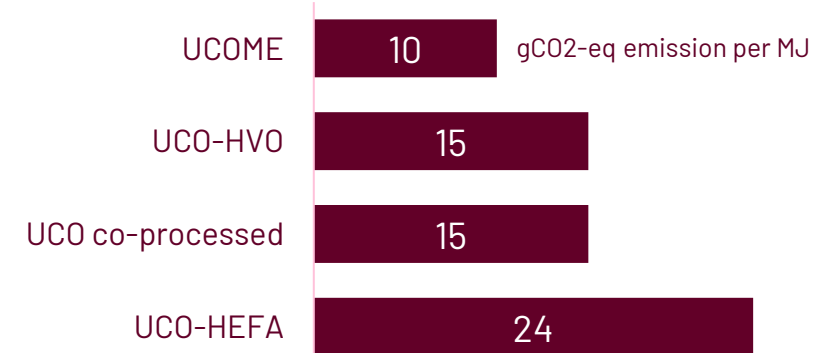
- No Carbon Residue
- Metal and contamination limits
- 0.001% sulphur
- Oxidation Stability stricter requirements from the previous edition and enhancing additives are usually added at the production stage.
- Min Cetane No. 51
- Min Visc@40°C 3.50 mm<sup>2</sup>/s

3.

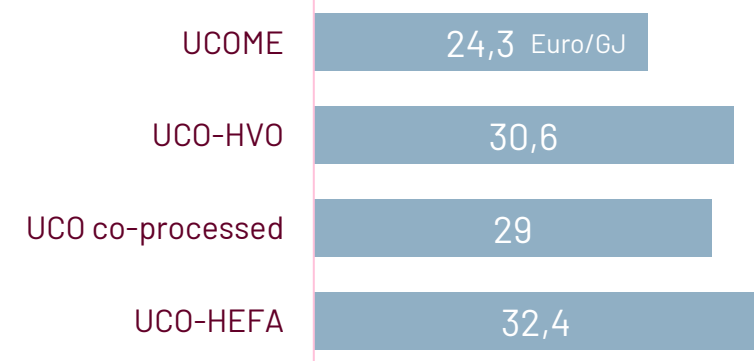
**ISO 8217 specification**

- Min. visc. 2.00 mm<sup>2</sup>/s
- Max. ash 0.01% m/m
- Min. Cetane Index 40

## GHG savings

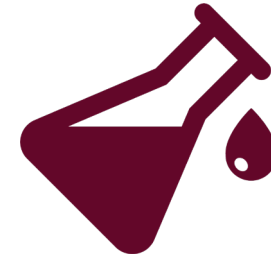


## Production costs



# Blending biofuel

- Blending is usually by volume (B24 is 24% volume of Biodiesel)
  - Max 25% by volume of Biofuel for IMO Annex I barges
  - Max 30% by volume to be considered a conventional fuel according to MEPC.1/Circ.795/Rev.7 (NOx emission limit)
- FAME and esp. HVO are compatible with MGO
- FAME is also compatible with HFO (ULSFO, VLSFO, HSFO)
- Biofuel blends with MGO:
  - Both fuels should meet their respective specifications
  - MGO should be clear and bright, and Biofuel should have good Oxidation Stability.
- Biofuel blends with HFO:
  - Both fuels should meet their respective specifications
  - HFO should have a low TSA/TSP result (below 0.05%)
- ISO 8217:2024 will soon be available and will cover Biofuel and biofuel blends with fossil fuels



**B100 meeting EN14214**



**HFO or MGO meeting ISO 8217**



**Final blend  
B24 VLSFO, B30 MGO etc... Meeting ISO 8217**



# Biofuel quality – B100 and blends with MGO

## Microbial growth

- Biodiesels are hygroscopic and have all the necessary nutrients for microbial growth. If growth occurs, it will lead to filter clogging and sludge formation.
- Microbial growth also occurs in MGO. Vessels that have/had issues with growth in MGO will most likely face same issues with Biofuels unless tank(s) have been cleaned and better housekeeping/no water ingress is in place
- OEM approved Biocides (same as MGO) may be used



# Biodiesel and compatibility of materials

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## Compatible

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Steel  
Aluminum  
Teflon  
Viton  
Fiber glass

## Not compatible

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Copper  
Brass  
Bronze  
Lead  
Zinc  
Tin  
NBR  
Polypropylene  
Polyvinyl  
Tygon  
EPDM  
polyurethane

# 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 <sup>3</sup> )	LCV (MJ/l)	% vol diff from MGO	% vol diff from VLSFO
MGO	43	860	37	-	-6%
VLSFO	41.5	950	39.4	+6%	-
HVO	44	772.7	34	-8%	-14%
B100 Netherlands	37	891.9	33	-11%	-17%
B30 MGO	41	870	35.7	-3.5%	-9.5%
B24 VLSFO Singapore	40	930	37.2	0%	-6%

**Note:** Actual consumption seems to be lower than theoretical consumption of biofuels due to less CO and improved engine efficiency (higher cetane number).

