

Everllence

Biofuel in Everllence B&W two-stroke engines

IMO TECHNICAL SEMINAR ON MARINE
BIOFUELS

Dorthe Jacobsen, Everllence Two-stroke R&D
12 February 2026



Agenda - Biofuel in Everllence B&W two-stroke engines

IMO Technical seminar on marine biofuels



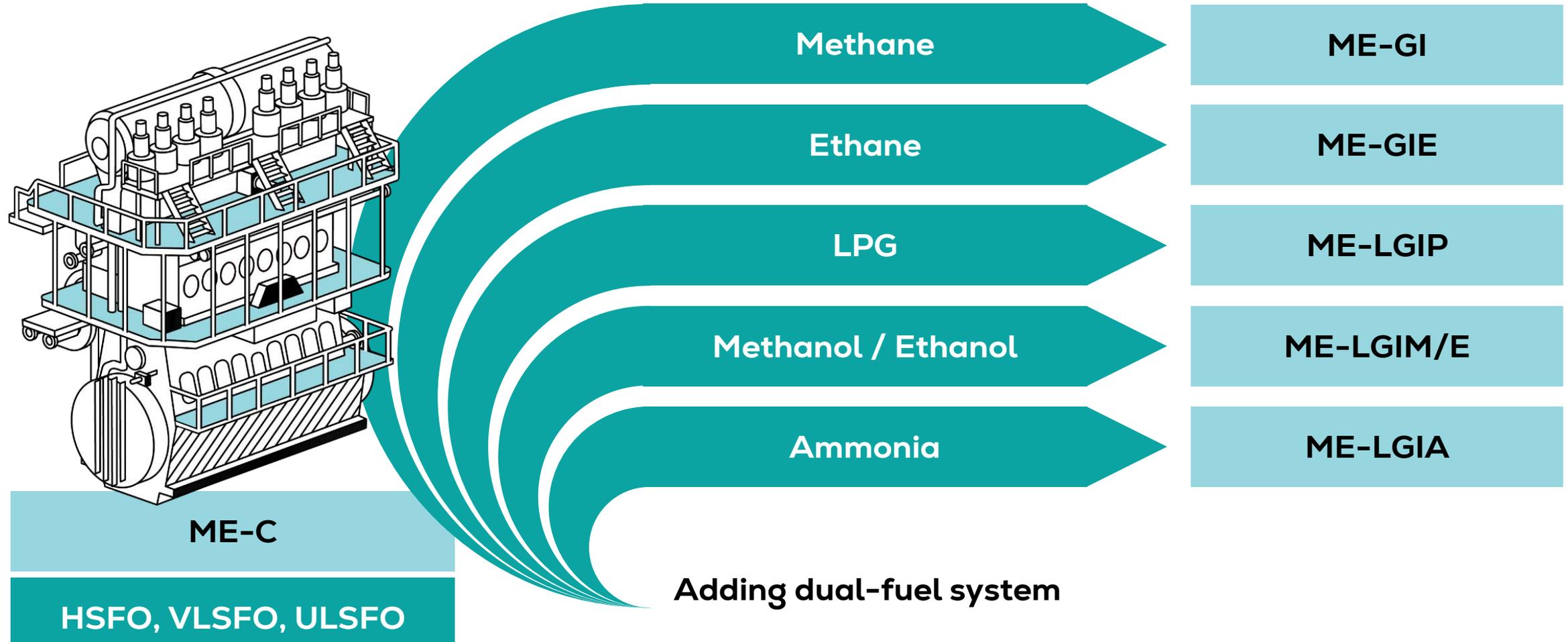
- 1. Everllence B&W engines**
- 2. Market and forecast**
- 3. What is biofuel?**
- 4. How do we approach biofuel?**
- 5. Regulatory clarity**
- 6. Sum up**

