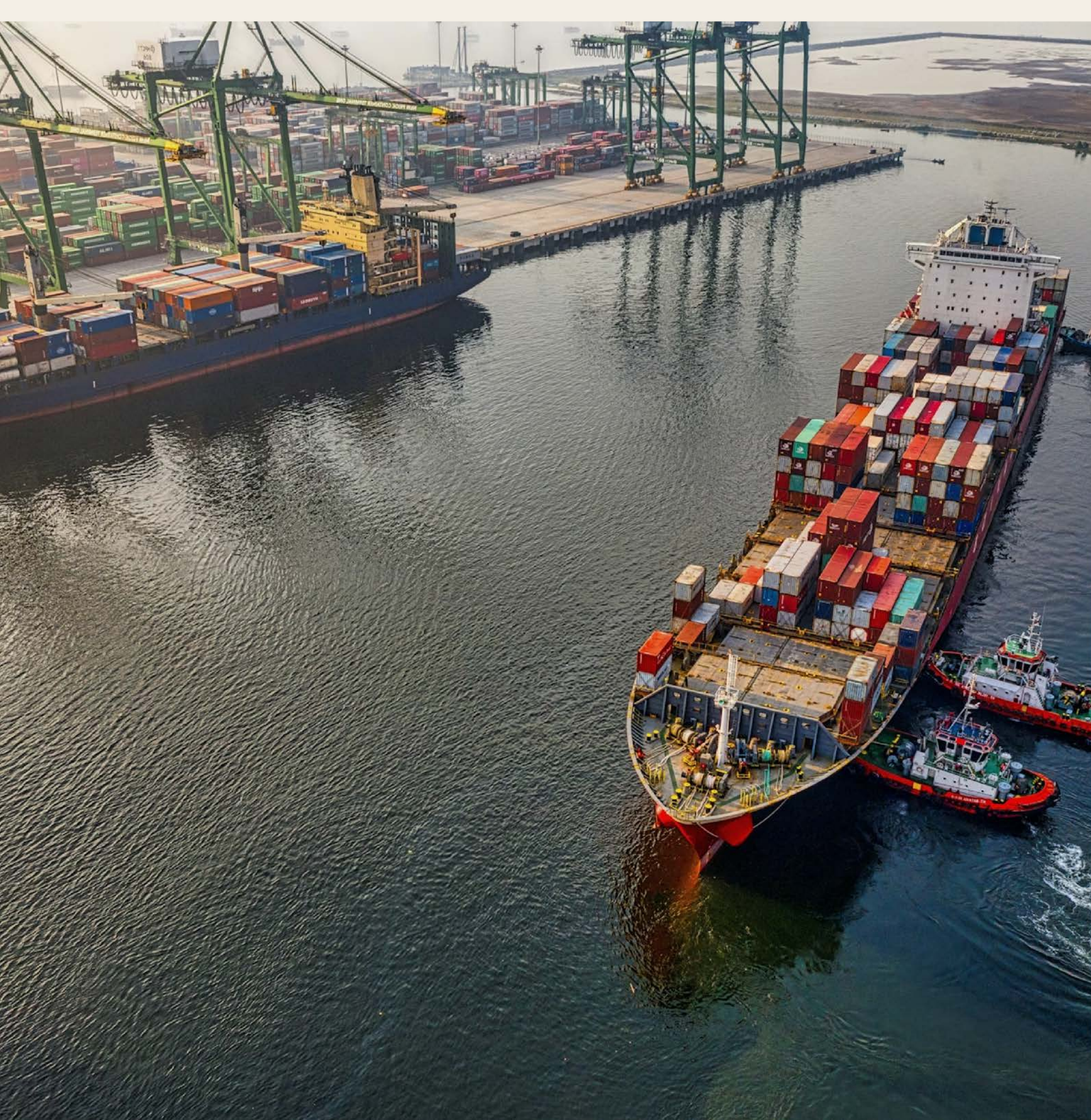




2026 INDUSTRY OUTLOOK
VOL. 01 / MARITIME

MARITIME & SHIPPING / GLOBAL OUTLOOK

Decarbonizing *Maritime & Shipping* with C3

Five sub-industries, three fuel waves spanning biofuels today, alcohol fuels scaling and e-fuels emerging, and a single argument: the bunker tank is now where multi-fuel decarbonisation meets financial allocation, and where no fuel pathway physically scales fast enough without a Scope 3 marketplace.

Executive summary.

Global shipping is in structural transition driven by the convergence of **regulation, fuel innovation, and Scope 3 demand**. No single fuel pathway — or combination — can scale fast enough to meet regulatory timelines and global demand. The primary constraint to maritime decarbonisation is no longer technology or fuel availability alone, but the lack of a mechanism to **efficiently allocate capital and emissions reductions across the value chain**. Regulation, technology, and demand are aligned — but the system that *connects* them is not. **Q2 2026 sharpened that picture:** Strait of Hormuz traffic ran at ~5% of pre-war volumes through April 2026 following the 28 Feb 2026 closure — an 8 Apr 2026 ceasefire produced first transits but commercial flow remains constrained, pushing bunker prices higher, while the IMO Net-Zero Framework was blocked a second time at MEPC 84 in May 2026 by a US-led coalition. The Mærsk Mc-Kinney Møller Center's ~30% headcount cut on 2 May 2026 reads as a broader market signal of deepening uncertainty across maritime shipping — leaving cargo-side Scope 3 demand as the marginal price-setter.



01 / FRAGMENTED SYSTEM

Maritime is five distinct sub-industries, not one.

Container, dry bulk, tankers, cruise and offshore each run on different cost structures, fuel exposure and abatement curves. Willingness-to-pay, regulatory exposure and credit-flow path differ across segments — uniform approaches fail.

02 / CARBON AS DIRECT COST

From 2026, carbon is a material P&L line.

From 2026, EU ETS reaches 100% scope on shipping CO₂, CH₄ and N₂O, and FuelEU Maritime is binding with a EUR 2,400/t VLSFO-equivalent shortfall penalty designed to be unpayable. The IMO Net-Zero Framework has been **blocked twice** — Oct 2025 extraordinary MEPC (57–49) and MEPC 84 May 2026 by a US-led coalition — leaving EU pricing as the only binding floor. EU instruments touch only a slice of global tonne-miles; cargo-side Scope 3 demand closes the green-fuel premium gap.

03 / SUPPLY GAP IS STRUCTURAL

All major fuel pathways face scaling limits.

Biofuels constrained by feedstock; alcohol fuels (methanol, ethanol) scaling but insufficient; e-fuels gated on renewable hydrogen. Bunker demand on the order of hundreds of millions of tonnes/yr — far beyond near-term low-carbon supply.

04 / DEMAND ALREADY EXISTS

Cargo owners are willing to pay.

Driven by Scope 3 reporting requirements and corporate climate commitments. But that demand does not translate efficiently into fuel switching or abatement — fragmentation and lack of standardised allocation block the loop.

THE CORE CHALLENGE

Even where reductions are technically feasible, they cannot consistently be **priced across stakeholders, allocated to end users, or reported without double-counting**. A structural gap between available capital and deployable solutions.

THE C3 APPROACH

Fuel-agnostic market infrastructure for Scope 3.

