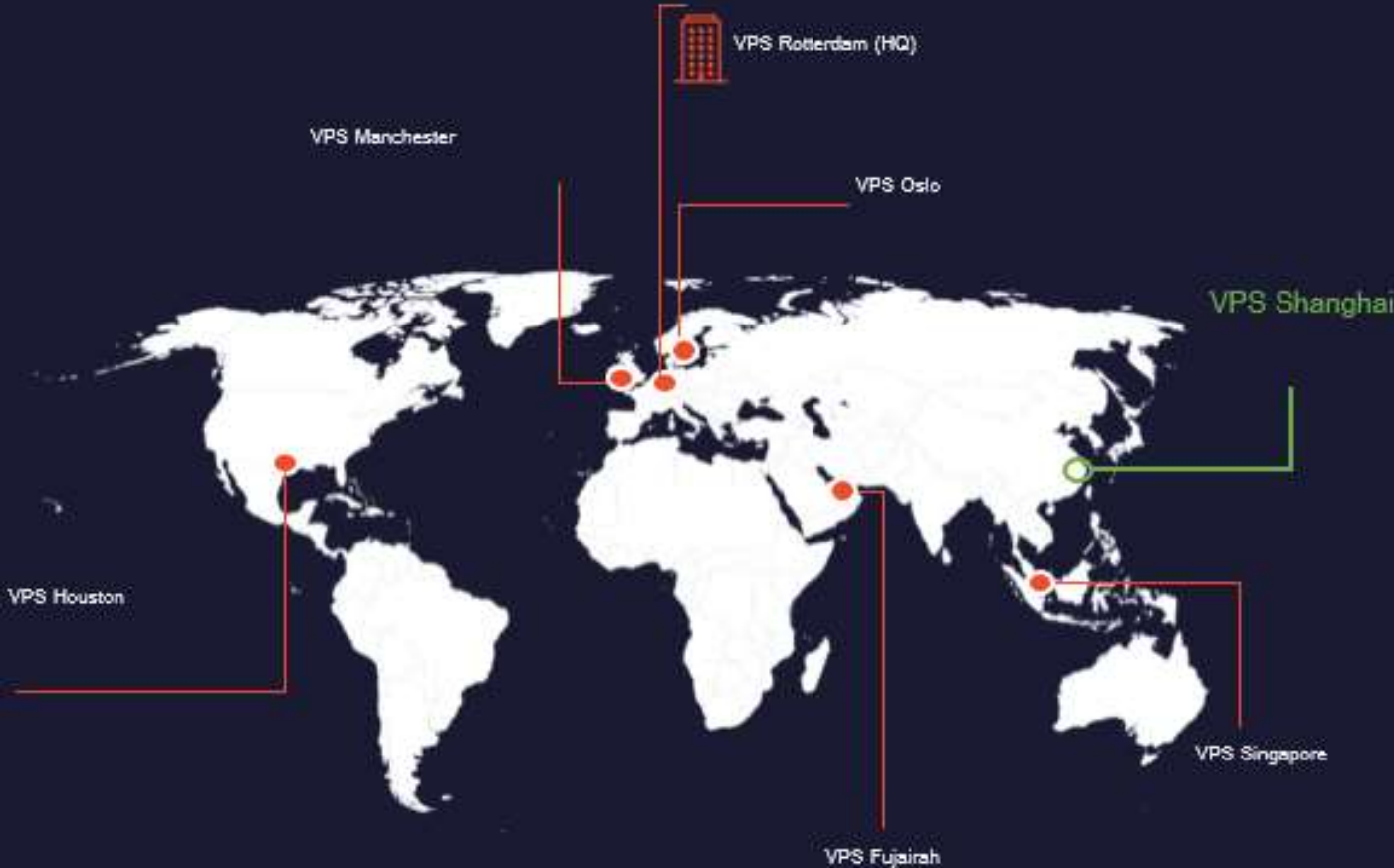




How fingerprinting guards the fuel quality by tracking fuel traceability



Li Ting
General Manager, VPS China

Shipping Decarbonization Forum, 20 May 2026



VERITAS FUEL QUALITY TESTING

Report from vessel

Vessel's name **M/S "MOSBROOK"**

Owner **a/s Mosvold rederi Farsund.**

Bunkering port **Bremerhaven.**

Bunkering date **18** DAY | **11** MONTH | **80** YEAR

Fuel Supplier **BP marine international**

Name of Barge or Pier **BLEXEN**

Sampling place and method **From supplier.**

Sample drawn date **18** DAY | **11** MONTH | **80** YEAR
1200 m/tons.

Amount bunkered

PROBLEMS ASSOCIATED WITH PREVIOUS FUEL
Bunkered **18** DAY | **11** MONTH | **80** YEAR in **Bremerhaven**

DIESEL PROPULSION

- No problems have been noted
- Problems with h.p. fuel pumps and injectors
- Problems with purification, filter clogging, etc.
- Problems with high cylinder and piston ring wear
- Problems with cylinder and exhaust system fouling
- Problems with loss of engine speed
- Other problems

Fuel parameters	Bunker receipt date
Spec. gravity, 15°C	0.95
Viscosity, Cst at 50°	180
Water content %	
Concentration Carbon Res. %	
Sulphur %	
Ash %	
Vanadium ppm	
Aluminum ppm	
Compatible with MDO?	
Calc. lower heating value MJ/kg	
Asphaltenes %	
Hot filter sediment %	
Sodium ppm	
Silicon ppm	
Heating value, MJ/kg	
Light end fractions, 180-300°C	
Interm. end fractions, 300-450°C	
Heavy end fractions, 450-550°C	
Heavy molecules > 550-2000	