1

Everllence B&W engines

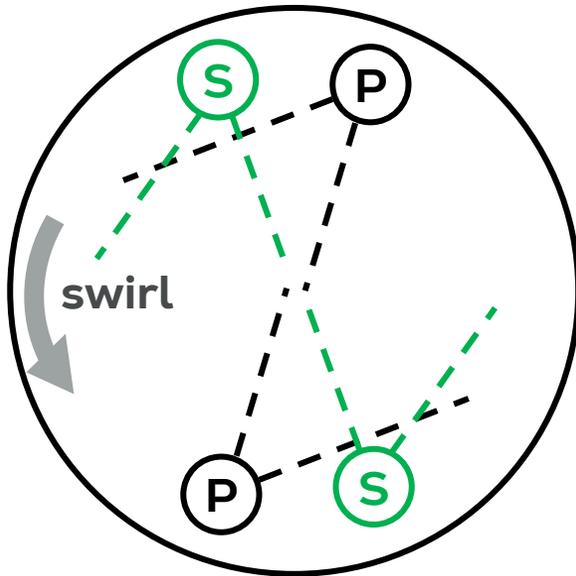
Everllence B&W two-stroke engines

The modular approach

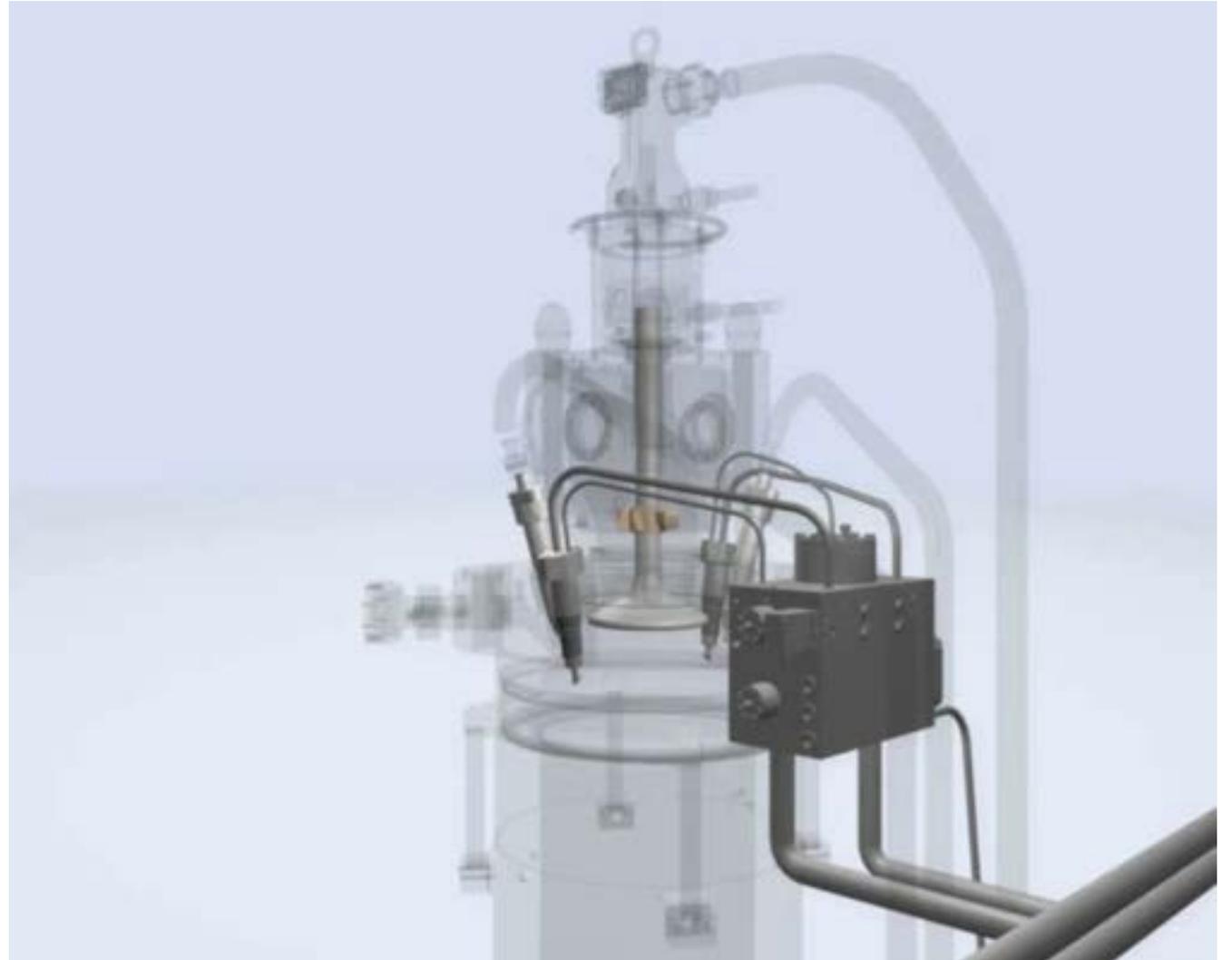


Dual fuel combustion

Some fuels require a pilot injection to stabilize the ignition

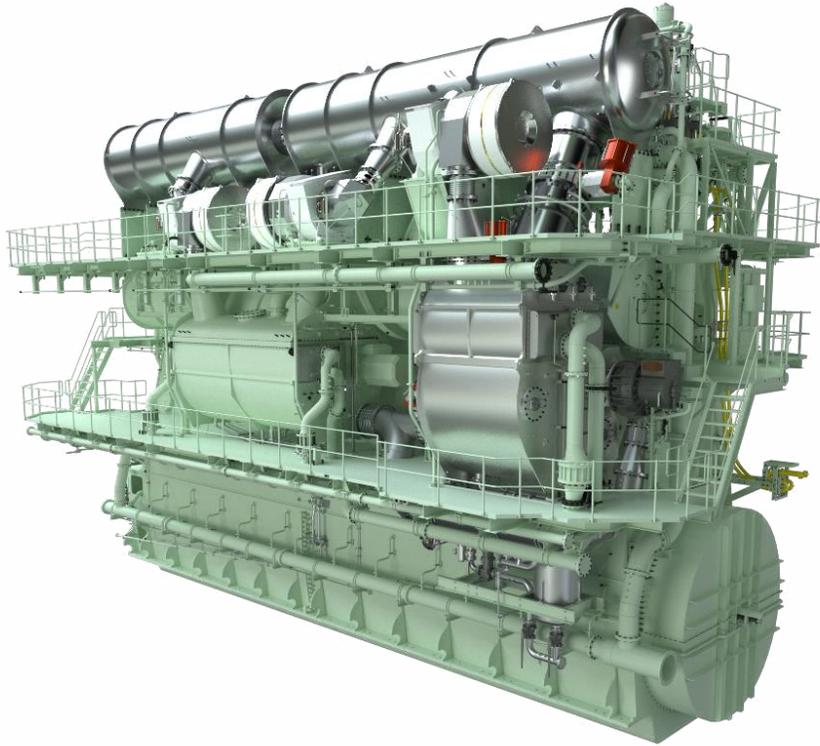


- P** Diesel injector for pilot injection
- S** Second fuel injector (Methane, Alcohol, etc.)