- **Verify** reductions across any fuel pathway
- **Allocate** via book-and-claim
- **Monetise** across owners, cargo, financiers
- **Report** single-use, audit-grade, ISCC/RSB-aligned

COMMERCIAL IMPLICATIONS

Alternative-fuel premiums can be *partially recovered* via verified allocation. Operational efficiency generates incremental revenue when combined with carbon allocation. Regulatory exposure shrinks via proactive participation. **Decarbonisation shifts from compliance cost to value creation.**

CONCLUSION

Decarbonisation at scale will not come from fuel substitution alone — it requires capital flowing efficiently to the point of emissions reduction. **Carbon3 provides that scaffold and financial infrastructure.**

No fuel pathway scales fast enough — *allocation is the bottleneck.*

The argument runs in three movements: (I) shipping is five distinct sub-industries, each with a different inset flow and fuel mix; (II) compliance regimes — EU ETS live, FuelEU live, IMO Net-Zero Framework expected — converge on the same tonne; (III) biofuels prove demand today, alcohol fuels (methanol + ethanol) build the pathway, e-fuels follow — but supply gaps are structural across all of them, and C3 is the fuel-agnostic scaling layer that prices, allocates, and clears the abatement.

REGULATORY & MARKET TIMELINE



I .

Five maritime industries — not one

Sub-industry segmentation map	P . 08
Container — green-premium pioneer	P . 09
Dry bulk & tankers — split economics	P . 10
Cruise & offshore — high WTP, decoupled	P . 11

II .

The *compliance walls* go live

The regulatory triple-stack	P . 13
IMO Net-Zero Framework — GFI tiers	P . 14
The 2026 vs 2030 cost stack	P . 15
Alternative fuels reality check	P . 16

III .

The *insetting playbook*

APAC focus — Singapore as bunker hub	P . 18
The C3 mechanism — verify, allocate, retire	P . 19
Deal 1 — Maersk-style green methanol	P . 20
Deal 2 — Singapore bulker slow-steaming	P . 21

01 — THE HEADLINE THESIS

2026 is the year the bunker tank becomes a *regulated, financeable* Scope 3 asset.

International shipping moves ~80% of merchandise trade by volume and burns ~300 Mt of fuel-oil equivalent each year, emitting ~1.06 GtCO₂e well-to-wake — about 2.9% of global anthropogenic GHG. 2026 is the first year two regimes price that tonne directly. **EU ETS** is now at 100% phase-in for vessels >5,000 GT, with CH₄ and N₂O brought into scope. **FuelEU Maritime** is binding with a EUR 2,400/t VLSFO-equivalent shortfall penalty designed to be unpayable — the mechanism forces pooling and abatement, not surrender. The **IMO Net-Zero Framework GFI** was approved in principle at MEPC 83 in April 2025 but has since been blocked twice — first at the October 2025 extraordinary MEPC on a 57–49 vote, then again at MEPC 84 in May 2026 by a US-led coalition — leaving the EU pricing stack as the only binding price signal on maritime carbon heading into 2027. *[DNV Maritime Forecast to 2050, 2024 ed.; UNCTAD RMT 2024]*

No fuel pathway — biofuels, alcohol fuels, e-fuels — scales fast enough physically. The gap is structural across all fuels.

In maritime, **book-and-claim** is the conceptual strategy for decarbonising **Scope 3** supply chains, channelling cargo-owner climate budgets to the bunker tank where emissions actually occur. **Carbon3 (C3)** provides the financial and technological infrastructure needed to execute that **insetting** strategy at scale — verifying the abatement, allocating it across shipowner, cargo owner and lender as audit-grade Scope 3 reductions without double-counting, and settling the transaction end-to-end between parties.

~1.06 Gt

SECTOR WELL-TO-WAKE CO₂E, 2023
DNV Maritime Forecast

\$540 /t

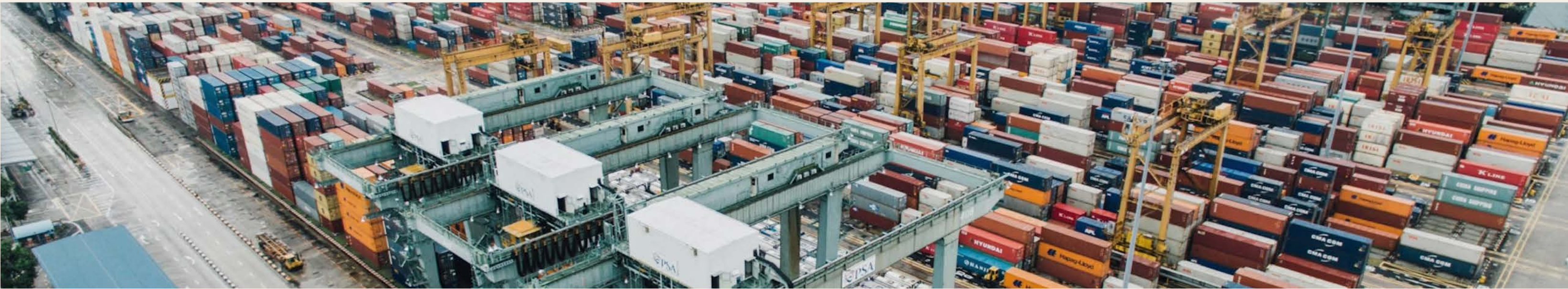
SINGAPORE VLSFO, Q1 2026
S&P Platts Bunkerwire

\$1,650 /t

SINGAPORE LANDED E-METHANOL —
SCENARIO ESTIMATE
DNV Alt Fuels Insight (central scenario)

<0.4 %

GREEN-FUEL SHARE OF GLOBAL
BUNKERS
Methanol Institute



02 — THE BIFURCATION

Vessel intent has moved. *Fuel supply hasn't.* That gap is the inset opportunity.

Shipowners have ordered US\$ 250 Bn+ of new vessels built to burn LNG, methanol or ammonia — yet all alternative fuels combined still account for only ~2% of global bunker demand. Even the only scaling fuel today — **biofuels** (~1.3 Mt sold in Singapore 2025) — is <1% of total demand. The supply problem is not engineering, it is timing and capital: green-methanol, ammonia and e-fuel projects need 4–7 years from final investment decision to first commercial volume, gated upstream by renewable-hydrogen build-out, while a vessel ordered today carries a 25-year asset life. The gap between what newbuilds *can* burn and what the market *actually* sells is therefore structural across all pathways. That mismatch — fast tonnage, slow molecules — is the precise space where book-and-claim insetting creates value while physical supply catches up.

CAPEX SIDE — MOVING

\$250 Bn+

Multi-fuel orderbook locked.

The global orderbook stands at 360 million DWT, roughly 15% of the existing fleet, and is dominated by dual-fuel hulls: LNG-DF and methanol-DF first, with ethanol and ammonia-ready tonnage rising fast. **Chinese yards build ~58% of new tonnage**, while Korean yards own the LNG-carrier and ammonia-ready segments.

Source: Clarksons SIW, 14 Mar 2026

BUNKER SIDE — LAGGING

~2%

Alternative-fuel share of global bunkers.

Singapore, the world's #1 bunker port, sold a record **56.8 Mt of marine fuel in 2025**. Biofuel blends grew to ~1.3 Mt, up from 0.88 Mt in 2024, alongside rising methanol and ethanol stems. e-methanol still lands at roughly **3× the VLSFO price**, while ethanol's energy cost runs materially lower.

Source: MPA Singapore Annual Bunker Statistics 2025; S&P Platts Bunkerwire Q1 2026

⚓ EU ETS — 100% (live)

From 1 Jan 2026, vessels >5,000 GT surrender allowances on 100% of intra-EU and 50% of extra-EU emissions. CH₄ and N₂O now in scope.