VERITAS FUEL QUALITY TESTING

ENGINE **A/S Mosvold**

Capacity **12000**

CLASSIFICATION

LABORATORY

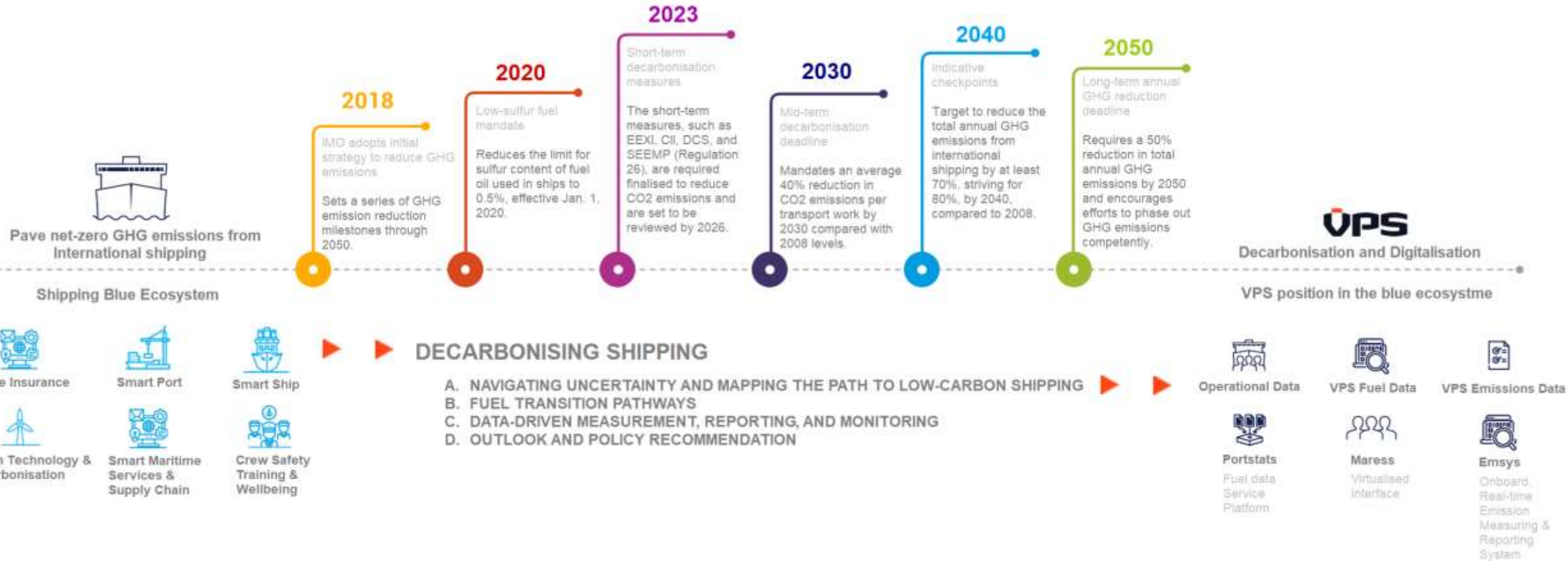
Slow steaming? **75** % of time

Date **18** | **11** | **80**



M.S. MOSBROOK

VPS D&D | VPS into Decarbonisation and Digitalisation Ecosystem



Mission Innovation - Towards A Zero-Emission Shipping - Clean Future
 Revised GHG reduction strategy for global shipping adopted (imo.org)
 Review of Maritime Transport 2023 | UNCTAD