NOx reduction equipment

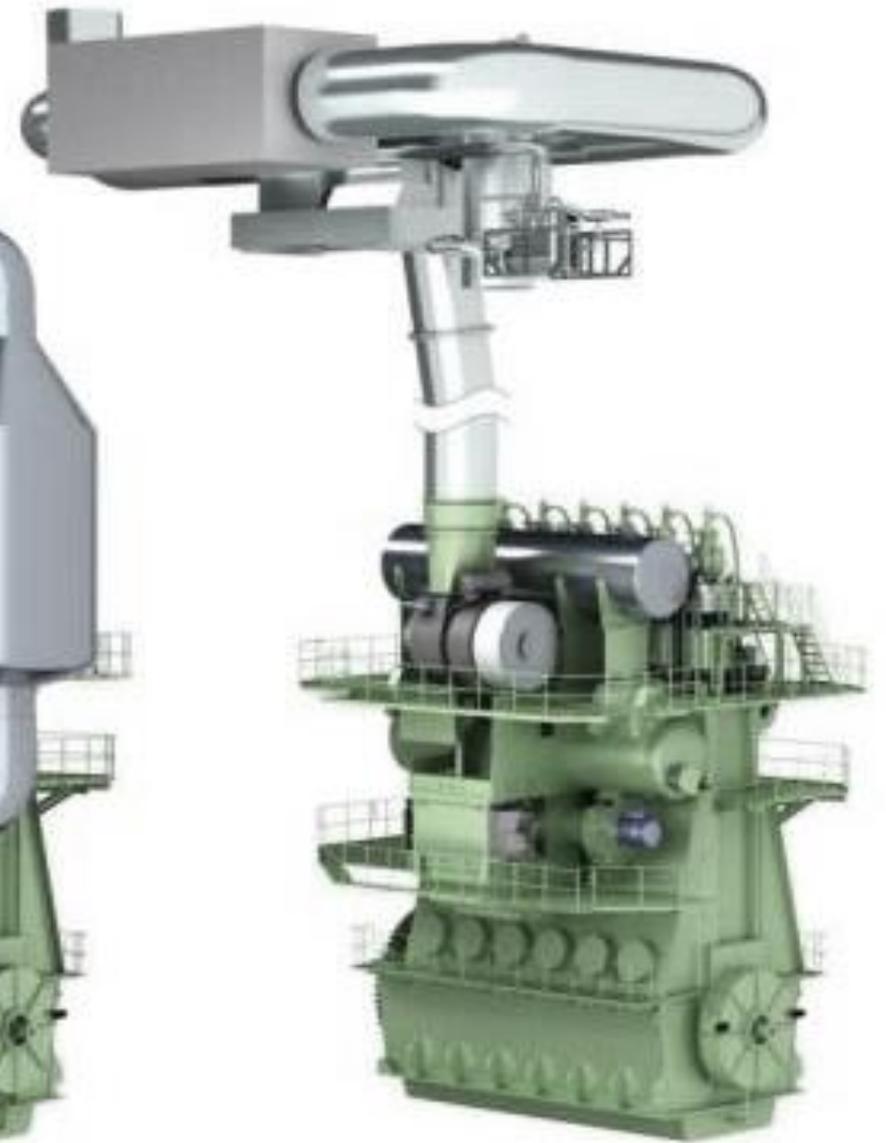
Tier III technology



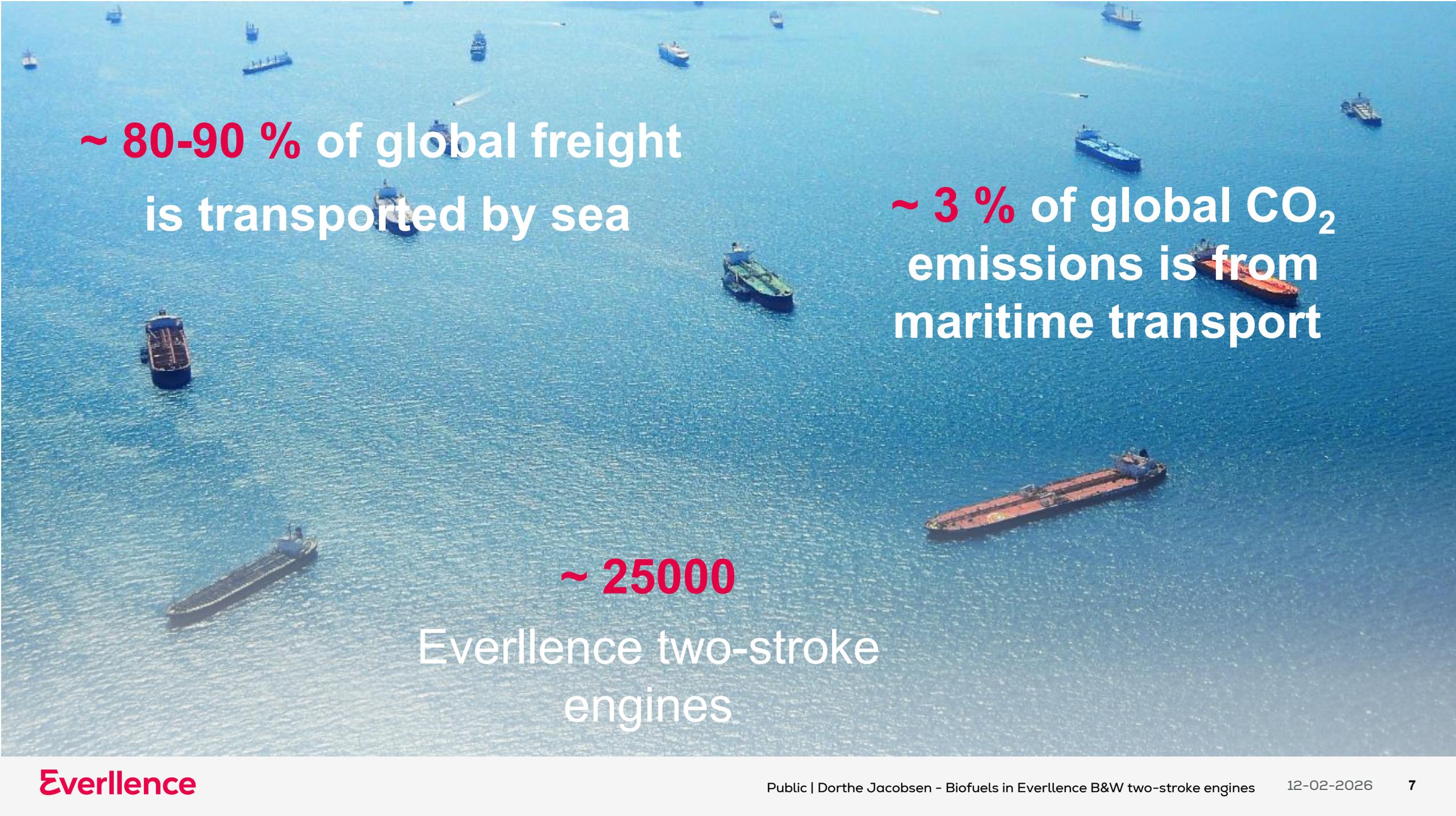
EGR – Exhaust Gas Recirculation



HP-SCR – High Pressure
Selective Catalytic Reduction



LP-SCR – Low Pressure
Selective Catalytic Reduction



~ 80-90 % of global freight
is transported by sea

~ 3 % of global CO₂
emissions is from
maritime transport

~ 25000
Everllence two-stroke
engines

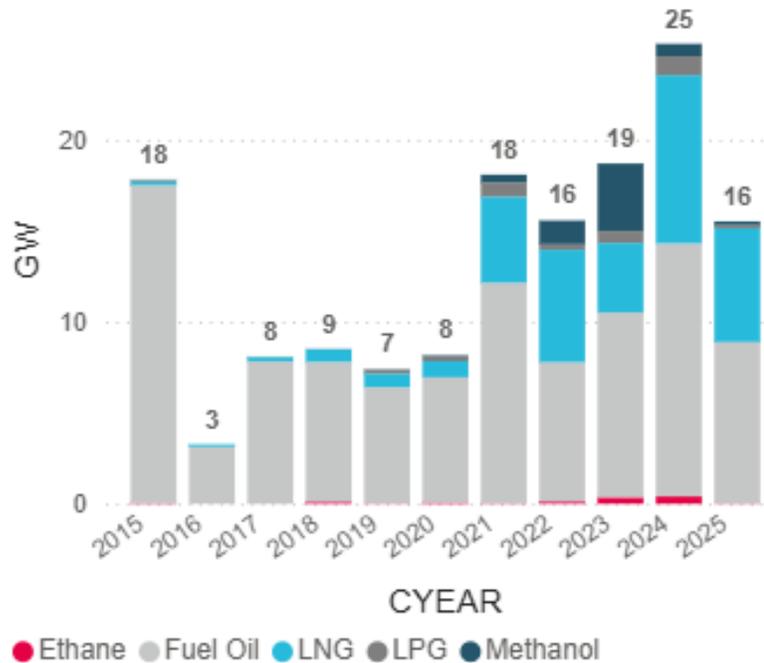
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Market and forecast