[Directive (EU) 2023/959]

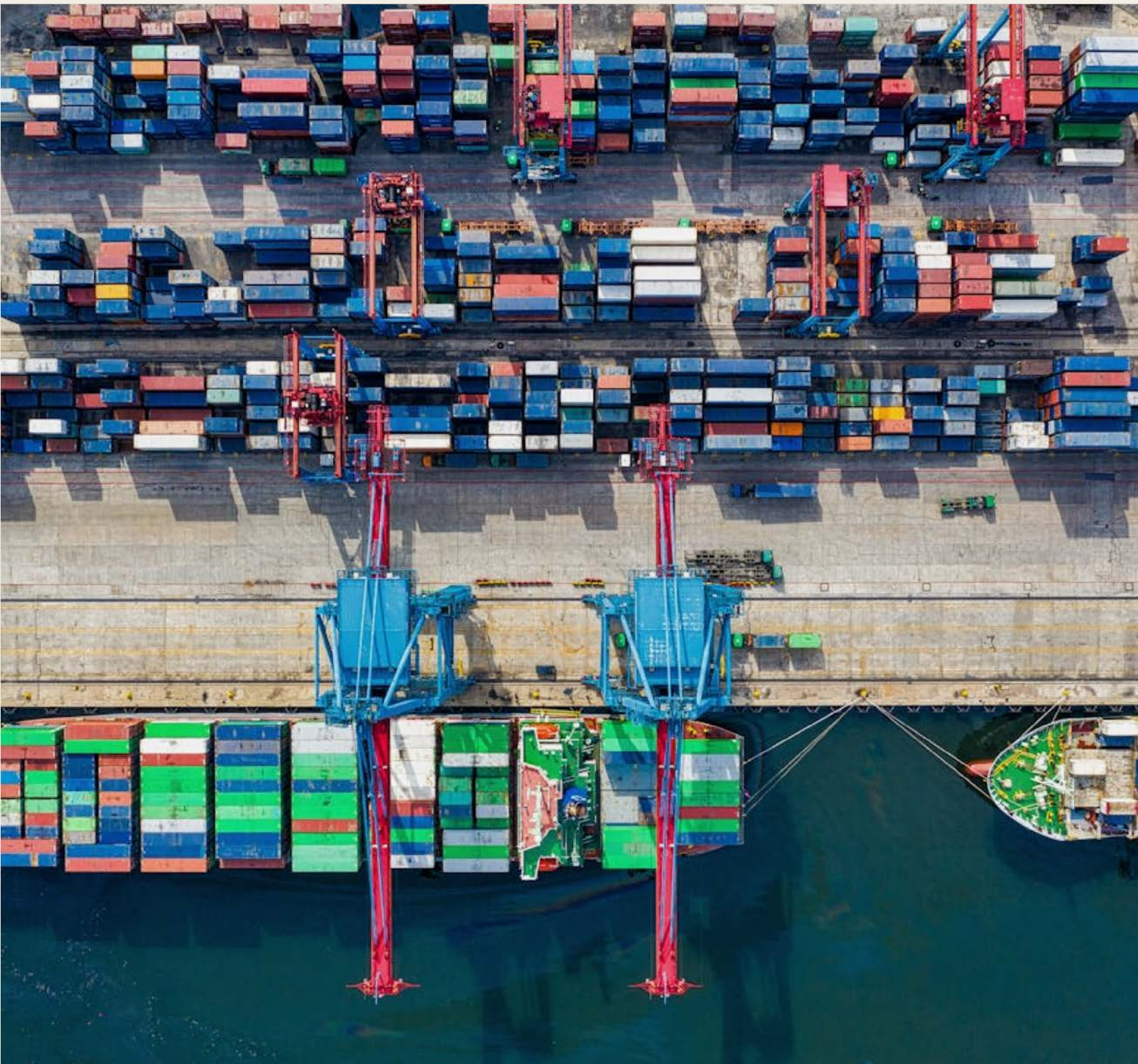
🔗 FuelEU Maritime (live)

–2% GHG-intensity target binding in 2026; multi-vessel pooling allowed. EUR 2,400/t shortfall penalty. [Reg. (EU) 2023/1805, Art. 23(2) and Annex IV]

🌐 IMO Net-Zero — emerging

Approved in principle at MEPC 83 (Apr 2025); formal adoption pending. If ratified: tier-2 ~US\$ 100 / tier-3 ~US\$ 380 per tCO₂e — earliest entry-into-force 2028. Subject to delay or amendment.

03 — SECTOR AT A GLANCE



Maritime is an *APAC-owned, APAC-built, APAC-bunkered* industry — and that's where the inset flow clears.

~80% of global merchandise trade physically moves through ships that are majority APAC-owned, ~58% delivered from Chinese yards in 2025, and increasingly bunkered in Singapore. Singapore's dual role as both bunker hub and financial center makes APAC the natural locus of the marine inset market.

~109k

COMMERCIAL VESSELS ≥100 GT — THE LARGEST REGULATED MOBILE CARBON SOURCE
Clarksons WFR, Jan 2026

~2.4 Bn DWT

WORLD FLEET CAPACITY — TWICE THE GLOBAL AIRLINE TONNE-KM BASE
Clarksons SIW Q1 2026

\$850 Bn+

SECTOR REVENUE, 2024 — FRAGMENTED ACROSS >5,000 OWNERS
Drewry Annual Review

~11 Bt/yr

CARGO MOVED — >80% OF MERCHANDISE TRADE BY VOLUME
UNCTAD RMT 2024

I Lumping shipping into one industry is the *central error*.

Container, dry bulk, tanker, cruise, and offshore each operate on different capex, charter forms, fuel-cost share of opex, and abatement levers. Each generates a distinct inset flow — and a distinct credit price band, US\$ 60–450/credit. Treating them as one sector hides where the abatement actually clears.

04 — THE FIVE AT A GLANCE

Five sub-industries. *Five distinct credit flows.* One marketplace.

Each segment has a different beneficiary, claim path, and clearing price (US\$ 60–450 / credit).

Below: fuel relevance + lead actors + key stats per sub-industry.

01 / CONTAINER

Alcohol-fuel pioneer

Twelve of Maersk's eighteen methanol dual-fuel boxships are in service, ethanol-fuel pilots are underway, and ammonia-ready hulls follow from 2027. Cargo-owner pull from Amazon, IKEA, Volvo and the ZEMBA buyer pool of 25+ corporates makes container the only segment with a sustained green-fuel premium — and the clearest route from cargo-side climate spend to bunker-tank abatement.

5,800

VESSLS

240+

MEOH/ETOH-DF ORDERBOOK

04 / CRUISE & PASSENGER

High visibility, highest WTP

Less than 0.6% of marine GHG, but the highest emissions per passenger-km of any segment. Intra-EU voyages count 100% under ETS, making cruise the most exposed per port-pair. Royal Caribbean, MSC and Carnival face brand-driven willingness-to-pay that outruns the rest of the industry — premium credit pricing flows directly through to ticket revenue.

~310

CLIA VESSELS

~250

GCO₂ / PAX-KM

02 / DRY BULK

Biofuels + efficiency

Ownership is fragmented — the top 10 owners hold less than 15% of the fleet — so decarbonisation is charterer-led. Vale, BHP, Rio Tinto and Cargill drive change via biofuel blends, slow steaming and wind-assisted propulsion. Bulk also carries the worst CII rating distribution of any major segment, with ~25% of vessels rated D or E in 2024 — making efficiency upgrades the highest-yield lever.

