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Certifying Carbon Integrity:
How IMO LCA, Global Schemes and Physical Assurance Converge for Marine Biofuels & E-Fuels

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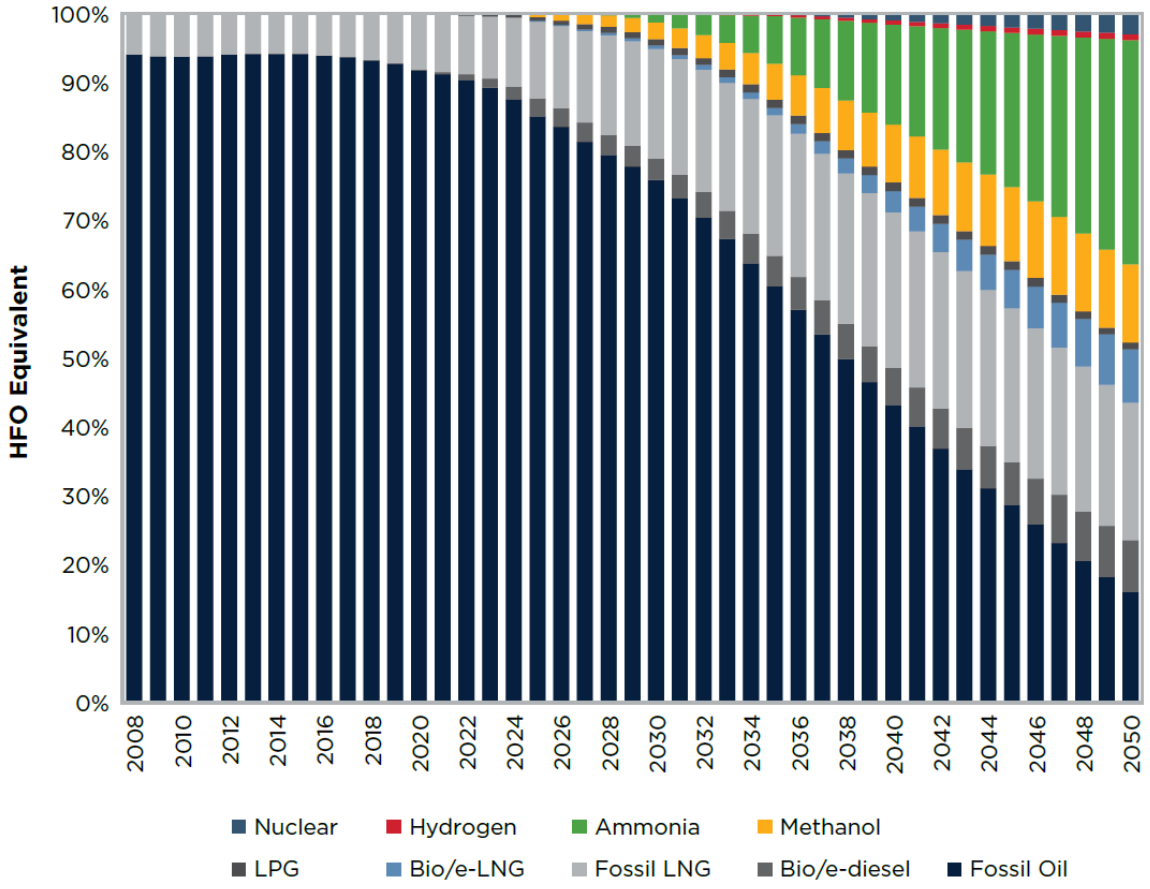
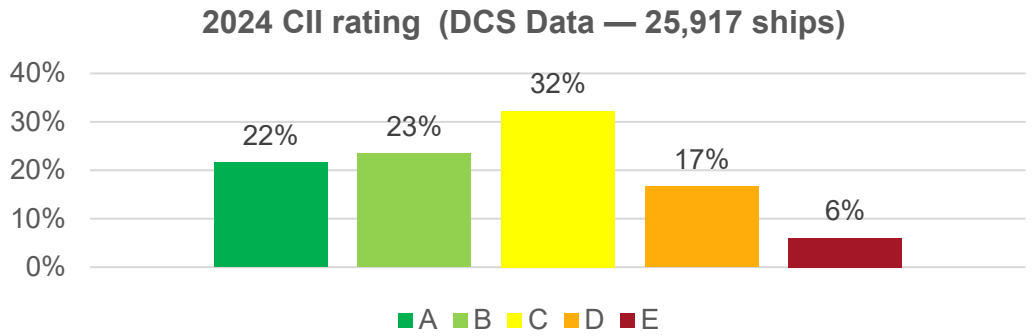
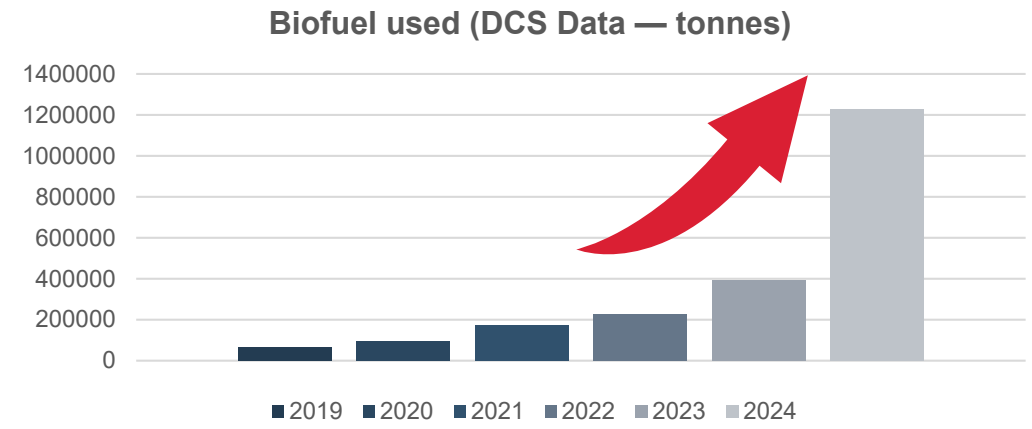
The Role of Biofuel for Shipping