VPS Readiness | Facts Over Forecasts

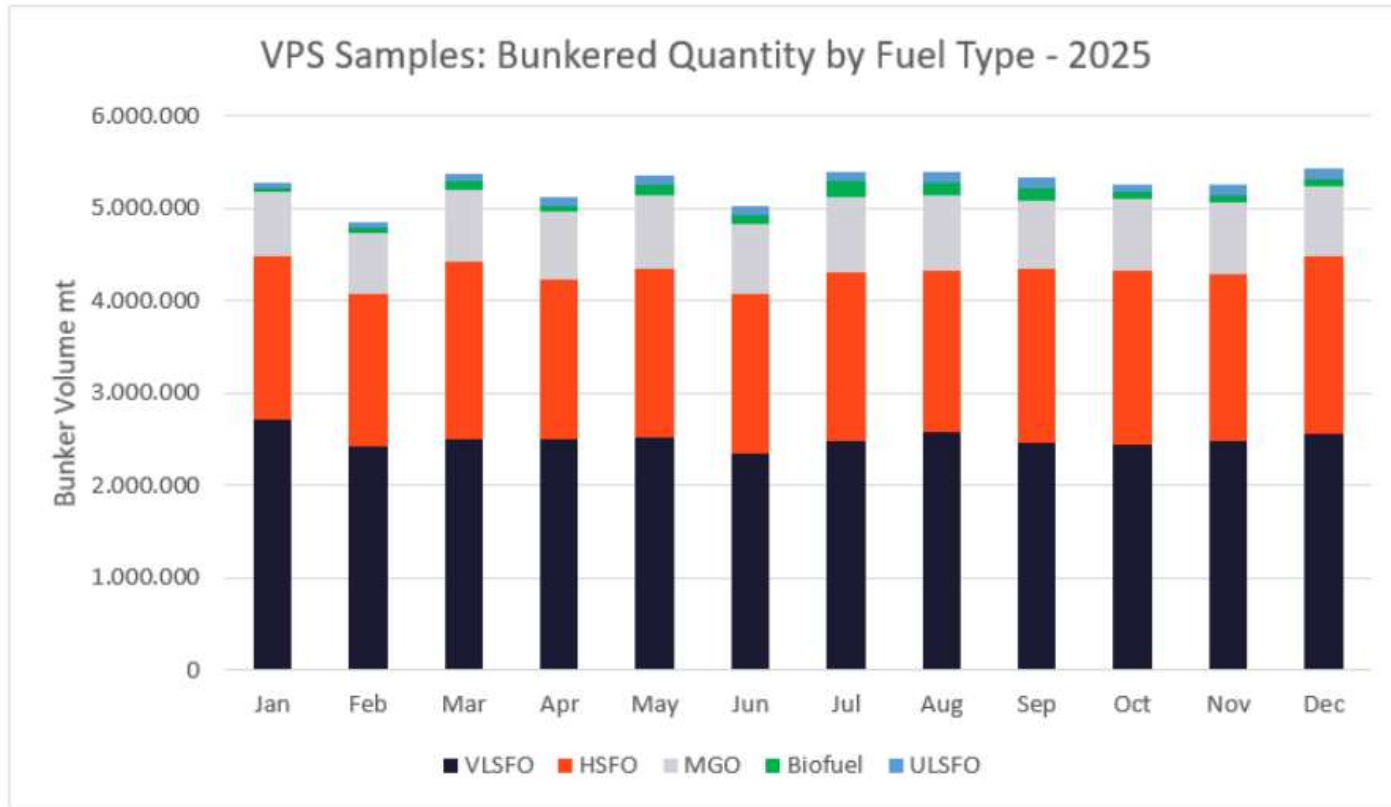


Figure 1: VPS Samples - Bunkered Quantity by Fuel Type

The future of shipping's decarbonisation is uncertain, no one can predict which fuel or technology will dominate. But what we can do is focus on what we know today: real data, proven solutions, and measurable progress. At VPS, we believe in building the future on facts, not forecasts.

VPS 2025/26 Outlook | Fuel options, drop-in flexibility & engine compatibility

Fuel / Energy Carrier	Typical Engine Type(s)	Drop-in Flexibility	Main Technical Requirements	Current Maturity
DROP-IN / BLEND-COMPATIBLE				
VLSFO / MGO	Conventional 2-/4-stroke diesel	100%	None — standard system	Fully commercial
Biofuel (FAME B20–B30)	Diesel / dual-fuel engines	Up to 100% (typ. ≤ B30)	Stability control, microbial & water management, oxidation resistance	Commercially available
HVO	Diesel / dual-fuel	High (up to 100%)	None — true drop-in; supply-constrained	Commercial / growing supply
Bio-LNG	Dual-fuel LNG engines	High (0–100%)	ISCC mass-balance certification, same handling as LNG	Limited but emerging
Bio- / E-Methanol	Methanol-ready dual-fuel	High (with fossil MeOH)	ISCC / RED II certification, tank coating	Pilot–commercial
E-Diesel / Synth. Diesel	Any diesel engine	High (drop-in)	Certification, cost (5–10x fossil MGO today)	Early pilot scale
NON-DROP-IN / NEW FUEL SYSTEMS				
LNG	Dual-fuel (Otto & Diesel cycle)	Fixed (not drop-in)	Cryogenic tanks, gas handling, methane slip control	Mature (global bunkering)
Methanol	MAN B&W LGIM, Wärtsilä 32M/20M	Low (dedicated system)	Low-flash-point design, stainless/PTFE materials, gas detection	Commercial (200+ vessels)
Ethanol	Wärtsilä 32 (demo 2024); LGI-type architecture	Low (alcohol fuel)	Same fuel-system architecture as methanol (per Wärtsilä); SCR for Tier III; LHV ~26.9 MJ/kg vs 19.9 for MeOH	Early commercial
Ammonia	WinGD X-DF-A, Everllence ME-LGIA, Wärtsilä 25 NH ₃	None	Toxic — leak detection & venting; ~5% pilot fuel; SCR for NO _x , separate catalyst for N ₂ O; double-walled piping	First deliveries Q4 2025–Q1 2026
Hydrogen (ICE)	MAN D2862 H ₂ , Kawasaki, Yanmar; J-ENG 2-stroke 2026	None	Compressed (350/700 bar) or cryogenic (–253°C) storage; low volumetric density; IGF risk-based design	Early commercial (small vessels)
Hydrogen (Fuel Cell)	PEM / SOFC fuel-cell systems	None	Cryogenic/pressurised storage, electrical integration, balance-of-plant	Demo / early pilot
LPG	Dual-fuel LPG (MAN ME-LGIP)	Moderate	Pressurised tanks, vaporisers	Commercial niche

Sources: ISO 8217:2024 · CIMAC WG7 (2024) · IMO IGF Code & MSC.1/Circ.1621 · MAN Energy Solutions / Everllence · WinGD · Wärtsilä · DNV Alternative Fuels Insight 2025 · Bureau Veritas · Riviera Maritime Media.