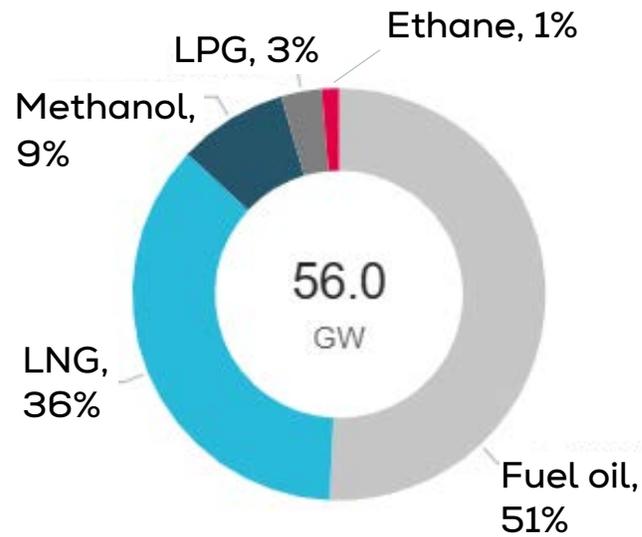
Everllence B&W two-stroke engines

GW by fuel type

Contracted engines

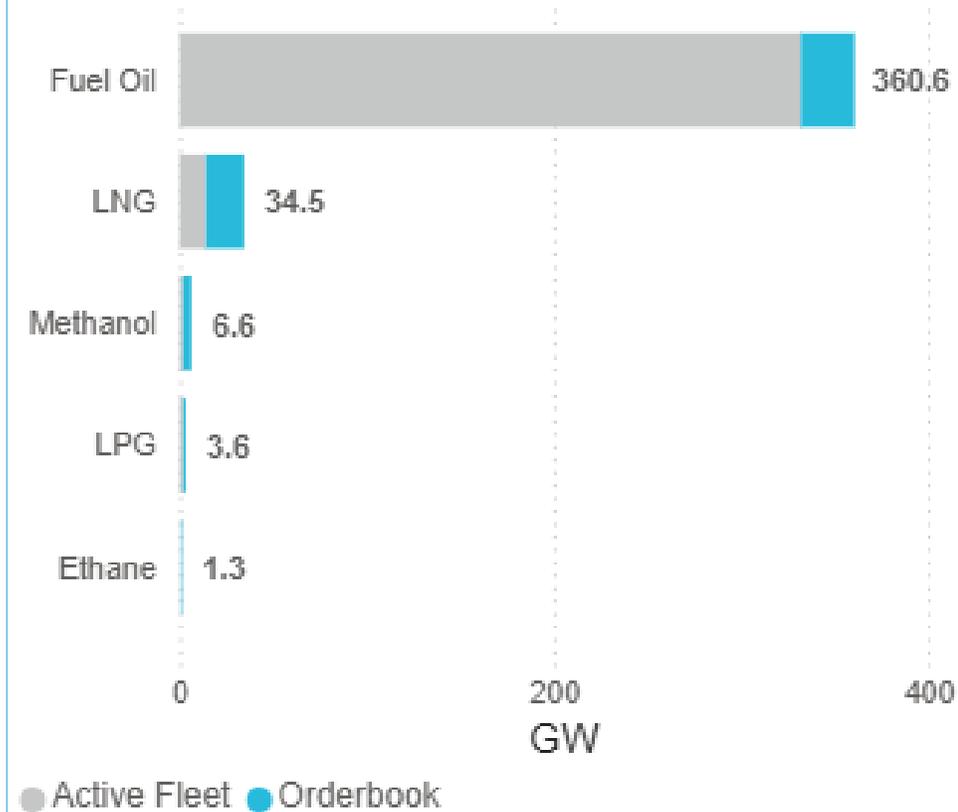


Yearly development



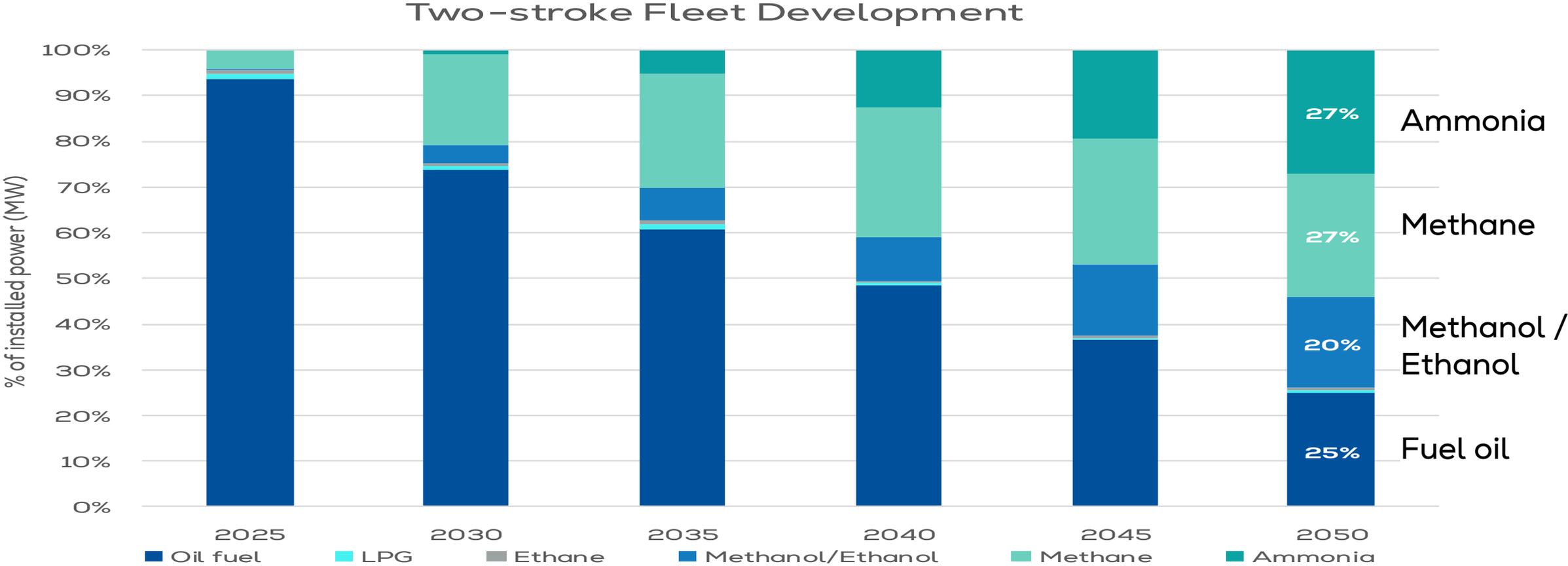
Order book

Active fleet and order book



Forecast: Fuel mix for two-stroke powered ships

A diversified fuel mix is expected for the coming decades



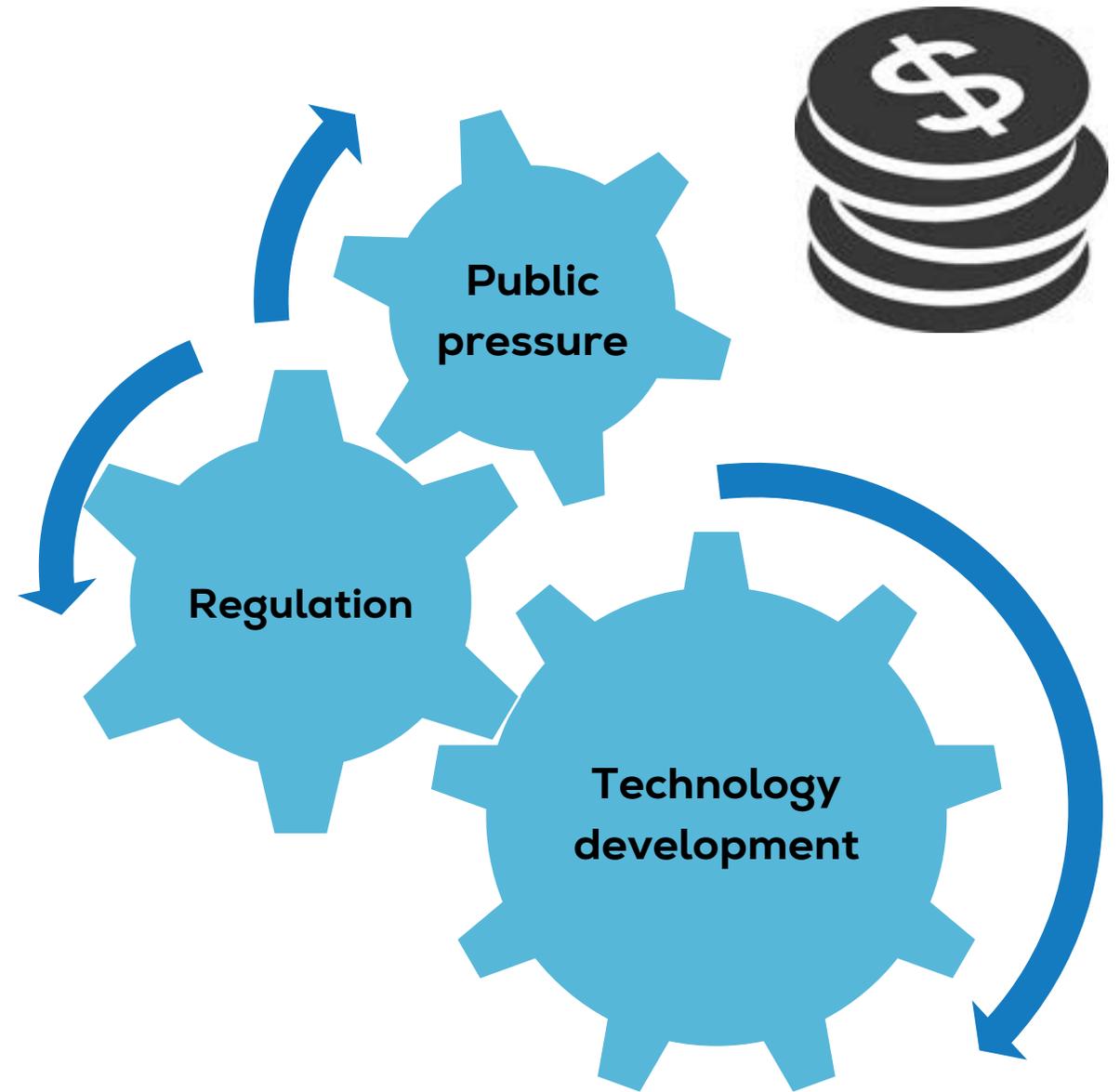
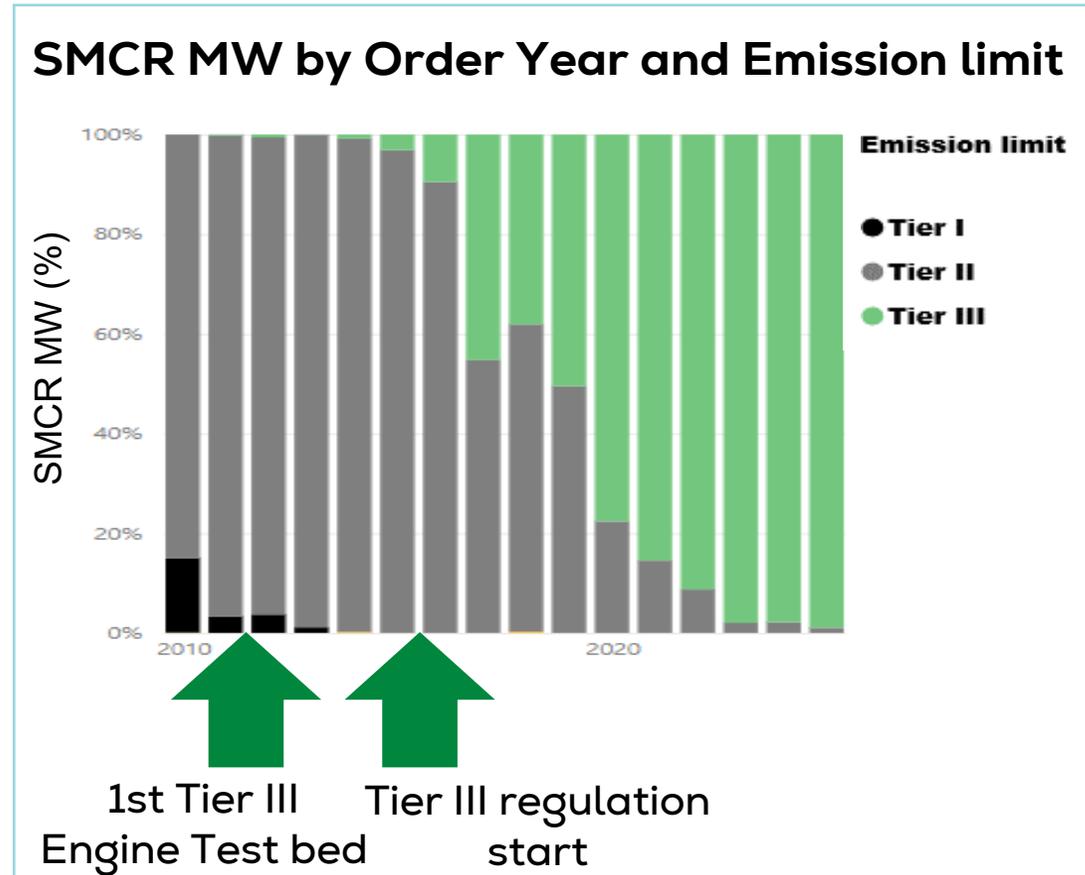
January 2026

Source: FRD/Everllence

Drivers for change

Public pressure + Regulation
+ Technology development

Market introduction: NOx reduction technology



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What is biofuel?

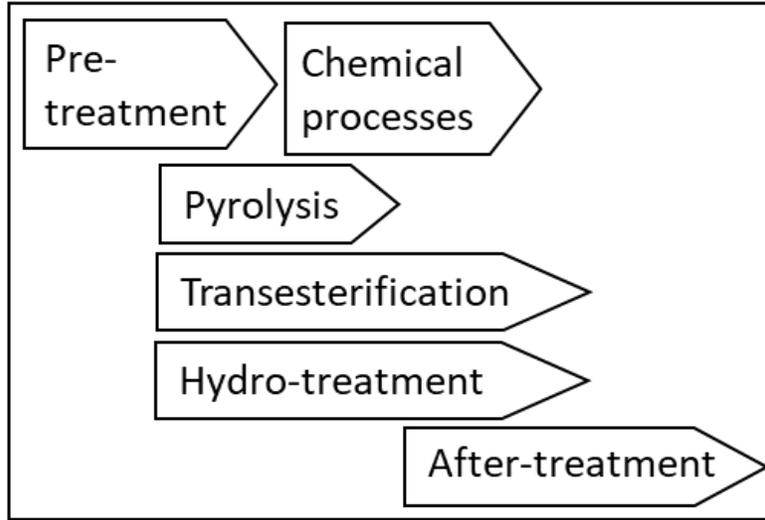
The biofuel era has begun

Important notes

- Differentiate between feedstock, production process and level of upgrading, and final product
- Clear and transparent communication is necessary

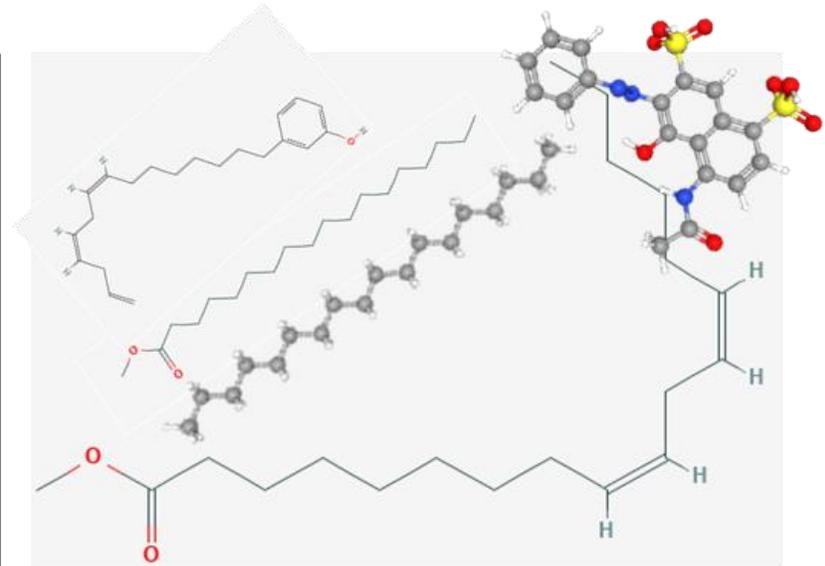


Feedstock



Production process

- Chemical processes
- Level of upgrading



Product

- Type of fuel, type of molecules
- FAME, HVO, pyrolysis oil, etc.