Fuel Mix Outlook for Shipping



Biofuel – Small but Important for Shipping





IMO Interim Approach to Address Biofuel Emissions

- **MEPC.1/Circ.905 to address the current challenges**
  - biofuels must be certified by international certification scheme, e.g., ISCC and RSB
  - well-to-wake GHG emissions reduction of at least 65% compared to fossil MGO
  - well-to-wake GHG emissions not exceeding **33 gCO2e/MJ**
  - CF = WtW GHG emissions * LCV

- A typical Proof of Sustainability for Biofuel

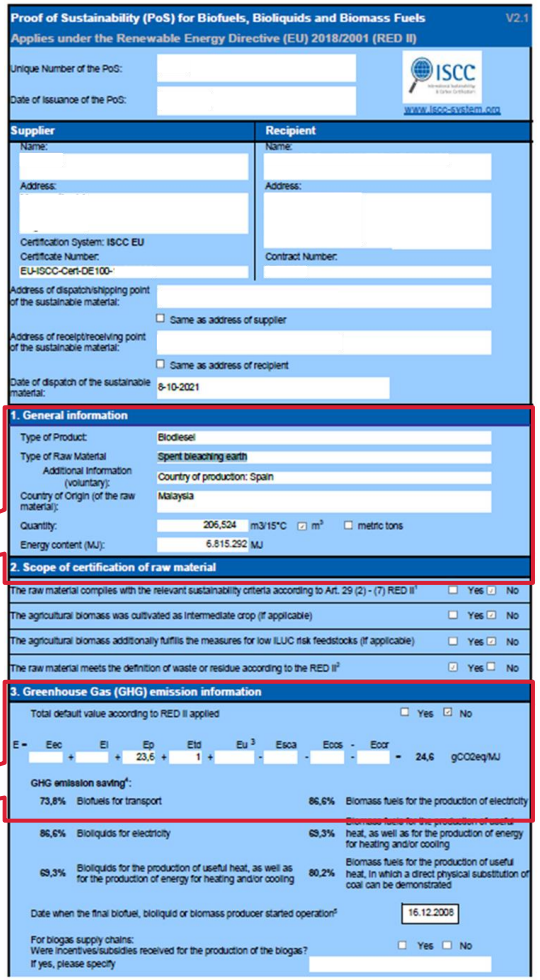
1. General information

Type of Product:	Biodiesel
Type of Raw Material	Spent bleaching earth
Additional Information (voluntary):	Country of production: Spain
Country of Origin (of the raw material):	Malaysia

3. Greenhouse Gas (GHG) emission information

Total default value according to RED II applied ☐ Yes ☑ No

E =	Eec		El		Ep		Etd		Eu [3]		Esca		Eccs	-	Eccr			
		+		+	23,6	+	1	+		-		-		-		=	**24,6**	gCO2eq/MJ



Proof of Sustainability (PoS) for Biofuels, Bioliquids and Biomass Fuels V2.1

Applies under the Renewable Energy Directive (EU) 2018/2001 (RED II)

Unique Number of the PoS:

Date of Issuance of the PoS:

ISCC www.iscc-system.org

Supplier	Recipient
Name:	Name:
Address:	Address:
Certification System: ISCC EU	
Certificate Number: EU-ISCC-Cert-DE100-	Contract Number:

Address of dispatch/shipping point of the sustainable material: ☐ Same as address of supplier

Address of receipt/receiving point of the sustainable material: ☐ Same as address of recipient

Date of dispatch of the sustainable material: 8-10-2021

1. General information

Type of Product:	Biodiesel