B30 MGO trials indicated only 1.5 to 2% increase (by volume compared to MGO)

B24 VLSFO trials indicated 3% increase by volume compared to VLSFO)

# Biofuel deliveries

## IN FLOW PORTS AND THE REST OF THE WORLD



Singapore  
(Mainly B24 VLSFO)

2022: 140,000 MT  
2023: 524,000 MT



Rotterdam  
(Mainly B30 VLSFO)

2021: 301,051 MT  
2022: 790,851 MT  
2023: 750,888 MT



Rest of the world

2021-2023: ~ 500,000 MT

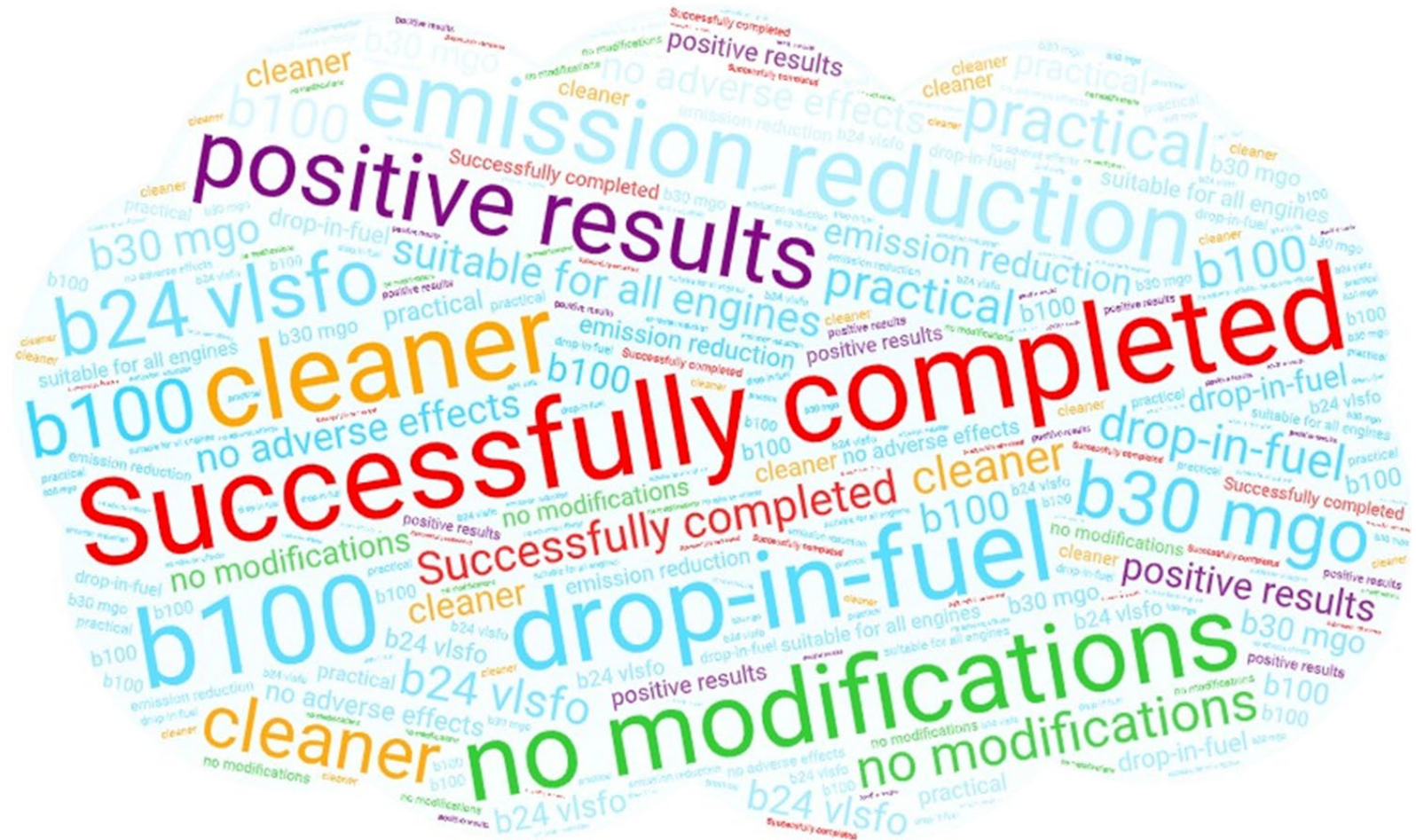


### Total 2021 - 2023

3 million MT of Biofuel blends (with fossil fuels) and B100  
>5000 deliveries to vessels with no major issues reported



# Biofuel Trials



# B100

## Bunker One

- **For almost one month**, Bunker One has supplied **B100 biofuel** to Color Line's SuperSpeed 1 and 2 ferries travelling between Hirtshals in Denmark and Larvik and Kristiansand in Norway. With this switch to biofuel, Color Line's two passenger ferries have reduced CO2 emissions by approximately 85% on average on the biofuel quantities used.
- The numerous benefits of the B100 biofuel, such as CO2 emissions reduction, energy efficiency, **and no required modifications to vessel engines**, have been the primary motivation behind Color Line's piloting of low-carbon biofuel. Equipped with technical expertise and extensive know-how on lower carbon fuels, compliance, and the regulatory landscape for shipping, Bunker One managed to find the best solution that accommodated Color Line's needs.



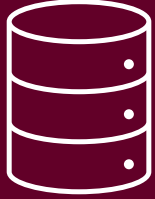