Biofuel types and blending ratios

Know what you bunker

Biofuels covered by ISO 8217:2024



- FAME (EN 14214, ASTM D6751)
- Hydrotreated vegetable oil (HVO)
- (0 to 100%) Blends of the above with ISO 8217 compliant distillate and residual fuel grades

Biofuels covered by Everllence SL2023-741



- FAME – up to 100%
- HVO – up to 100%
- Similar FAME-type fuels – up to 100%
 - E.g. “bottoms of FAME esterification” – certain conditions apply → SL2023-741
- Blends of the above with ISO 8217 compliant distillate or residual fuel grades

Other bio-components

- Distillation bottoms from FAME production (FDR)
- Cashew nutshell liquid (CNSL) – different qualities
- Pyrolysis oil – different qualities
- Straight / unprocessed waste and residue fats and oil

Biofuels for Everllence B&W two-stroke engines

SL2023-741 / Biofuel Operation



Technology	Biofuel			
	FAME	HVO	Similar FAME-type	Blends
Engine design: MC/MC-C, ME/ME-C, ME-B, ME-GI, ME-GIE, ME-LGIM, ME-LGIP, ME-GA and ME-LGIA	Acceptable ¹⁾	Acceptable ¹⁾	Acceptable ¹⁾	Acceptable ¹⁾
Tier III: EGR, Tier II: EcoEGR	Acceptable ¹⁾	Acceptable ¹⁾	Acceptable ¹⁾	Acceptable ¹⁾
Tier III: High pressure SCR ²⁾	Acceptable ¹⁾	Acceptable ¹⁾	Acceptable ¹⁾	Acceptable ¹⁾
Tier III: Low pressure SCR ^{2) 3)}	Acceptable ¹⁾	Acceptable ¹⁾	Acceptable ¹⁾	Acceptable ¹⁾
Pilot fuel for dual-fuel engines	Acceptable ¹⁾	Acceptable ¹⁾	Acceptable ¹⁾	Acceptable ¹⁾

1) Lifetime of components may be reduced.

2) Urea consumption may slightly increase due to potentially slightly increased NOx during biofuel operation.

3) LPSCR is only for max 0.10% S fuels.

Liquefied biogas (LBG) or Bio-LNG

A biofuel to engines capable of operating on LNG

Biogas

Feed stocks: organic waste, manure, etc.

Methane, CO₂, various impurities

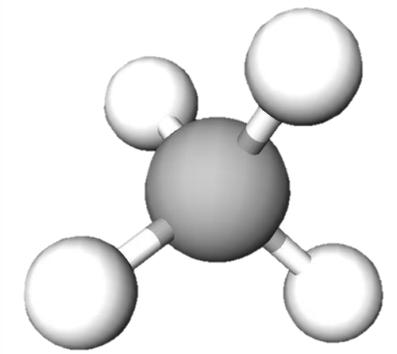
Low energy density due to CO₂ content,
Variable composition

Impurities damaging equipment

Main use: Electricity generation and heating



Purification
Cooling
Liquefaction



Liquefied biogas (LBG)

Impurities and CO₂ removed

Mainly methane - similar to LNG

Higher energy density

Less variation in composition

ISO 23306:2020 Specification of liquefied natural gas as a fuel for marine applications

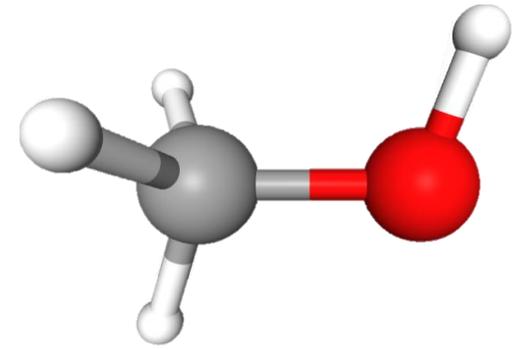


Feed stock agnostic

Bio-methanol

A biofuel to engines capable of operating on methanol

- Engines capable of operating on methanol from conventional sources as well as bio-methanol
- ISO 6583:2024 Methanol as a fuel for marine applications – General requirements and specifications
 - Feedstock and production agnostic



ISO 6583

First edition
2024-11

Methanol as a fuel for marine applications — General requirements and specifications



01 | 2025

CIMAC Guideline

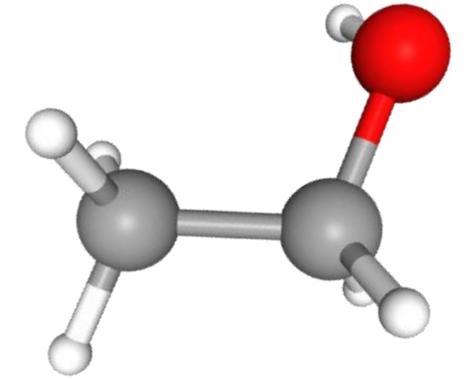
Frequently Asked Questions (FAQ)
ISO 6583:2024: Methanol as a fuel for marine applications – General requirements and specifications

Bio-ethanol

A biofuel to engines capable of operating on ethanol/methanol

ISO/TC 28/SC 4/ WG 18 "Specifications of alternative fuels for marine applications"

- Has started to investigate the qualities worldwide



Ethanol as fuel for LGIM/E engine

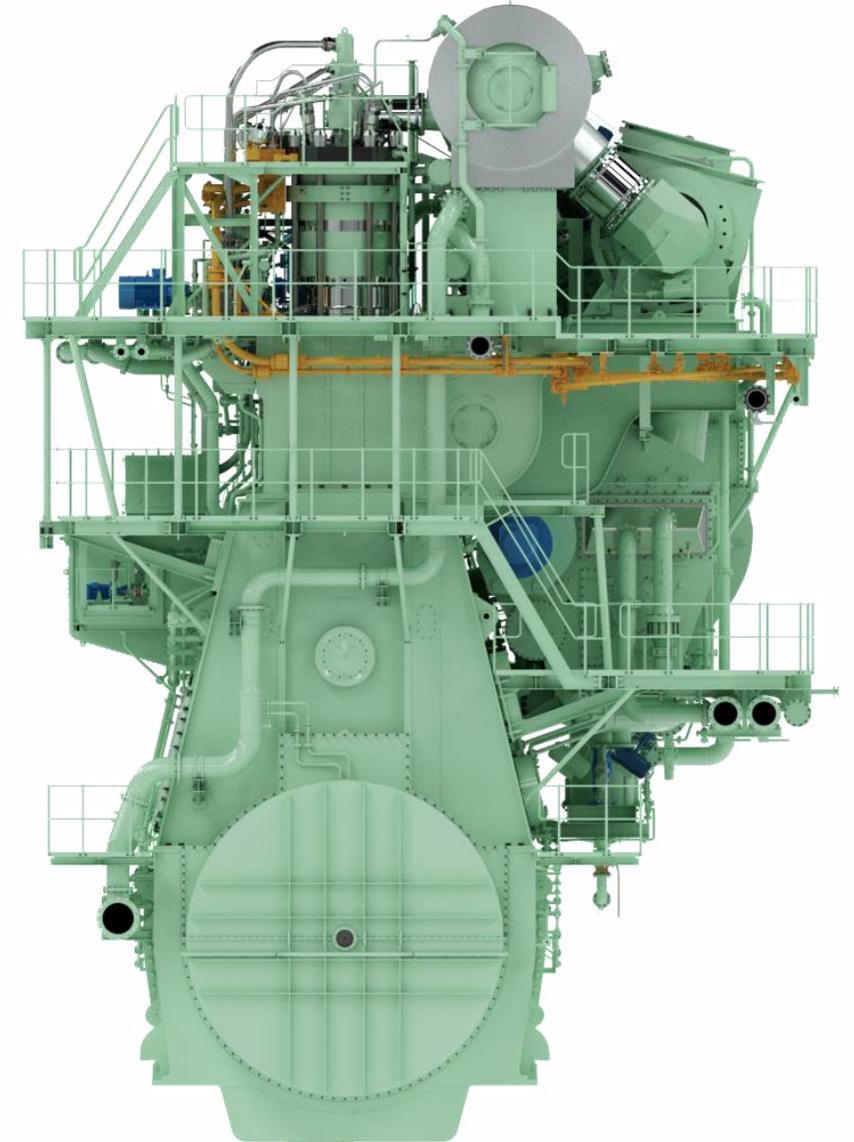
Ethanol vs Methanol

Current results

- ✓ Ethanol burns just as nice as Methanol
- ✓ The same LGIM system can be used
- ✓ NOx emission changes. It depends...
- ✓ Fuel consumption trends follow the expected trends regarding atomizer layout and engine tuning
- ✓ An LGIM engine can be optimized for Methanol **or** Ethanol

Next steps

- Future Alcohol grades can potentially have larger variability
 - What can be tolerated?
- Maintenance?
- Regulation?