Type of Raw Material	Spent bleaching earth
Additional Information (voluntary):	Country of production: Spain
Country of Origin (of the raw material):	Malaysia
Quantity:	206,524 m3/15°C ☑ m³ ☐ metric tons
Energy content (MJ):	6.815.292 MJ

2. Scope of certification of raw material

The raw material complies with the relevant sustainability criteria according to Art. 29 (2) - (7) RED II[2] ☐ Yes ☑ No

The agricultural biomass was cultivated as intermediate crop (if applicable) ☐ Yes ☑ No

The agricultural biomass additionally fulfills the measures for low ILUC risk feedstocks (if applicable) ☐ Yes ☑ No

The raw material meets the definition of waste or residue according to the RED II[2] ☑ Yes ☐ No

3. Greenhouse Gas (GHG) emission information

Total default value according to RED II applied ☐ Yes ☑ No

E = Eec + El + Ep + Etd + Eu [3] - Esca - Eccs - Eccr = 24,6 gCO2eq/MJ

GHG emission saving[4]:

73,8%	Biofuels for transport	86,6%	Biomass fuels for the production of electricity
86,6%	Bioliquids for electricity	69,3%	Biomass fuels for the production of useful heat, as well as for the production of energy for heating and/or cooling
69,3%	Bioliquids for the production of useful heat, as well as for the production of energy for heating and/or cooling	80,2%	Biomass fuels for the production of useful heat, in which a direct physical substitution of coal can be demonstrated

Date when the final biofuel, bioliquid or biomass producer started operation[5] 16.12.2008

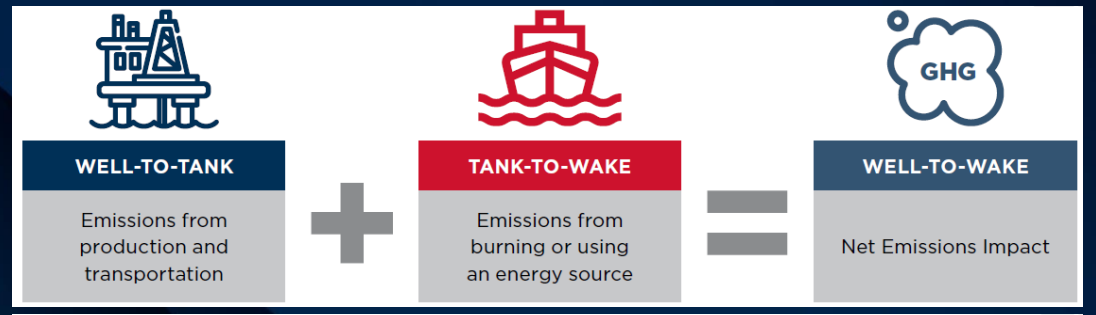
For biogas supply chains: Were incentives/subsidies received for the production of the biogas? ☐ Yes ☐ No