13,500

VESSLS

1,000

m DWT CAPACITY

05 / OFFSHORE / WTIV

Decoupled economics

Wind-turbine installation vessel (WTIV) day rates have exceeded US\$ 400k as the >70 GW European, Korean and Taiwanese offshore-wind pipeline outruns available tonnage. Owners — Cadeler, Eneti, Van Oord, Jan De Nul — self-finance abatement on the day-rate spread. Hybrid-battery PSV retrofits cut at-station fuel use 25–40%, paying back without subsidy.

3,600

VESSLS

\$400k+

WTIV DAY RATE

03 / TANKERS

Fuels + methane management

Crude tankers run long-haul Asia trades with light EU exposure; product tankers are EU-heavy on diesel and jet flows, where ETS surcharges are now standard pass-through (Hafnia, Torm). LNG carriers face a new economic angle: methane-slip control turns from a compliance line into a direct revenue lever now that FuelEU and ETS price both CH₄ and N₂O.

7,400

CRUDE/PRODUCT

720

LNG CARRIERS

EDITORIAL VALUE-ADD

Differentiation = where the credits clear.

Container clears the alcohol-fuel premium onto bills of lading; dry bulk monetises biofuels and efficiency to charterers; tankers stack methane-slip control into oil-major Scope 3 lines; cruise pulls brand willingness-to-pay alongside shore-power abatement; offshore self-finances on the day-rate spread. Five distinct credit flows, five distinct beneficiaries — one marketplace clears them all in the US\$ 60–450/credit range.

5

DISTINCT FLOWS

\$60–450

US\$/CREDIT RANGE



Container is the *alcohol-fuel* segment — methanol now, ethanol scaling, ammonia coming.

The top-9 carriers — Maersk, CMA CGM, ONE, Hapag-Lloyd, COSCO, Evergreen, HMM, ZIM and MSC — control ~85% of global TEU capacity, making container the most concentrated of all maritime sub-industries [Alphaliner Q1 2026]. The methanol dual-fuel orderbook now exceeds 240 vessels (~3.4 m TEU), with ethanol pilots running on the same engine platform; ethanol carries a smaller green premium and draws on a far larger global production base, opening a credible bridge until e-methanol and ammonia infrastructure scales. Cargo-owner pull from Amazon, IKEA, Volvo and the ZEMBA buyer pool of 25+ corporates anchors the only segment with sustained green-fuel willingness-to-pay — making container the first real proving ground for book-and-claim insetting at commercial scale.

ALCOHOL-FUEL DEMAND BY 2030

6–13Mtpa

Projected green methanol + ethanol demand —
order of magnitude above current global green-alcohol nameplate [Methanol Institute 2026; DNV Apr 2026].

CII RISK BY 2027

>30%

of box fleet projects to CII rating D/E by 2027 absent intervention, given 2%/yr tightening off 2019 reference [ICCT, Mar 2025].

CII RATING DISTRIBUTION, 2024 FLEET (% OF VESSELS):
A 22% · B 27% · **C 32%** · D 13% · E 6% [ICCT, Mar 2025]

Bulk + tanker — twice the tonnage of containers, and where *biofuels + efficiency scale today*.

Together, dry bulk (~1,000 m DWT) and tankers (~690 m DWT) carry over five times the container fleet by deadweight — yet receive a fraction of the green-fuel headlines. The decarb vectors run through different actors: dry bulk through charterer mandates from Vale, BHP, Rio Tinto and Cargill that deploy biofuel blends and slow-steaming at scale; tankers through retrofit packages — air lubrication, shaft generators, methane-slip control on LNG carriers. Critically, both segments abate on existing engines and existing fuels: biofuels, slow steaming and wind-assisted propulsion clear at MACs of –15 to +90 US\$/tCO₂e — the cheapest credits in the marine inset stack, deployable today and beneficiary-mapped directly to charterer and oil-major Scope 3 lines.



02 / Dry bulk — *charterer-led*

Bulk ownership is fragmented — the top 10 owners hold less than 15% of fleet — so decarbonisation moves through cargo. Iron-ore majors Vale, BHP, Rio Tinto and Anglo American, plus grain traders Cargill, ADM, Bunge and COFCO drive change via TC clauses and joint pilots. Vale fitted a Valemax with rotor sails in 2024; Rio chartered methanol-capable Newcastlemaxes; Cargill's Pyxis Ocean WindWings retrofit reported ~14% voyage savings. Slow steaming + WAPS + biofuel blends form the cheapest abatement stack in the marine MAC curve.

LEVER	MAC US\$ / T	FUEL SAVE
Slow steam 14→12 kn	–15	~30%
Air lubrication	60	5–10%
Norsepower rotor sails	90	5–25%
ISCC B30 biofuel	~300	–65 to –90%

ICCT 2024; CE Delft MAC 2026; Vale ESG 2024.

03 / Tankers — *split economics*

Tankers split into three distinct economics. Crude tankers run long-haul Asia trades and carry the lightest EU exposure by ton-mile. Product tankers — reshaped by post-Russia diesel and jet flows — are the most EU-exposed segment, with Hafnia and Torm now passing ETS through in 80%+ of new TC contracts. LNG carriers face methane slip as a direct cost line under FuelEU and ETS CH₄ scope, turning re-liquefaction and engine tuning from compliance items into revenue levers post MEPC 83.

SEGMENT	FLEET	LEAD OPERATOR	CAPEX \$M
VLCC	~770	Frontline / DHT / COSCO	130
MR product	~1,600	Hafnia / Torm	50
Chemical	~840	Stolt / Odfjell	75–110
LNG carrier	~750	HD Hyundai / Samsung	265

Clarksons SIW Mar 2026; SEA-LNG mid-2025; Hafnia Q4 2025.



Cruise pays the *highest WTP*. Offshore *self-finances* on day-rate spread.

Two tail segments — both decouple from cargo and run cleaner insetting structures than the rest of maritime. Cruise is the most ETS-exposed per voyage and most consumer-visible; offshore self-finances retrofit on day-rate spread. In both cases the credit goes directly to the operator or developer, with no charterer in the chain.

04 / Cruise

Royal Caribbean, Carnival, MSC and Norwegian operate ~310 CLIA-member ocean-going vessels — **~32 m passengers** in 2024 [CLIA]. Brand-driven willingness-to-pay outruns every other shipping segment: premiums pass straight through to ticket pricing.

Intra-EU voyages count **100% of emissions** under the 40 / 70 / 100% ETS phase-in — cruise is the most ETS-exposed segment per port-pair. Royal Caribbean's Icon class with shore-power-equipped homeports cuts at-berth emissions ~98%, making ports the highest-impact lever.

SHORE-POWER IMPACT

98%

at-berth emissions reduction — Hamburg, Rotterdam, Marseille, Singapore Marina Bay.

05 / Offshore / WTIV

WTIV day rates exceeded **US\$ 400k/day in Q1 2026** as the >70 GW EU/Taiwan/Korea offshore-wind pipeline outran tonnage. Cadeler, Eneti, Van Oord, Jan De Nul and Penta-Ocean lead — the day-rate spread lets operators self-finance abatement without subsidy.

Hybrid-battery PSV retrofits (Edda Wind, Esvagt) cut at-station fuel **25–40%** by displacing diesel gensets on turbine. Credits map directly to wind-farm developer Scope 3 and offshore-wind LCOE-CO₂ — a closed-loop accounting structure unique inside maritime.

➡ 70 GW pipeline

EU + Taiwan + Korea offshore-wind awaiting tonnage by 2030.