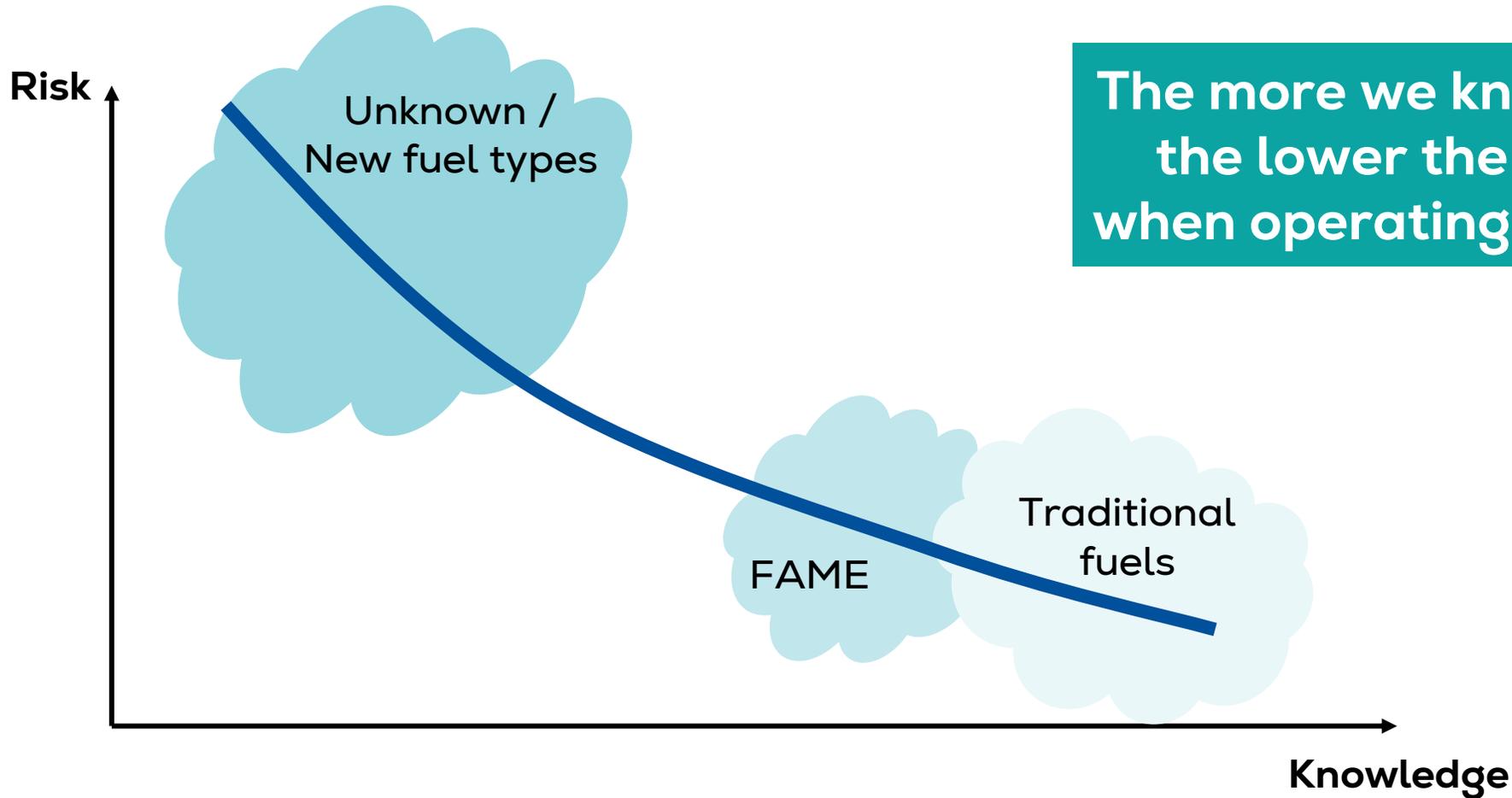


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How do we approach biofuel?

Fuel testing program

Risk based approach

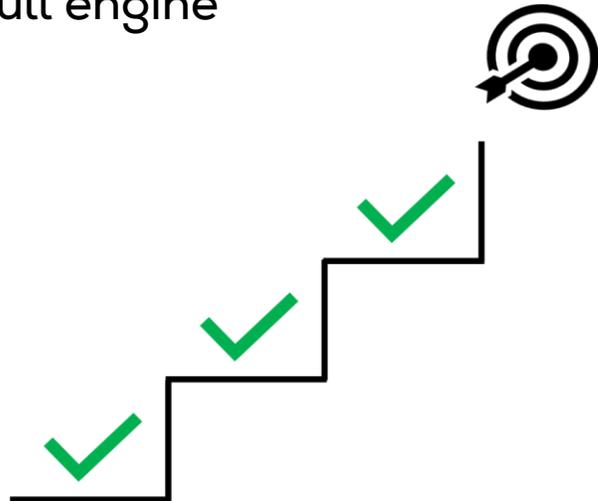


The more we know and learn, the lower the risk will be, when operating on a new fuel

Fuel testing program

Fuel testing program outline

1. Market evaluation
2. Fuel examination
3. Pump rig tests
4. Test engine (commonly land based)
5. Service test
 1. 1 cyl. / half engine?
 2. Full engine



Risk based approach:

- If the fuel is largely unknown or very different to known fuels:
 - Proceed with all 5 steps
- If the fuel is similar to known fuel types:
 - Skipping some steps can be discussed



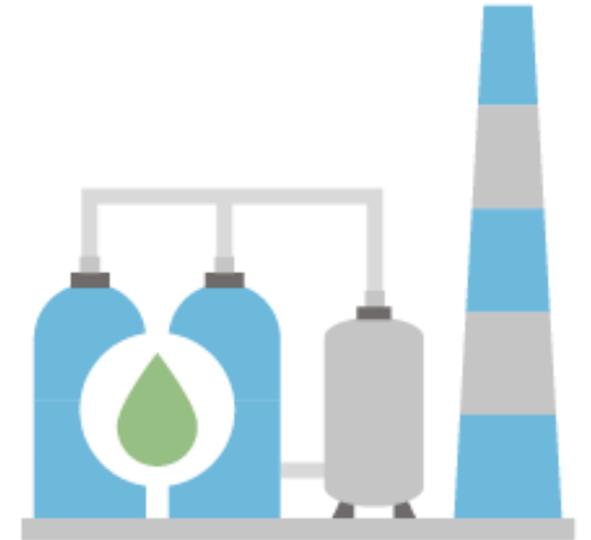
1. Market evaluation

Information required

- Technology readiness level of fuel production?
- Feedstock information? – incl. sustainability evaluation
- Production process info?
- Production Scalability, Amounts possible?
- Worldwide availability?
- Supply chain and Logistical information / challenges?
- Etc.

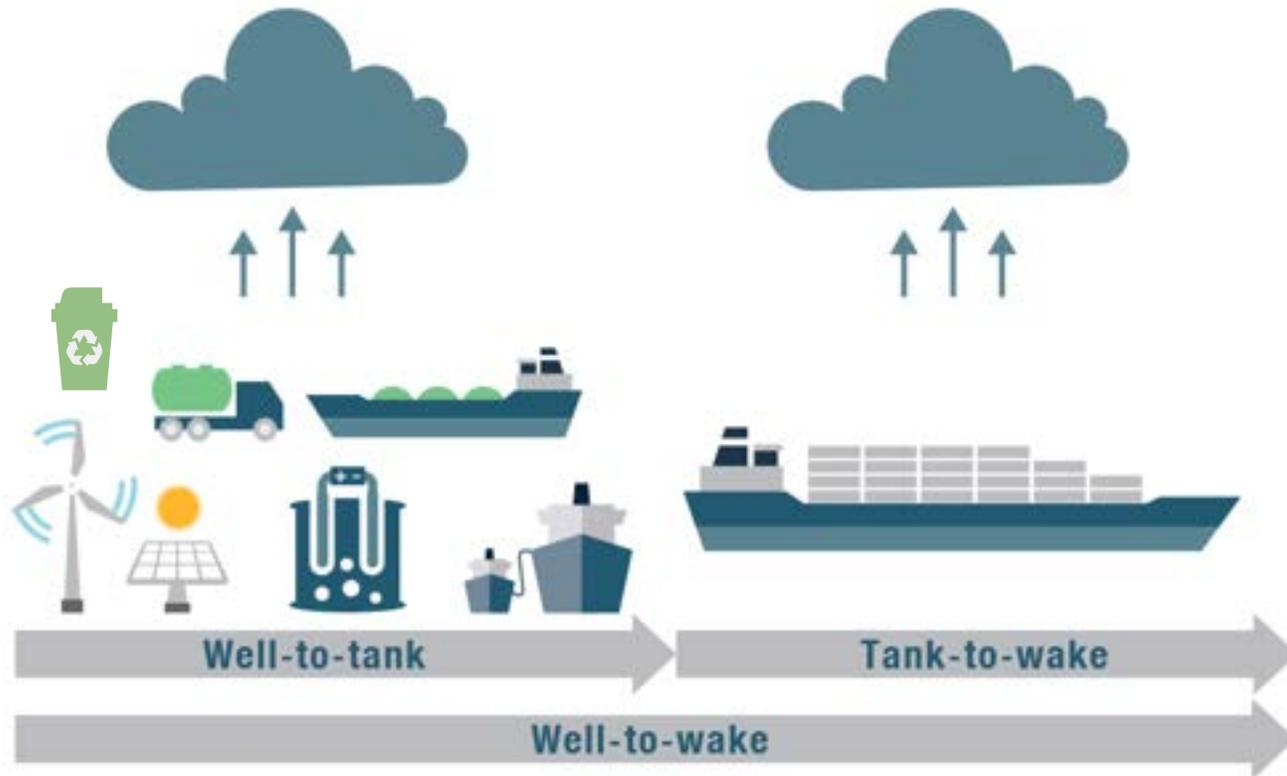
Time is limited

- Everllence will be hesitant to commit resources to evaluating commercially unviable products
- Sustainable fuels are weighted higher