VPS 2025/26 Outlook | Biofuels

Biofuels are liquid fuels converted from biologically renewable resources such as crops, animal fats and biodegradable waste and as such are considered to be more sustainable than conventional fossil fuels

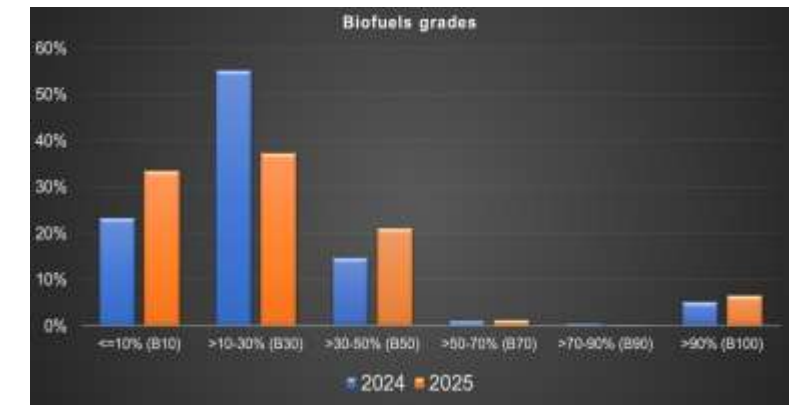
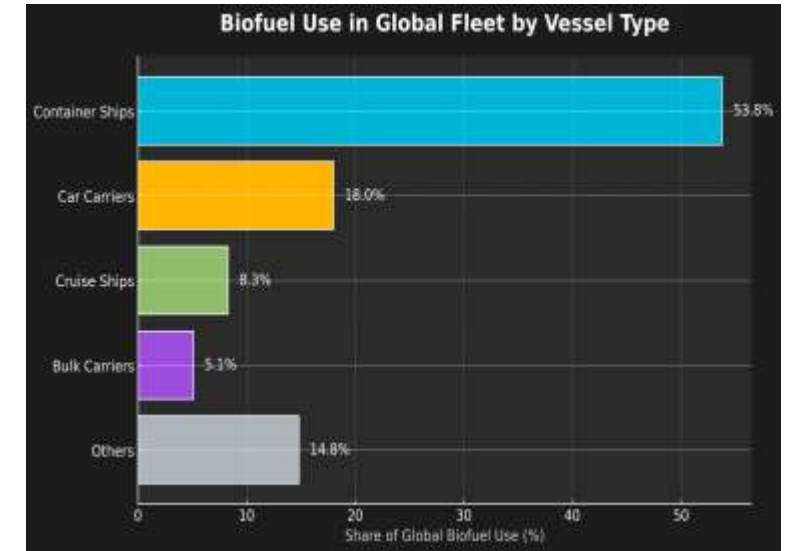
Different production processes have been developed over the past few years:

- ▶ 1st Generation – Made from food crops, Typical CO2 reduction 36-62%
- ▶ 2nd Generation – Made from Waste, Typical CO2 reduction 88%
- ▶ 3rd Generation – Made from microorganisms (e.g. algae), Typical CO2 reduction 75-90%
- ▶ 4th Generation – Made from genetically modified microorganisms (e.g. algae), Under development

A range of different types of biofuels currently exist, and this list is growing rapidly:

- ▶ Fatty Acid Methyl Esters (FAME) – most common type of biofuel
- ▶ Hydrogenated Vegetable Oils (HVO)
- ▶ Hydro-processed Esters and Fatty Acids (HEFA)
- ▶ Cashew Nut-Shell Liquid (CNSL)
- ▶ Tyre Pyrolysis Oil (TPO)

There is a risk of unsustainable production of biofuels. Traceability of biofuels is very important to ensure the authenticity of sustainable biofuels and to prevent their adulteration.



VPS 2025/26 Outlook | Biofuels (FAME / HVO) – Pros & Cons

VPS tested samples representing 71,000mt of bunkered biofuel in 2021 compared to over 1,000,000mt of delivered biofuels in 2025 - **an increase by a factor of 12 over 4 years.**

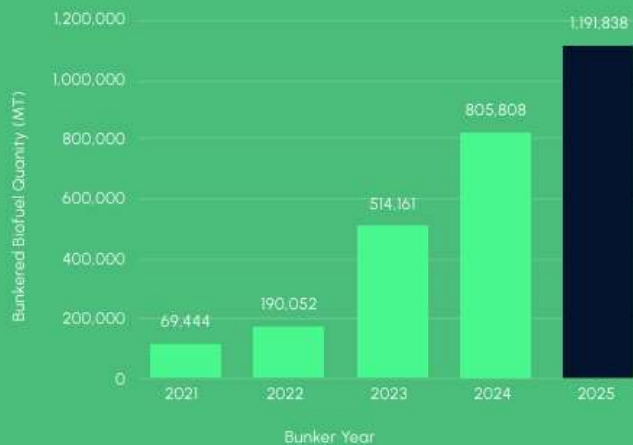
Advantages

- ✓ **Immediate decarbonisation impact:** Up to 80–90 % lifecycle CO₂ reduction when ISCC/RSB certified.
- ✓ **Drop-in potential:** HVO 100 % compatible with existing diesel systems; FAME blends up to B100 possible under OEM approval.
- ✓ **Safe handling:** Flashpoint > 60 °C, no cryogenic or gas-handling risks.
- ✓ **Proven technology:** Used in pilot projects across offshore, ferry, and short-sea segments.
- ✓ **Positive ETS / FuelEU accounting:** Certified GHG intensity directly reduces compliance exposure