⚡ 25–40% fuel cut

Hybrid PSV retrofits — at-station diesel-genset displacement.

Two regimes live, one stalled — *regulation alone won't close the green-fuel premium gap.*

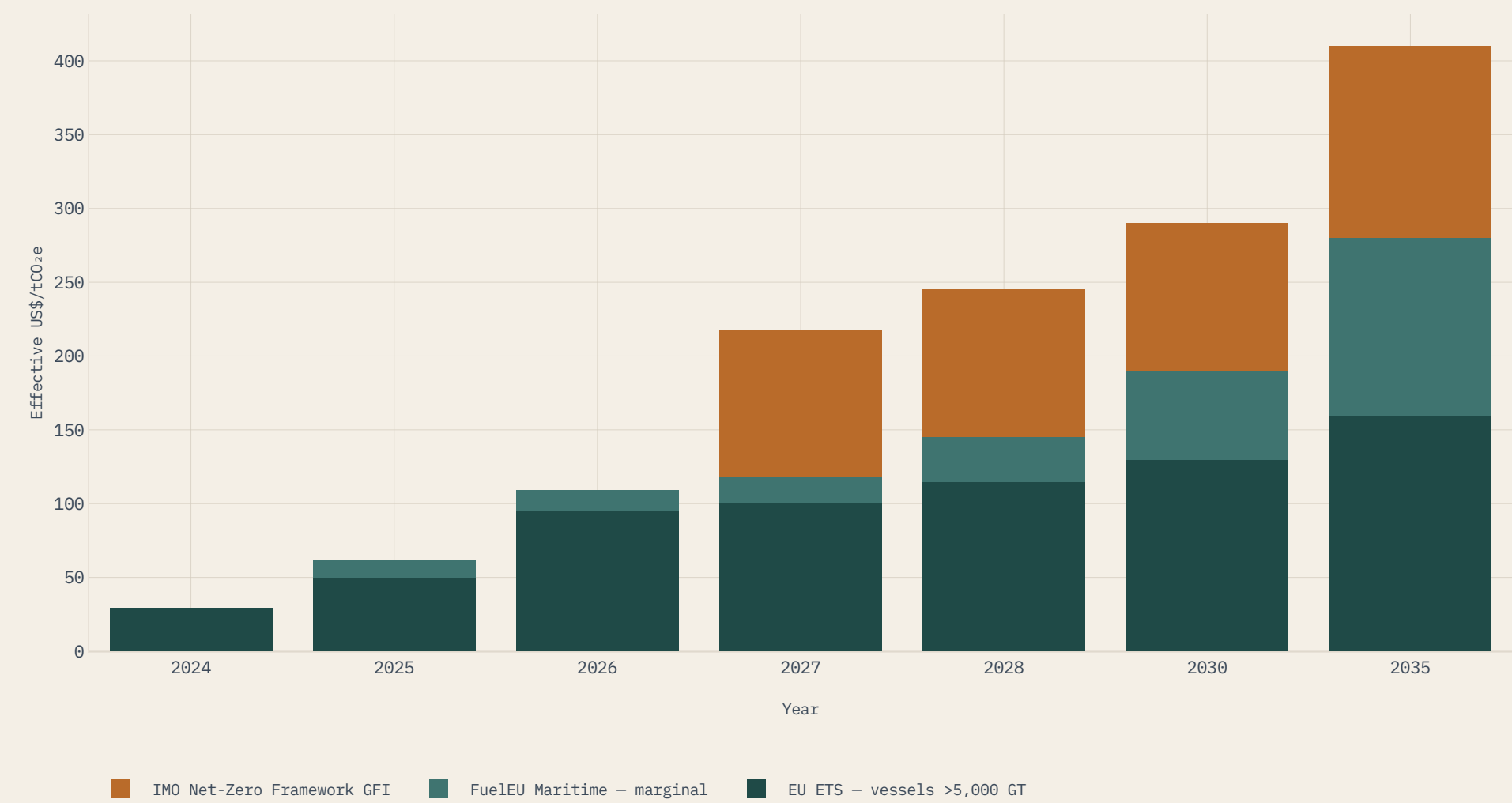
II

EU ETS and FuelEU Maritime are both binding in 2026 and form the locked regulatory floor on every EU-touching voyage. The IMO Net-Zero Framework GFI was approved in principle at MEPC 83 in April 2025 but has been blocked twice — at the October 2025 extraordinary MEPC on a 57–49 vote and again at MEPC 84 in May 2026 by a US-led coalition — leaving its future genuinely uncertain. EU pricing alone makes the cheapest levers commercial — slow steaming, biofuel blends, efficiency retrofits — but does not close the premium gap on e-methanol, e-ammonia or fleet-wide alternative-fuel rollouts. Cargo-side Scope 3 willingness-to-pay, channelled through book-and-claim insetting, has to do the rest of the work — which is why a globally-operating insetting platform like C3 is needed to clear the trade across every flag, every fuel and every regulatory regime.

08 — EFFECTIVE MARINE CARBON PRICE BY REGIME

EU prices the tonne in 2026. IMO *may* price it globally — both directions point up.

FIGURE 2 — EFFECTIVE MARINE CARBON PRICE BY REGIME, 2024–2035 (US\$/TCO₂E, ILLUSTRATIVE SCENARIO; NOT A FORECAST)



Sources: IMO MEPC.377(80); MEPC 83 Press Brief 11 Apr 2025; Reg. (EU) 2023/1805 Art. 4–5, 23; Directive (EU) 2023/959; BloombergNEF EUA Outlook Q1 2026.

TAKEAWAY 1 — EU IS LIVE

EU ETS at 100% + FuelEU at EUR 2,400/t shortfall create a binding price floor on EU-touching trade in 2026.

Every voyage with an EU port-call now carries an explicit per-tonne carbon charge.

TAKEAWAY 2 — IMO IS THE GLOBAL WILDCARD

If ratified, IMO GFI tier-2 (~\$100) and tier-3 (~\$380) extend pricing globally.

Blocked twice: Oct 2025 (57–49) and MEPC 84 May 2026 — US-led coalition with Saudi Arabia, Liberia, Panama, Argentina. Next attempt Dec 2026; entry-into-force ≥ 2028 if adopted.

TAKEAWAY 3 — FUELEU SHORTFALL IS PUNITIVE

EUR 2,400/t VLSFO-eq is designed to be unpayable.

The penalty exists to force pooling and abatement, not to be surrendered routinely [Reg. (EU) 2023/1805, Art. 23].

If ratified, the IMO Net-Zero Framework would be the first *global* carbon price.

MEPC 83 (Apr 2025) approved the GFI mechanism in principle. **Adoption has stalled twice** — Oct 2025 extraordinary MEPC (57–49 vote) and MEPC 84 (May 2026), where a US-led coalition with Saudi Arabia, Liberia, Panama and Argentina blocked progress. Next attempt: Dec 2026; entry-into-force ≥ 2028 if adopted. If passed as drafted, tier-priced Remedial Units layer on top of annual fuel-intensity targets. Tiers below illustrate the *proposed* pricing floor — currently a scenario, not a forecast.

TIER 1 — COMPLIANT

\$0

Vessels meeting both Base GFI and Direct-Compliance targets.

No payment owed. Vessels reach compliance through fleet-efficiency upgrades, voyage optimisation, slow steaming or a low-carbon-intensity fuel mix — typically a combination of biofuel blends and operational levers. This is the cheapest route to compliance, achievable on existing engines without any new infrastructure dependency.