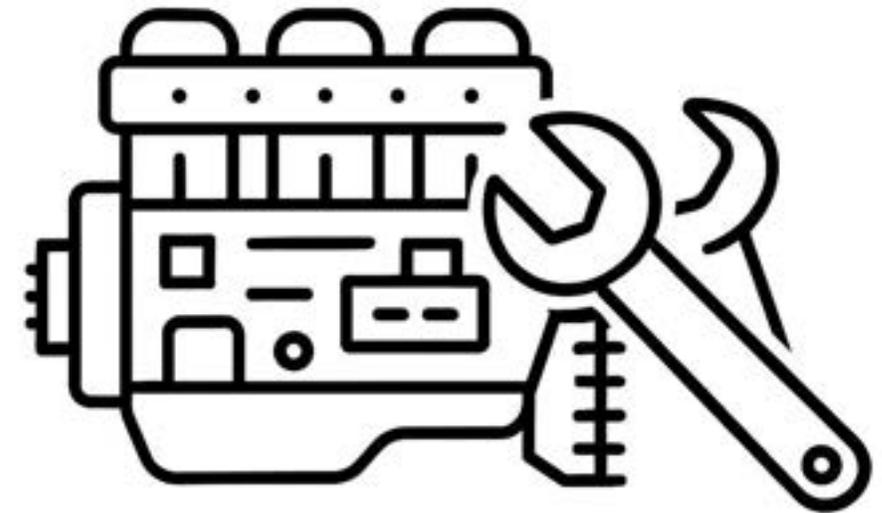


Fuel quality and sustainability

Fuel sustainability is important for the environment



Fuel quality is important for the equipment on board – and possibly the environment



Fuel quality matters

Marine engines are robust – but there are limits!

Chemical and physical properties of the fuel matter

- Chlorinated organic compounds in the fuel caused heavy corrosion damages in the fuel system onboard the ships
- The chlorinated organic compound case in 2022 resulted in an addition in ISO 8217:2024



ISO 8217:2024(en)

5.3 The fuel shall be free from inorganic acids and organic chlorides (chlorinated hydrocarbons).

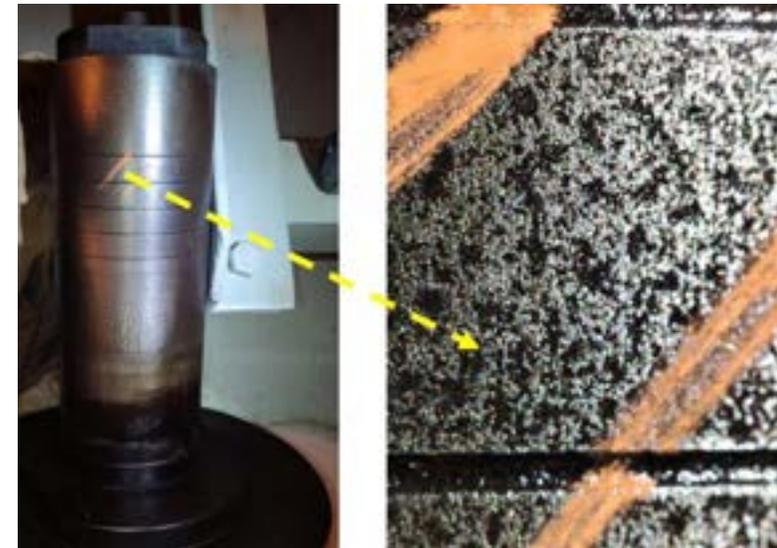
6.17 Organic chlorides

A fuel shall be considered to be free from organic chlorides (chlorinated hydrocarbons) when the total organic halogen content as chlorine is not exceeding 50 mg/kg when tested in accordance with EN 14077.



CIMAC WG 7 – statement: 2022 Organic chlorides, marine fuel incidents. October 2022

Damaged fuel equipment



Responsibilities and Actions: Biofuel in operation

We all have roles to play



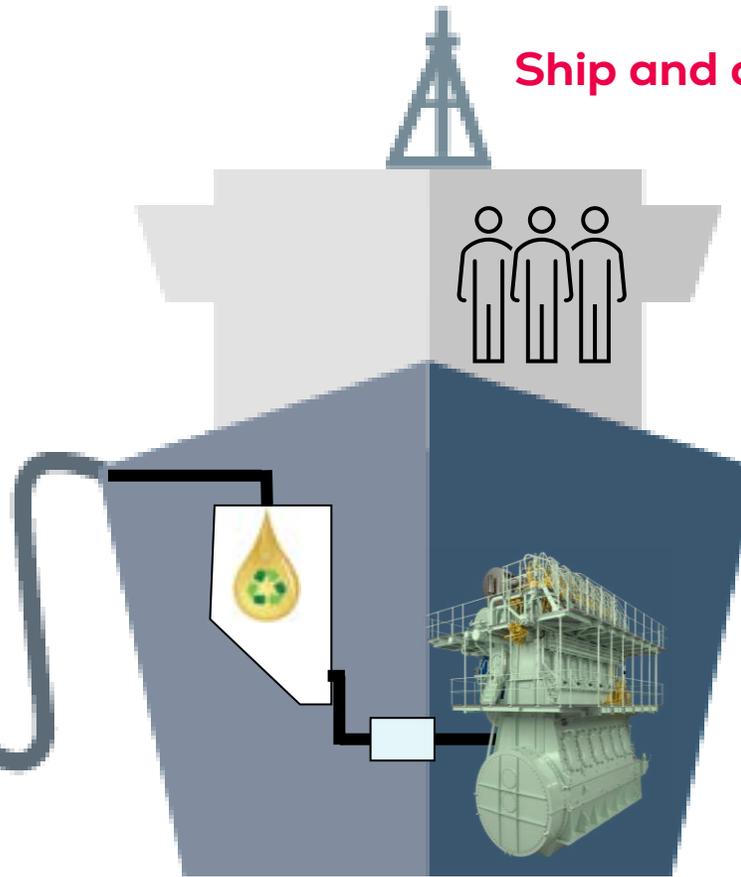
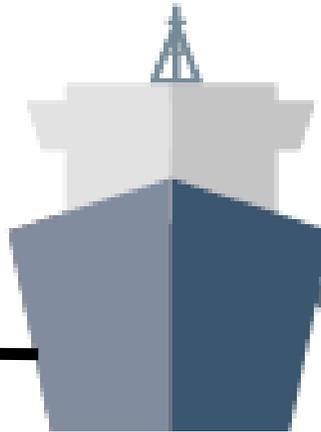
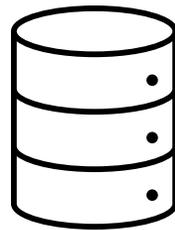
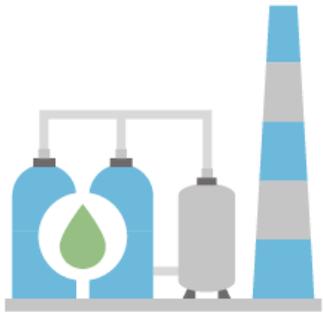
Fuel buyer



Onshore technical management



Fuel producer
Fuel seller



Ship and crew onboard

Engine

Biofuel operation in service – SL2023-741

Most operational recommendations are the same as for conventional fuels



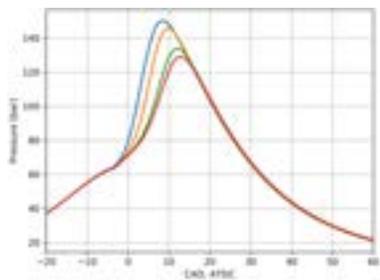
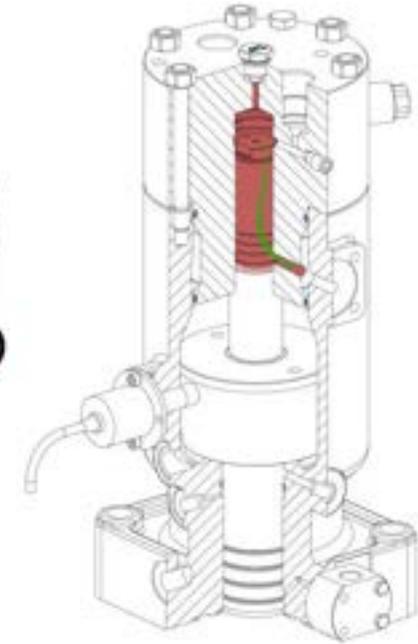
Cylinder condition