Challenges

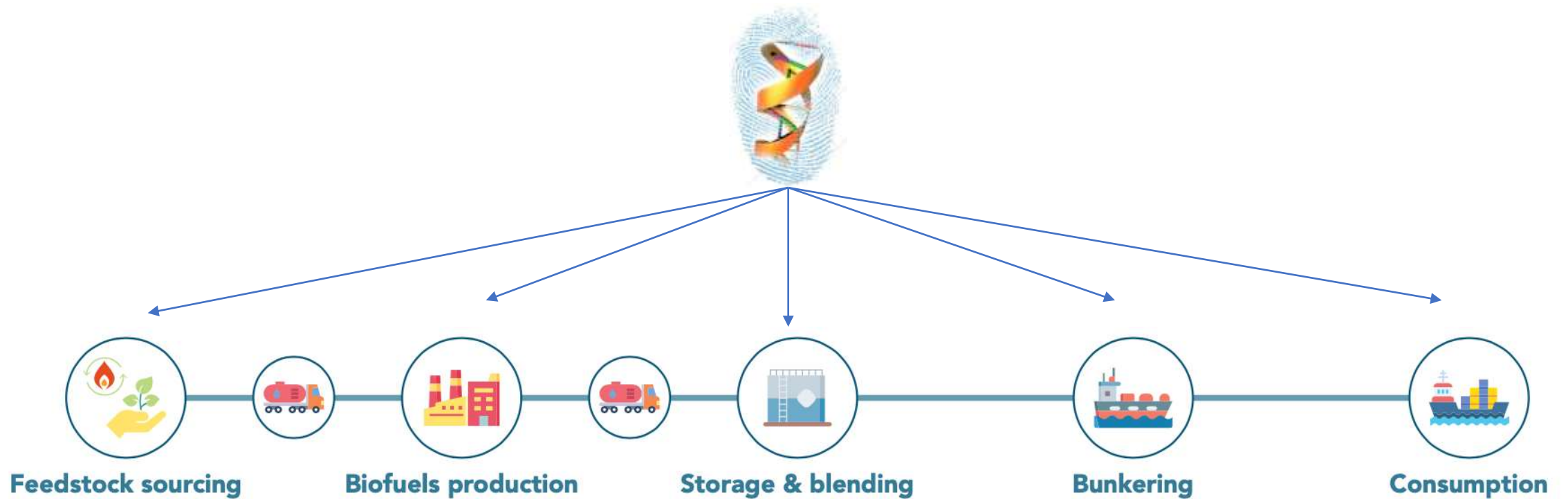
- ✓ **Fuel stability:** FAME oxidises and absorbs water → risk of filter clogging, corrosion, microbial growth.
- ✓ **Cold-flow performance:** High cloud and pour points limit Arctic or seasonal operation.
- ✓ **Supply consistency:** Feedstock and certification traceability vary regionally.
- ✓ **Cost and availability:** Premium vs fossil fuels; limited large-scale marine supply.
- ✓ **Standardisation:** ISO 8217:2024 now allows up to 100 % FAME, but operational best practice still evolving.

Figure 2: VPS Tested Biofuel Volumes: Bunkered Quantity (MT) | Biofuels | 2021 - 2025



Included with permission of VPS

Fingerprinting guards the fuel quality by tracking fuel traceability



[Global Centre for Maritime Decarbonisation \(2025\). "Tracers for biofuels authentication: Evaluating the efficacy of tracer technologies in marine fuel supply chains"](#)

Fingerprinting guards the fuel quality by tracking fuel traceability



Fingerprinting provides a solution to these concerns by offering a tool to detect fraud in the marine fuel supply chain. This technique ensures the authenticity of marine fuels, providing physical validation that complements existing certification schemes.

Fingerprinting - Marine Fuel

Trace the fuel quality stock

ISO8217 Parameters

Such as: Sulphur, Density, MCR, Elements, etc

Fuel Type: HSFO, LSFO, ULSFO, MGO, Biofuels, etc

FAME Fingerprinting is based on the principle that the fatty acid profile of FAME is unique to its feedstock and can be preserved during feedstock transesterification. The unique chemical signature, or "fingerprint," of FAME can be compared against a database of known fatty acid profiles to identify the feedstock origin.

To address the lack of an established method, VPS and GCMD co-developed an analytical method based on EN 14103 to facilitate the acquisition of FAME fingerprints.

FAME Fingerprinting - Biofuel

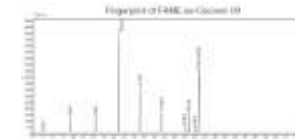
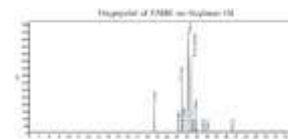
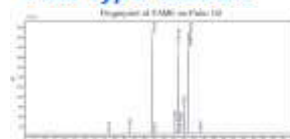
Distinguish the source of FAME