TIER 2 — DIRECT-COMPLIANCE GAP

~\$100/tCO₂e

Met Base target but failed Direct Compliance — Remedial Units required.

Vessels meet the Base GFI target but miss Direct Compliance — they purchase Remedial Units at ~US\$ 100/tCO₂e to close the gap. The tier-2 price sets a de-facto global floor for marine inset credit pricing, and below US\$ 350 every commercial efficiency lever turns positive-NPV by 2027–2028 — making operational abatement and biofuel/alcohol-fuel blends profitable on their own merit.

TIER 3 — ABOVE BASE

~\$380/tCO₂e

Failed the Base GFI target — the highest-priced Remedial Units.

The penalty rail at ~US\$ 380/tCO₂e — applied when a vessel fails the Base GFI target outright. Operators stacking tier-3 exposure across multi-year contracts carry unmanageable carbon liability without abatement, retrofit or inset coverage. Tier-3 turns alternative-fuel adoption from a long-term ambition into a near-term financial necessity.

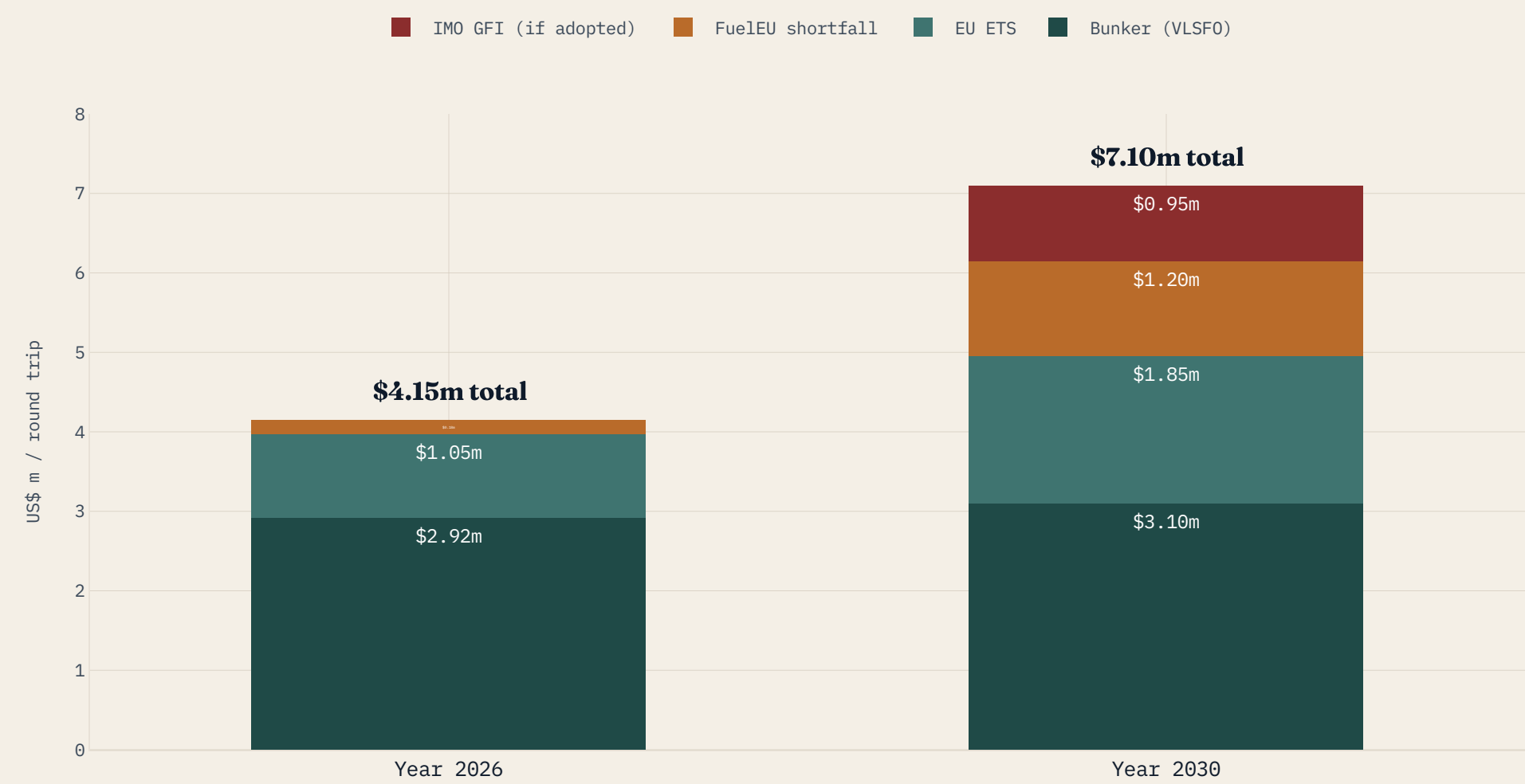
WHY THIS MATTERS

*If adopted, tier-2 would set a **de-facto global floor** for inset credit pricing. Until then, EU pricing alone makes efficiency levers commercial — but cargo-side Scope 3 demand, cleared globally via C3, has to close the green-fuel premium gap.*

10 — 14K-TEU BOX SHIP – ASIA-EUROPE ROUND TRIP

By 2030, fuel choice + carbon allocation *jointly determine* total cost — carbon nearly equals fuel bill.

FIGURE 3 – FUEL + CARBON COST STACK PER ROUND TRIP, 2026 VS 2030 (US\$ M)



Sources: Drewry Container Forecaster Q1 2026; ONE investor day 2025; BNEF EUA Outlook Q1 2026. Assumptions: EUA US\$ 95/t (2026), US\$ 130/t (2030).

2026 → 2030

\$4.15m → \$7.10m

Total fuel + carbon per Asia–Europe round trip on central-case EUA pricing. Carbon is now the **second-largest opex line**.

PASS-THROUGH TO CARGO

US\$ 30–50/TEU on Asia–Europe; US\$ 12–22/TEU on transpacific.

Already visible in published ETS surcharge schedules from every major liner since 1 Jan 2024.

WHERE INSETTING FITS

Cargo owners pay the carbon premium today.

Insetting determines whether those dollars *finance abatement* or merely *fund compliance*.

Price gaps are closing. *Volume gaps are structural across all fuels.*

Premiums to VLSFO sit within compliance-cost range (EUR 2,400/t shortfall makes 2–3× premium economic). Physical supply is the bottleneck across *every* pathway. Where molecules can't yet flow, financial allocation can.

FUEL	US\$/T (VLSFO-ENERGY BASIS)	WTW CO ₂ E VS VLSFO	2025 MARINE BUNKER VOLUME	KEY RISK
VLSFO — baseline	540	100	~300–320 Mt/yr (total marine bunkers)	Full regulatory exposure
MGO	720	95	freely available	Premium over VLSFO
LNG (fossil)	~620	78–92	~5–8 Mt	Methane slip; FuelEU CH ₄
Biofuel blends (B24–B30, FAME)	720–1,150	20–80	~1.0–1.5 Mt (largest scaling fuel)	Feedstock cap (UCO/POME); ISCC-EU compliance
Bio-methanol	~1,100	15–35	~0.01–0.02 Mt/yr	Slow scaling
Ethanol (sugarcane / cellulosic)	~900–1,200	20–40	marine pilots 2025–26; ~85–95 Mt/yr fuel ethanol production base	Sustainability cert.; engine compatibility scaling
e-methanol	~1,650	5–10	<0.05 Mt/yr	Renewable H ₂ supply gap
Green ammonia	~1,400	5–10	commercial pilots 2026–27	Toxicity, NOx, N ₂ O GWP
Hydrogen (LH ₂)	~2,200	5	not deep-sea viable 2026	Volumetric density

Sources: MPA Singapore Annual Bunker Statistics 2024 + 2025; S&P Global Platts Bunkerwire Q1 2026; DNV AFI Apr 2026; Methanol Institute Mar 2026; IRENA Renewable Methanol 2024; ICCT 2023; Renewable Fuels Association 2025; FAO Sugar Outlook 2025.