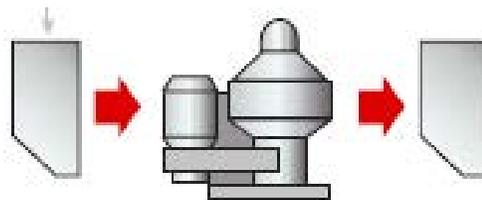
Fuel analysis



Viscosity, temperature, fuel system



Energy density / Performance



Fuel cleaning



Compatibility
Fuel management
Remove water

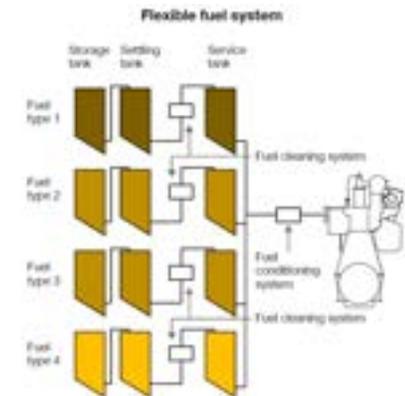


Figure 1: Schematic of a flexible fuel system

5 Regulatory clarity

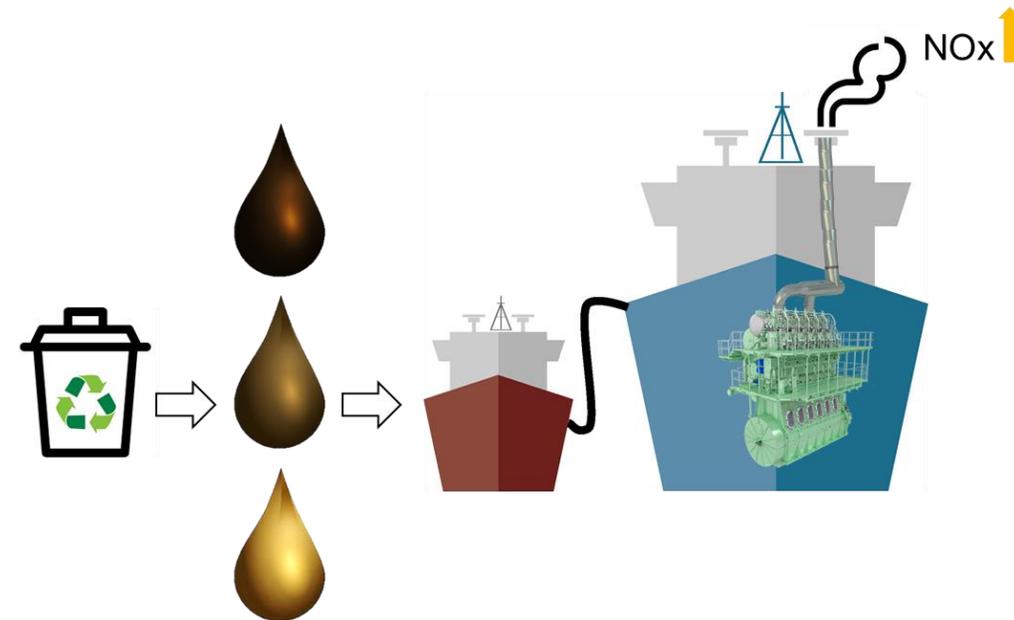
NOx compliance and Biofuel

Unified Interpretation MEPC.1/Circ.795/latest rev. and SL2023-741



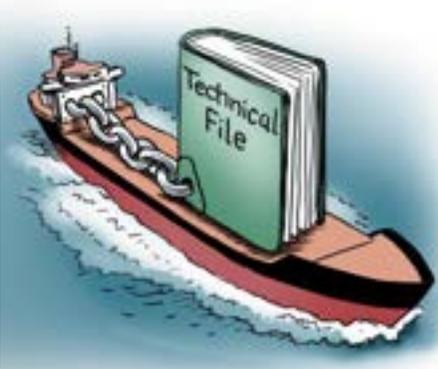
For Everllence B&W two-stroke engines operating on biofuels, up to 100% (B100), defined in SL2023-741, **changes** to NOx critical components or setting/operating values outside those given by the engine's approved Technical File **are not required**.

As always when changing fuel, it is the responsibility of the operator to ensure that the settings/operating values stated in the Technical File are fulfilled.



NOx compliance strategy

Parameter check method



NOx critical components

Operating values

Settings: NOx checksums

ID	Unit	Type	Min	Max	Current	Design	NOx Check	NOx Limit
0001	234	ADJ	0	360	4000	2700	0	0
AC01	235	ADJ	0	360	4000	2700	0	0
AC02	236	ADJ	0	360	4000	2700	0	0
0002	240	ADJ	0	511	7700	38000	38000	20070
0003	241	ADJ	0	511	7700	38000	38000	20070
0004	242	ADJ	0	511	7700	38000	38000	20070
0005	243	ADJ	0	511	7700	38000	38000	20070
0006	244	ADJ	0	511	7700	38000	38000	20070
0007	245	ADJ	0	511	7700	38000	38000	20070
0008	246	ADJ	0	511	7700	38000	38000	20070
0009	247	ADJ	0	511	7700	38000	38000	20070
0010	248	ADJ	0	511	7700	38000	38000	20070
0011	249	ADJ	0	511	7700	38000	38000	20070
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0013	251	ADJ	0	511	7700	38000	38000	20070
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0015	253	ADJ	0	511	7700	38000	38000	20070
0016	254	ADJ	0	511	7700	38000	38000	20070
0017	255	ADJ	0	511	7700	38000	38000	20070
0018	256	ADJ	0	511	7700	38000	38000	20070
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0066	304	ADJ	0	511	7700	38000	38000	20070
0067	305	ADJ	0	511	7700	38000	38000	20070
0068	306	ADJ	0	511	7700	38000	38000	20070
0069	307	ADJ	0	511	7700	38000	38000	20070
0070	308	ADJ	0	511	7700	38000	38000	20070
0071	309	ADJ	0	511	7700	38000	38000	20070
0072	310	ADJ	0	511	7700	38000	38000	20070
0073	311	ADJ	0	511	7700	38000	38000	20070
0074	312	ADJ	0	511	7700	38000	38000	20070
0075	313	ADJ	0	511	7700	38000	38000	20070
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0077	315	ADJ	0	511	7700	38000	38000	20070
0078	316	ADJ	0	511	7700	38000	38000	20070
0079	317	ADJ	0	511	7700	38000	38000	20070
0080	318	ADJ	0	511	7700	38000	38000	20070
0081	319	ADJ	0	511	7700	38000	38000	20070
0082	320	ADJ	0	511	7700	38000	38000	20070
0083	321	ADJ	0	511	7700	38000	38000	20070
0084	322	ADJ	0	511	7700	38000	38000	20070
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0086	324	ADJ	0	511	7700	38000	38000	20070
0087	325	ADJ	0	511	7700	38000	38000	20070
0088	326	ADJ	0	511	7700	38000	38000	20070
0089	327	ADJ	0	511	7700	38000	38000	20070
0090	328	ADJ	0	511	7700	38000	38000	20070
0091	329	ADJ	0	511	7700	38000	38000	20070
0092	330	ADJ	0	511	7700	38000	38000	20070
0093	331	ADJ	0	511	7700	38000	38000	20070
0094	332	ADJ	0	511	7700	38000	38000	20070
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0096	334	ADJ	0	511	7700	38000	38000	20070
0097	335	ADJ	0	511	7700	38000	38000	20070
0098	336	ADJ	0	511	7700	38000	38000	20070
0099	337	ADJ	0	511	7700	38000	38000	20070
0100	338	ADJ	0	511	7700	38000	38000	20070

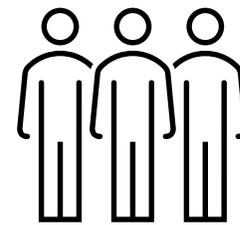
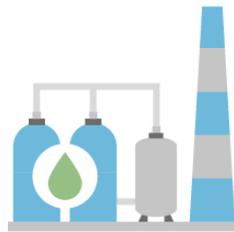
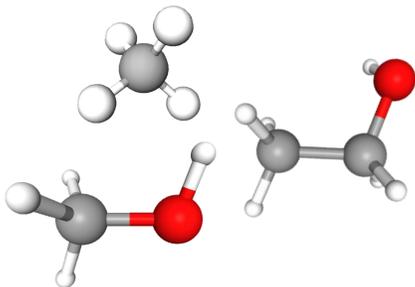
6 Sum up



Sum up

Biofuels in Everllence B&W two-stroke engines

- **Biofuel – as fuel oil** – is already in the market
 - The accepted qualities can be used with attention and care → SL2023-741
- Other biofuels are emerging: **Bio-methanol**, bio-gas (as **LBG**), **bio-ethanol** (when the engine is ready)
- **Fuel quality** is important for the engine and equipment on board
- **Fuel sustainability** is relevant for the environment
- **Regulation** should be clear to support a level playing field
 - Regulation is necessary to support market uptake
- **We** all have our roles and responsibilities



Disclaimer

All data provided in this document is non-binding. This data serves informational purposes only and is especially not guaranteed in any way. Depending on the subsequent specific individual projects, the relevant data may be subject to changes and will be assessed and determined individually for each project.

This will depend on the particular characteristics of each individual project, especially specific site and operational conditions.



Thank you!
Questions?

Dorthe Jacobsen