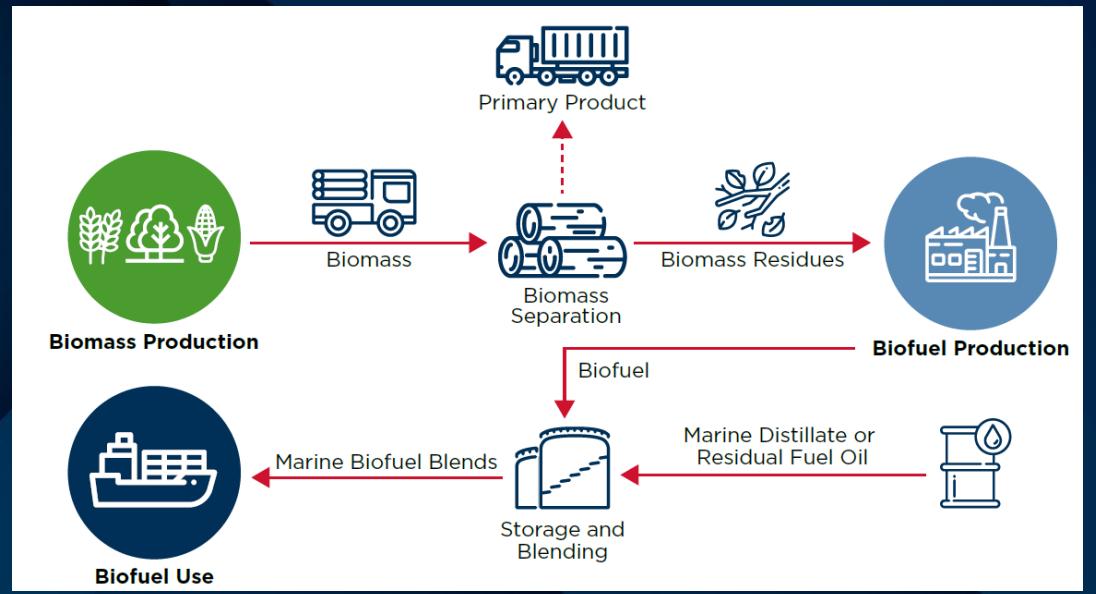
If yes, please specify

The emerging IMO architecture

2024 LCA Guidelines: the backbone

- The 2024 LCA Guidelines establish an IMO framework for **WtT, TtW, and WtW** GHG intensity of marine fuels
- The framework covers the full chain from **feedstock extraction/cultivation/recovery** through **production, transport, bunkering, and onboard use**
- The **Fuel Lifecycle Label (FLL)** is the central data structure linking fuel identity, pathway, emissions values, and sustainability information
- The relevant GHGs are explicitly **CO_2, CH_4, and N_2O**





Fuel pathway codes and default vs actual emission factors

Unique fuel pathway code to each fuel route.

The code captures key pathway attributes such as:

- **fuel type**
- **feedstock origin / carbon source**
- **production / conversion process**
- **energy source used in production**

These codes are the backbone for linking a fuel to its corresponding **default emission factors**

Default values in Appendix 2 provide standardized WtT/TtW inputs for comparability