BIOFUELS — PROVES DEMAND

~1.3 Mt today

Largest deployable alternative. UCO/POME feedstock cap is the binding constraint.

ALCOHOL FUELS — BUILD THE PATHWAY

~0.4 Mt combined

Methanol + ethanol on the same engine platform. Ethanol — lower premium, larger production base.

E-FUELS — FOLLOW

<0.05 Mt

Renewable-H₂ gated. Inset financing bridges the cost gap before molecules flow.

III

One verified green tonne — *any fuel pathway* — pays three balance sheets.

A single green-fuel bunker tonne — biofuel, methanol, ethanol or e-fuel — is simultaneously **Scope 1** for the shipowner, **Scope 3 Cat 4 (upstream transport)** for the cargo owner, and **financed-emissions** for the lender under Poseidon Principles. Without an industry-grade allocation mechanism, that same tonne risks being claimed multiple times across these balance sheets — the central failure mode of voluntary carbon markets to date. C3's marketplace is fuel-agnostic: it verifies the abatement once against ISCC EU/Plus, RSB and ZEMBA chain-of-custody standards, allocates the credit via book-and-claim across the value chain, and ensures the tonne retires exactly once. That is what makes Scope 3 reductions audit-grade rather than reputational.



SINGAPORE HARBOUR — PORT OF SINGAPORE AUTHORITY ANCHORAGE

Singapore proves *demand is real and scaling* — biofuels grew sharply in 2025.

Singapore sold a new record **~56.8 Mt of bunkers in 2025**, of which **~1.3 Mt biofuel blends** plus rising methanol + ethanol stems. The port hosts the IMO-recognised methanol bunkering standard (TR 80-4:2024) and sits in the financial jurisdiction where C3 is incorporated. China + Korea + Japan deliver >93% of global newbuilds by CGT — meaning abatement, bunkering and verification physically converge in one APAC corridor. Even so, the green-fuel premium gap is global and regulation outside the EU remains fragmented — which is why C3 operates as a globally-operating insetting platform clearing trades across every flag, every fuel and every regime.

~56.8 Mt

SINGAPORE BUNKERS, 2025 — NEW ANNUAL RECORD
MPA Annual Bunker Statistics 2025

~1.3 Mt

BIOFUEL BLENDS 2025 — UP FROM 0.88 MT IN 2024
MPA

>93%

CN + KR + JP SHARE OF GLOBAL CGT DELIVERED, 2025
Clarksons Annual 2025

>1 Mt

MPA GREEN-METHANOL DEMAND ASPIRATION BEFORE 2030; GREEN-NH₃ INFRASTRUCTURE FROM 2026
MPA media communications, 2023

C3 turns *any verified green tonne* — biofuel, alcohol fuel, e-fuel — into a financial-grade Scope 3 reduction.

The same green-fuel bunker tonne — biodiesel, methanol, ethanol, or e-ammonia — sits as **Scope 1** for the shipowner, **Scope 3 Cat 4** for the cargo owner, and **financed-emissions** for the lender. C3 makes one verified tonne legible to all three balance sheets — and ensures it retires only once.

THE FOUR-STEP FLOW

01. VERIFY Verified incremental abatement	Vessel-specific baseline; well-to-wake LCA per ISO 14040/44 + ISO 14064-2; chain-of-custody under ISCC EU + RSB.
02. ISSUE Inset credits on C3 registry	1 credit = 1 tCO ₂ e. Single-issuance registry. Methodology, project, vessel, voyage carried as metadata.
03. ALLOCATE Book-and-claim to bills of lading	Cargo owner buys by tonnage; allocation links to specific BoLs, charter parties, voyage manifests.
04. RETIRE & REPORT Single retirement event	Reported in Scope 3 Cat 4 — CDP, ISSB, ESRS E1. Lender claims under Poseidon Principles. No double-count.

STAKEHOLDER BENEFIT GRID

 Project owner Shipowner, fuel producer or port operator. Earns US\$ 60–450/credit on verified abatement, recovering the green-fuel premium gap and de-risking newbuild FIDs. CII rating uplift lowers charter-out friction and financing cost.	 Cargo owner / charterer Buys verified tonne-mile abatement against contracted freight, plugging directly into ZEMBA-style pooled demand. Reductions land as Scope 3 Cat 4, SBTi-aligned, and book straight into CDP, ISSB and ESRS E1 disclosures with audit-ready chain of custody.
 Lender / lessor Anchors sustainability-linked loans, leases and charter financing to verified climate alignment. Inset-credit retirement evidences Poseidon Principles compliance and unlocks concessional pricing on green-tagged tonnage.	 ESG advisor / verifier Owns methodology, well-to-wake LCA and audit workflows across ISO 14040/44, ISO 14064-2, ISCC EU and RSB. Recurring third-party assurance fees scale with market growth and lock in long-cycle advisory mandates.

MECHANISM IN ONE LINE

Verify once. Allocate via book-and-claim. Retire only once. Same pipe — biofuels, methanol, ethanol, e-fuels.

Insetting recovers *25–45% of the alcohol-fuel premium* — without subsidy, without a single new molecule.

Take a 16,000-TEU methanol dual-fuel box ship on the Asia–Europe trade. The structural cost gap is large: e-methanol lands at ~US\$ 1,650/t against ~US\$ 540/t for VLSFO. Routing the verified abatement to APAC cargo owners through book-and-claim recovers a quarter to a half of that premium today, and avoided EU + IMO compliance cost stacks on top. **The same structure applies to bio-methanol, bio-ethanol and biofuel blends.**

Project	16,000-TEU MeOH-DF box ship on Asia–Europe trade
Volume	30,000 t/yr e-methanol (Chinese/Australian green-H ₂ producer; ex-Singapore)
Baseline	VLSFO; ISCC EU LCA defaults 2024
Abatement	~44,000 tCO ₂ e/yr WtW
Cost gap	~US\$ 33 million / year (e-MeOH 1,650/t vs VLSFO 540/t)
Marginal cost	~US\$ 750/tCO ₂ e
Cargo-owner claim	Korean electronics OEM; German auto group — Scope 3 Cat 4 (book-and-claim to BoL)
Inset clearing price	US\$ 250–450/credit (C3 scenario estimate)
Premium recovery	25–45% of green-methanol premium for Maersk

AVOIDED REGULATORY COST ON THE SAME 44 ktCO₂e/YR

US\$ 14–22 million / year

EU ETS + IMO GFI tier-2 share + FuelEU marginal. Avoided cost stacks on top of credit revenue from the cargo-owner claim chain.

- The flow.
1. Verified 44 ktCO₂e/yr issued to C3 registry under ISCC EU + RSB.
 2. Cargo owners buy by tonnage — book-and-claim assigns to specific BoLs.
 3. Cargo owners report Scope 3 Cat 4 reduction in CDP / ISSB / ESRS E1.
 4. Maersk monetizes credits; recovers 25–45% of premium.