# B100, HVO and Biodiesel blends with MGO

## 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 solvency 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
	<b>Q2, 2023</b>	<b>3.82</b>	<b>858.3</b>	<b>0.06</b>	<b>48</b>	<b>0.05</b>	<b>-3</b>

Source - Bureau Veritas, VeriFuel

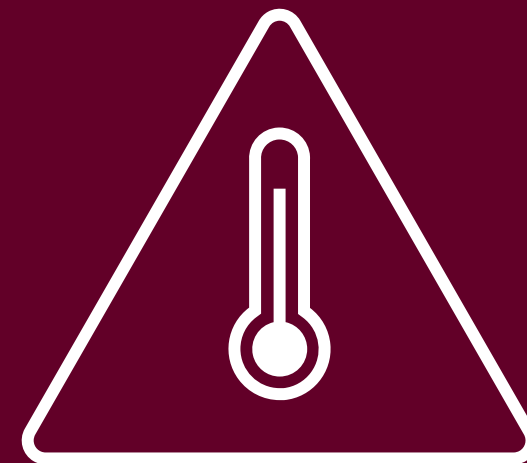
# Biodiesel with HFO

## 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





# Benefits of Biofuels for Marine //



Drop-in fuel that can be used in existing ship engines without modifications to the engine



Globally tested by shipping companies and bunker suppliers.



Approved by most OEM & accepted by IMO in blends up to B100 without approval from flag state



ISCC certification ensures compliance with sustainability criteria throughout the entire supply chain



Excellent fuel characteristics

- ✓ Better ignition and combustion properties
- ✓ Improved lubricity and good cold flow properties
- ✓ Reduction in Particulate Matters and Black Carbon
- ✓ Reduction in GHG emission



B20-B30 pathway to IMO and FuelEU Maritime compliance



Helps fulfil customers ESG targets and sustainability linked loans.

# Why is Dan-Bunkering your preferred partner



ISCC certified offices



Support of the  
Bunker Holding  
technical experts



Extensive supplier and  
product vetting

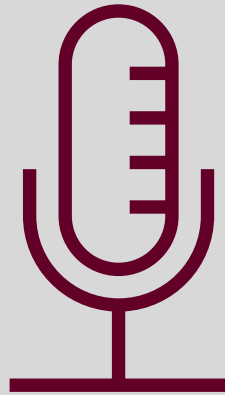


Diverse portfolio of  
solutions and global  
coverage

  
**Dan-Bunkering**  
Ride the Next Wave

Support from the  
Dan-Bunkering  
New Fuels Team

**Q/A**



**The microphone is open.**

# Thank you