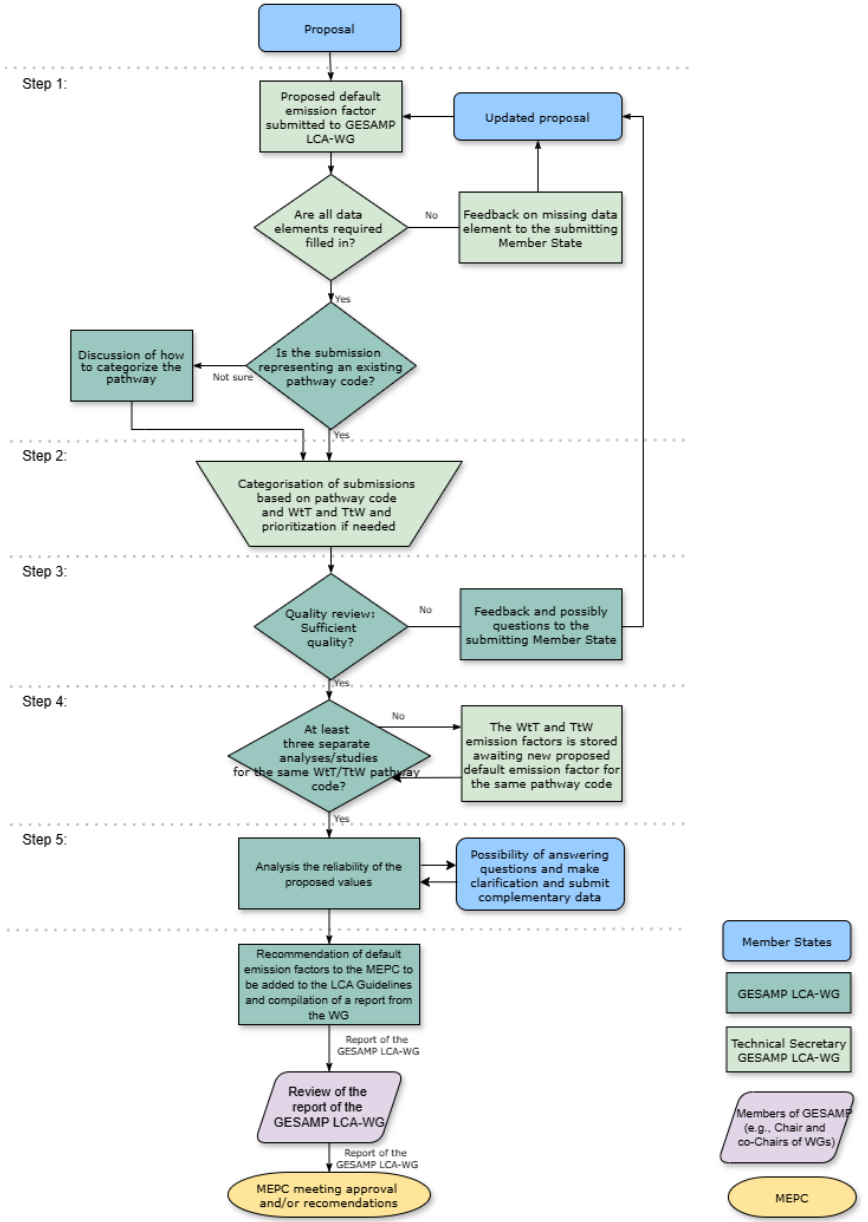
- Under the Guidelines, default WtT factors are based on **representative and conservative assumptions**; among at least three reference values, the **upper emission value** is selected as default

Actual values can demonstrate better real-world performance, but only after **third-party verification/certification**

- Actual WtT values are not allowed for purely fossil pathways, except where captured fossil carbon or CCS/CCUS is involved

GESAMP-LCA WG methodology: what is becoming stricter

- GESAMP-LCA WG is refining how proposed default factors are submitted, reviewed, and recommended under **MEPC.1/Circ.916**
- The Group's current view is that **representativeness** means modelling the most common real-world pathway, with geographic relevance
- In principle, **three cases from different countries** are needed for a global default; if one country represents roughly **80% of global volume** for that pathway, three cases from that country may suffice
- **Conservativeness** means the default should not understate emissions; selecting the **highest** of at least three proposed default values is treated as conservative
- The Group is also pushing for stronger documentation: clear pathway description, mass/energy balances, logistics, and transparent reporting of all emissions sources



Source:MEPC.1-Circ.916.