Each source of FAME gives a different GC traces

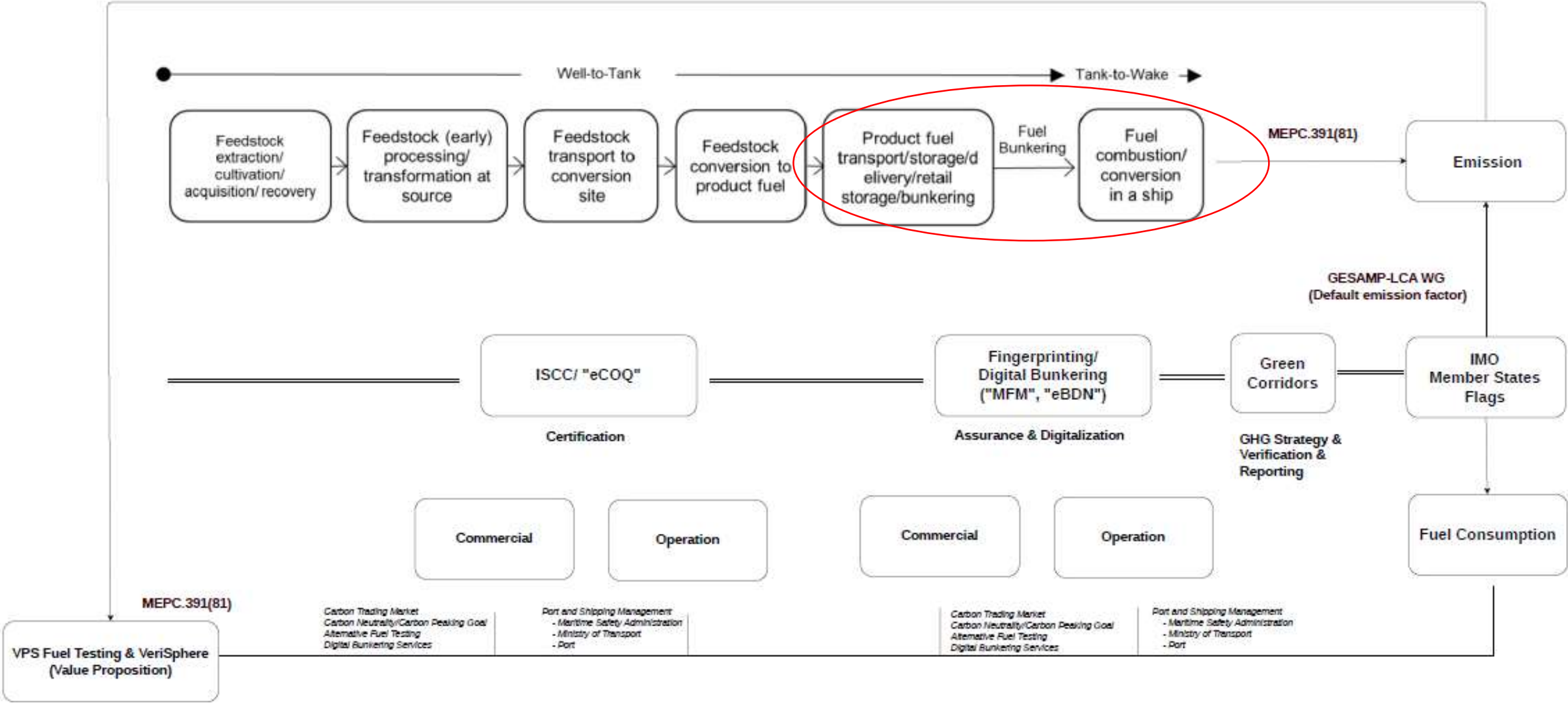
Analytical method based on EN 14103 to facilitate the acquisition of FAME fingerprints.

- Varying peaks displaying different carbon chain length esters
- The variation will impact on the performance of the FAME

Fuel Type: Biofuels



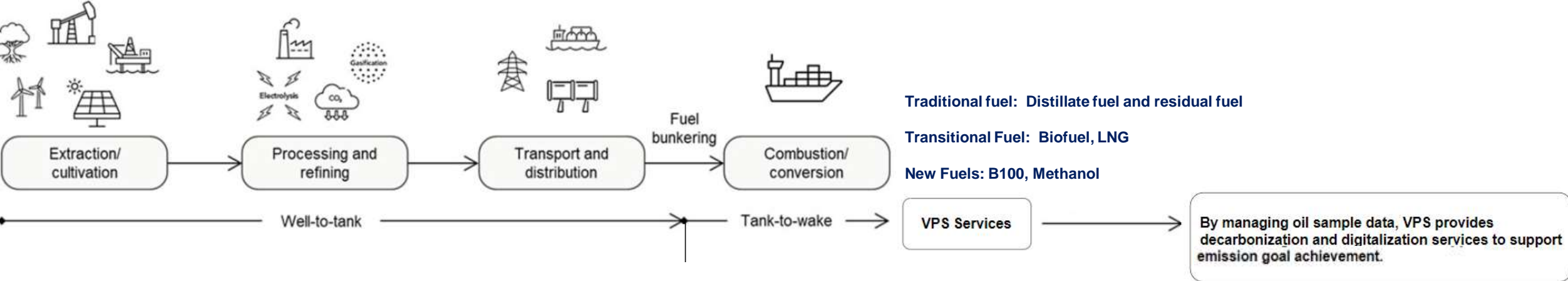
How fingerprinting supports LCA



Source MEPC 81.

How fingerprinting supports end-to-end supply chain visibility

Generic well-to-wake supply chain



Data Assurance:

- Relevance
- Adequacy
- Completeness
- Consistency
- Reliability
- Transparency
- Accessibility

RESOLUTION MEPC.391(81) (adopted on 22 March 2024)
2024 GUIDELINES ON LIFE CYCLE GHG INTENSITY OF MARINE FUELS
(2024 LCA GUIDELINES)

MEPC 81/16/Add.1
Annex 10, page 62

MAIN RESULTS

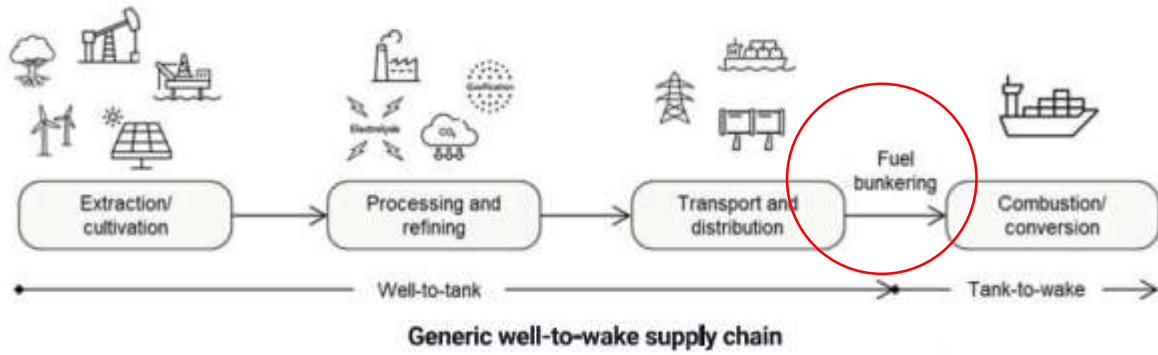
10 This section should present the results of the modelled pathway.