NET EFFECT FOR MAERSK

Inset revenue + avoided regulatory cost = US\$ 25–40 million / year captured on the same 44 ktCO₂e/yr — without freight-rate hikes.

Biofuel blend + efficiency + C3 credits — three layers stacked into *recurring revenue*.

A 24-vessel Singapore-based dry-bulk operator (Kamsarmax + Capesize mix) builds a three-layer abatement programme. **Layer 1:** B30 ISCC-certified biofuel blended on EU-exposed legs, capturing FuelEU compliance and ETS reduction in the same molecule. **Layer 2:** fleet-wide slow steaming (16→13 kn ballast / 12 kn laden) plus Norsepower rotor-sail retrofits on 8 hulls, cutting voyage fuel ~25–30% on trade-wind routes. **Layer 3:** C3 verifies the incremental abatement, issues inset credits and allocates them via book-and-claim to APAC charterer Scope 3 chains — COFCO, ITOCHU, NYK, K Line, MOL and Cargill among the typical demand pool. Inset revenue layers **US\$ 15–30 million / year** on top of bunker savings, lifts ~60% of the fleet from CII C/D to B, and unlocks Poseidon-Principles-aligned cheaper finance — converting an opex play into recurring inset revenue.

Project	Singapore-based operator, 24 Kamsarmax/Capesize. Fleet-wide slow steaming (16→14.5 kn) + 8 Norsepower rotor sails + B30 biofuel on EU legs.
Baseline	2019 Sea Cargo Charter vessel-specific baselines
Abatement	~250,000 tCO ₂ e/yr (~180 kt slow steam + ~70 kt WAPS)
Bunker savings	~US\$ 18 million / year (slow-steam tranche MAC ≈ -10 US\$/t)
WAPS capex	US\$ 18 m fleet-wide; payback ~4 yrs unsubsidized
Voyage time penalty	+8–12%
Charterer claim chain	COFCO, ITOCHU, Cargill, plus downstream Asian steelmakers — Scope 3 Cat 4 via multi-year COA/TC
Inset clearing price	US\$ 60–120/credit (C3 scenario estimate)

OPERATOR P&L IMPACT – INSET REVENUE LAYERED ON TOP OF BUNKER SAVINGS

\$15–30 million / year

Converts an opex play into recurring climate-aligned revenue. Lifts ~60% of fleet from CII C/D to B. Unlocks Poseidon-Principles-aligned cheaper finance.

Strategic effect.

~250 ktCO₂e/yr of verified abatement flows across the APAC charterer chain — COFCO, ITOCHU, Cargill — and downstream into Asian steelmakers, food and consumer brands. Each stakeholder takes something tangible: the shipowner gains a **recurring revenue stream and cheaper debt**; the charterer **hits sustainability commitments without changing operations**; cargo brands earn a **defensible green-product claim that supports premium pricing**; the lender **lowers portfolio risk and gains a competitive Poseidon-aligned position**. Decarbonisation reprices from a single-actor cost into a multi-stakeholder asset.

STRATEGIC FLIP

*Operational savings **plus** recurring inset revenue **plus** Poseidon-aligned cheaper finance — three layers stacked on the same fleet.*

THE CLOSING THESIS

No fuel pathway scales fast enough physically. *The bottleneck is allocation, not technology.*

Biofuels prove demand. Methanol builds the alcohol-fuel pathway. Ethanol expands supply. E-fuels follow. None of them — separately or together — can scale fast enough to meet ~300–320 Mt/yr total bunker demand on the regulatory timeline.

Carbon pricing is already live in the EU via ETS and FuelEU Maritime, while the IMO Net-Zero Framework — blocked at MEPC in October 2025 and again in May 2026 — leaves the global price uncertain. Cargo-owner willingness-to-pay for verified Scope 3 reductions rises regardless of which regulator moves next. Abatement levers exist today, and many are already MAC-negative. The missing piece is the **financial infrastructure** to route those cargo dollars to the bunker tank where emissions actually occur — across every fuel, every flag and every regulatory regime. That is what C3 delivers.

THAT IS WHAT C3 IS BUILT FOR

Turns **shipowner carbon liability** into **recurring revenue**. Gives **brands audit-grade Scope 3 reductions** that hold up to regulators and customers. **Co-finances and de-risks** the underlying capex — turning a high-cost green-fuel bet into a backable project. Preserves **full fuel optionality** across biofuels, alcohol fuels and e-fuels, so neither side is locked into a single technology.

5

SUB-INDUSTRY CREDIT FLOWS

3

FUEL WAVES SERVED

\$60–450

US\$/CREDIT CLEARING RANGE

1×

RETIREMENT, THREE CLAIMS

TALK TO THE TEAM

carbon3.net

APP. — SOURCES

~30 sources cited inline. Selected bibliography below.

REGULATORS / STANDARD-SETTERS

IMO 4th GHG Study 2020; Resolution MEPC.377(80); MEPC 83 Press Brief, 11 Apr 2025; MEPC 84 Outcome, May 2026

Reg. (EU) 2023/1805 (FuelEU Maritime); Directive (EU) 2023/959 (EU ETS shipping)

MPA Singapore — Annual Bunker Statistics 2024 + 2025; Methanol Bunkering Standard TR 80-4:2024; Decarbonisation Blueprint 2050

European Commission DG CLIMA; Sea Cargo Charter; Poseidon Principles; ZEMBA

ISCC EU / ISCC Plus chain-of-custody rules 2024; RSB Global Fuel Certification 2024

INDUSTRY DATA & RESEARCH

Clarksons SIW 14 Mar 2026; Shipbuilding Report Annual 2025; World Fleet Register Q1 2026

Drewry Container Forecaster Q1 2026; Annual Review 2024-25; Alphaliner Top 100 Q1 2026

S&P Global Platts Bunkerwire Q1 2026; BloombergNEF EUA Outlook Q1 2026; Rystad Offshore Wind Q1 2026

DNV Maritime Forecast to 2050 (2024); Alt Fuels Insight Apr 2026

ICCT — CII Rating Distribution; Methane Slip from LNG Marine Engines 2023; Slow Steaming and Bulk Carrier Emissions

Biofuel + ethanol references (added in v3): IEA Bioenergy Task 39 — Marine Biofuels 2025; Methanol Institute — World Methanol Outlook Mar 2026; IRENA Renewable Methanol 2024; Renewable Fuels Association — World Fuel Ethanol Production 2025; FAO Sugar & Ethanol Outlook 2025; UMAS / Lloyd's Register Fuel Pathway Studies 2025; CE Delft MAC 2026.

AUTHORS

Ilja Nevolin
C3 CO-FOUNDER

ilya@carbon3.net

Paul Cruickshank
C3 CO-FOUNDER

paul@carbon3.net

Chris Chatterton
C3 CO-FOUNDER

chris@carbon3.net

"The challenge in maritime decarbonisation is not technology, but fairly distributing the green premium and benefits across the value chain."

— CARBON3, 2026 MARITIME OUTLOOK

STAY IN TOUCH

carbon3.net

linkedin.com/company/c3org

Methodology — Quantitative claims sourced inline. Inset-credit volumes and price bands are central-estimate scenarios anchored to MAC curves (CE Delft 2026), DNV alternative-fuels cost curves, and ZEMBA tender-implied pricing. Compliance cost projections use BloombergNEF EUA central scenario. IMO Net-Zero Framework GFI tier prices are illustrative and subject to formal IMO adoption, ratification, and possible amendment.