Further Development of the LCA Framework

Latest outcome from MEPC 84

- Committee considered the ISWG-GHG 21 / GESAMP-LCA WG work on operationalizing the 2024 LCA Guidelines
- No amendments adopted; agreement on a structured way forward, with further technical work via GESAMP-LCA WG and **MEPC 85 as next decision point**

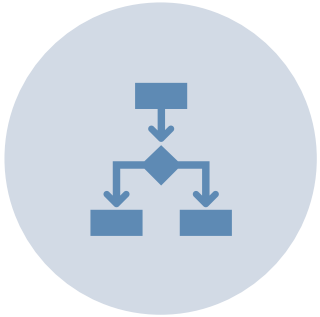
Key directions

- Uniform understanding of "**representativeness**" and "**conservativeness**" for WtT default factors
- Invitation to propose incorporation of **country of origin** into default factors
- Recommendation to use statistical approaches for global default WtT factors
- Support in principle for a **risk-based approach to ILUC**, subject to further quantitative analysis
- Support for the use of **mass-balance chain-of-custody** models for fuel traceability

Requested further work

- Ships using cargo as fuel
- GHG intensity of electricity
- OCCS/CCU
- Avoided emissions
- Fossil fuel WtT values
- Cslip corrections

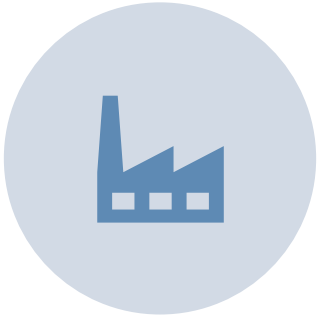
What certification must prove in the IMO context: Certification must do more than validate a scheme logo



Actual WtT values: prove the pathway, method, and data behind any lower-than-default claim

All GHGs separately: the Group has stressed the need to report **CO_2, CH_4, and N_2O individually**, not only as an aggregated CO_2e total

Embodied electricity for e-fuels: recent GESAMP reviews show increasing scrutiny on the life-cycle emissions of renewable electricity and related infrastructure/CAPEX assumptions



ILUC risk class: biofuel claims will need to align with the IMO's evolving **risk-based ILUC framework**, not just generic sustainability claims

Where schemes like ISCC and RSB fit — and where they do not

- **Strengths:** established audit systems, global reach, chain-of-custody experience, feedstock traceability, and practical familiarity with waste/residue classification and sustainability governance
- GESAMP's own discussions reference existing approaches used in **ISCC, RSB, RED, and CORSIA** when exploring ILUC, waste/residue classification, and certification experience
- **But gaps remain versus IMO needs:**
  - pathway-code-specific alignment to IMO definitions
  - explicit reporting of **CO_2/CH_4/N_2O** at required stages
  - treatment of **embodied electricity** for e-fuels
  - alignment with IMO-specific **representativeness/conservativeness** rules
  - future IMO recognition and governance requirements are still under development