Table 5: Fuel identification

Fuel Pathway Code	LCV (MJ/g)	Density (kg/m ³)	C _{fCO2} (gCO _{2eq} /MJ)	Carbon Content (wt%)

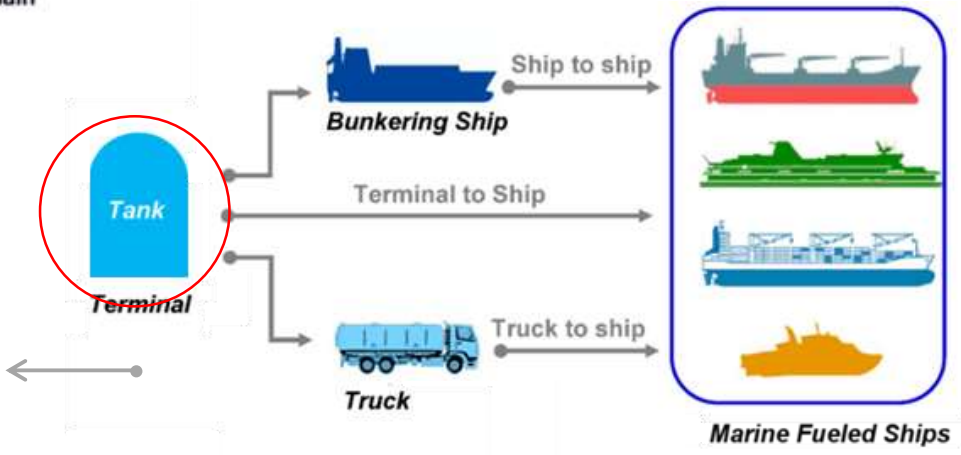


Standard Sampling for reliability and transparency



BQS - Tank Sampling

- Ideally, to evaluate the quality of fuel stored in a tank, the following samples should be obtained:
- Top sample - taken at approximately 6 inches below the surface of the oil.
 - Upper sample - taken from the middle of the upper one-third of the tank's contents.
 - Middle sample - taken from the middle of the tank's contents.
 - Lower sample - taken from the middle of the lower one-third of the tank's contents.
 - Bottom sample - taken from the bottom surface of the tank.



BQS - Transfer Pump Samples BQS shipping bunkering sample



Figure 1. Schematic representation of the different bunkering methods

How fingerprinting being supported with D&D solutions

Maritime Digitalization Platform

- VPS VeriSphere



Green Shipping Services

- Global and domestic shipping testing and survey
- Offshore emission management tool
- Carbon emission/ taxation/ ESG support



VPS VeriSphere Portal - Marketplace

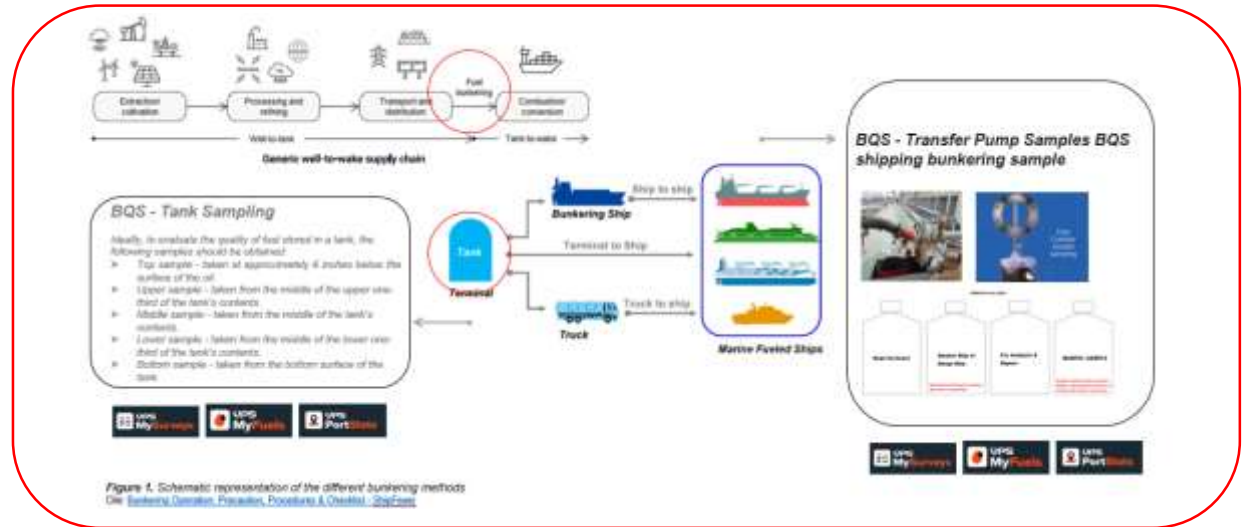


Figure 1. Schematic representation of the different bunkering methods
 Cite: [Bunkering Operation, Procedures & Checklist - Ship Crew](#)