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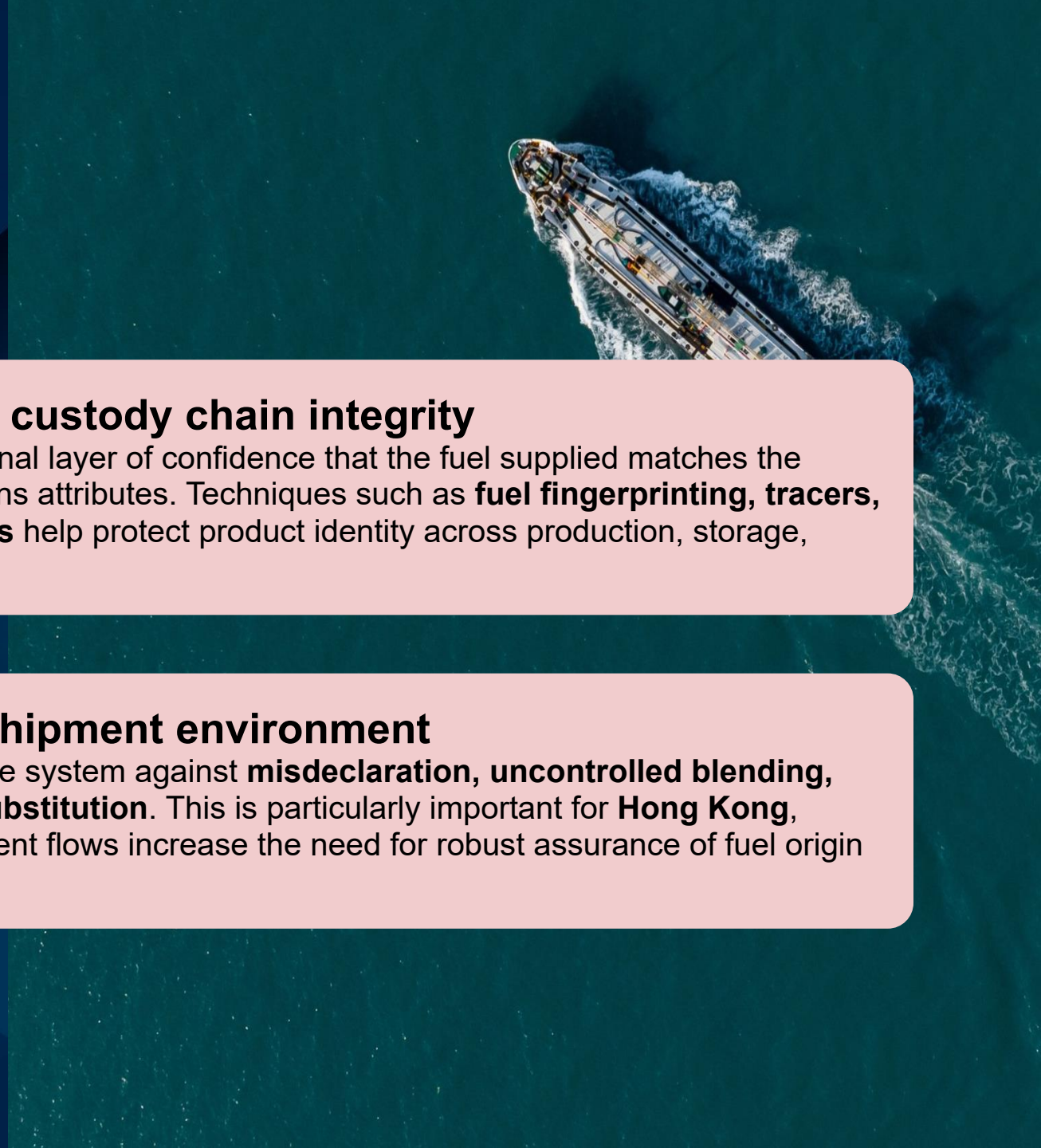
The role of physical assurance



Fingerprinting, tracers, and custody chain integrity

Physical assurance provides an additional layer of confidence that the fuel supplied matches the certified pathway and declared emissions attributes. Techniques such as **fuel fingerprinting, tracers, and secure chain-of-custody controls** help protect product identity across production, storage, transfer, and bunkering.

Fraud-resilience in a transshipment environment

Physical assurance also strengthens the system against **misdeclaration, uncontrolled blending, document inconsistency, and fuel substitution**. This is particularly important for **Hong Kong**, where complex trading and transshipment flows increase the need for robust assurance of fuel origin and integrity.

A practical blueprint for Hong Kong

- **Clear institutional interface**

  Port authorities define delivery, reporting, and control points; **certifiers** validate pathway and emissions claims; **testing labs** verify fuel identity where needed through sampling and checks.

- **Minimum data package**

  Each batch should carry a core data set linking **fuel identity, pathway code, emissions values, chain of custody, delivery record, and vessel receipt**.

- **Registry linkage**

  A **GO/PGO-style registry** should track ownership and environmental attributes from production to final use, with clear transfer and retirement rules to prevent double counting.

Thank You

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