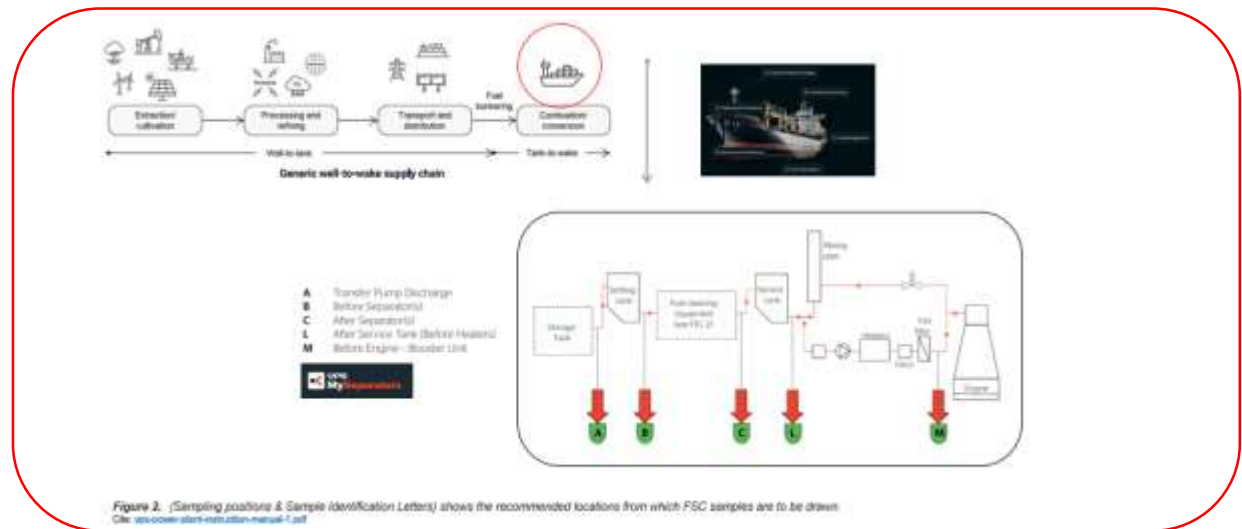
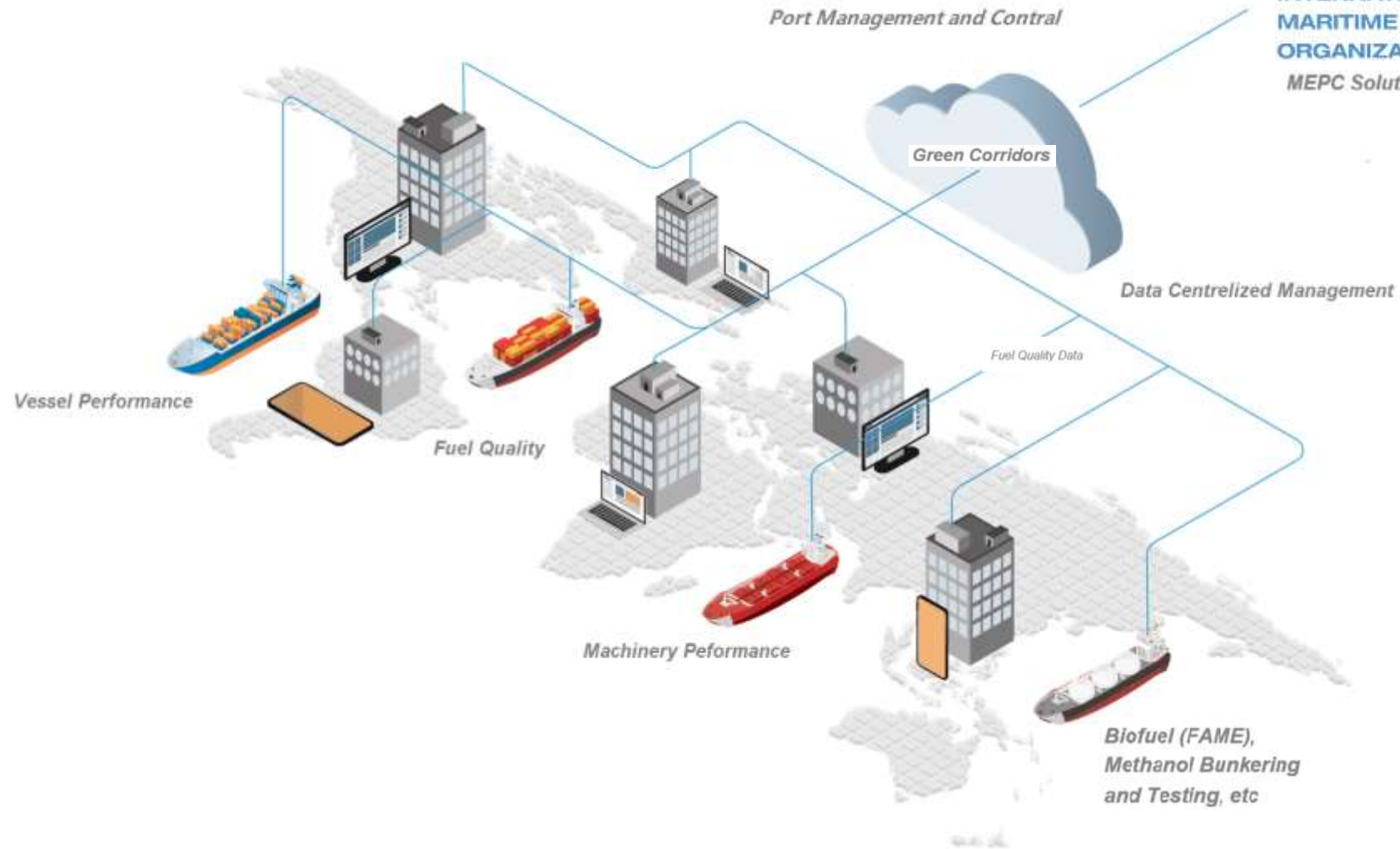


Figure 2. (Sampling position & Sample identification Letters) shows the recommended locations from which FSC samples are to be drawn
 Cite: [vps-overview-own-ship-manual-7.pdf](#)

VPS Value Proposition | Support Green Corridors





Thanks

Li Ting

[Email: Ting.li@v-p-s.com](mailto:Ting.li@v-p-s.com)
[Website: Home | VPS](#)



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