Smart Freight Centre

2025 Global Ocean Container Greenhouse Gas Emission Intensities

Suggested citation

Smart Freight Centre. Clean Cargo 2025 Global Ocean Container Greenhouse Gas Emission Intensities. May 2026.

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Smart Freight Centre (SFC) is an international non-profit organization focused on reducing the emission impacts of global freight transportation. Smart Freight Centre's vision is a zero-emission global logistics sector by 2050 or earlier, consistent with 1.5° pathways.

Smart Freight Centre's mission is to accelerate the reduction of logistics emissions by fostering collaboration within the global logistics ecosystem.

The SFC's goal is to mobilize the global logistics ecosystem, particularly members and partners, to track and reduce its greenhouse gas emissions to achieve 1.5° pathways.

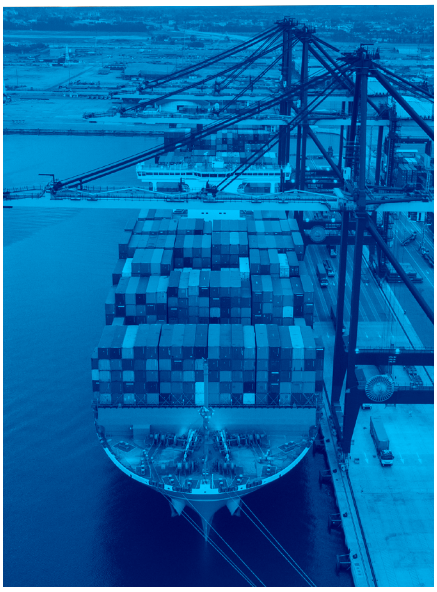
Clean Cargo

Clean Cargo is a collaborative initiative between ocean container carriers, freight forwarders, and cargo owners.

Clean Cargo serves as a source of high-quality containership greenhouse gas emission performance information that supports members in their work to decarbonize containerized ocean cargo transportation. Specifically, the Clean Cargo secretariat collects operational and technical data from ocean container carriers to generate containership emission performance information that:

- Offers access to primary data in accordance with the GLEC standardized framework and ISO 14083.
- By providing a standardized methodology and guideline for measuring and reporting carbon emissions associated with ocean container carriers, this enables members to identify areas for improvement and track progress in reducing emissions.
- Facilitates accurate greenhouse gas emissions inventory calculations for Clean Cargo members.
- This data-driven approach allows members to make informed decisions about their supply chain choices on ocean freight procurement decisions to minimize their carbon emission impact.

Clean Cargo also serves as a forum for decarbonization best practice sharing amongst members.



2025 Greenhouse Gas Emission Performance Information

The emission performance information presented in this report is calculated according to the Clean Cargo methods for a series of Clean Cargo ocean container transportation trade lanes. The information in Table 1 represents average annual performance[1] across all reporting Clean Cargo ocean container carrier members. For 2025, there were 18 reporting Clean Cargo carriers. These carriers were responsible for more than 85% of global ocean container freight capacity (by volume).

Clean Cargo emission intensities are based on emission factors that incorporate greenhouse gas emissions related to combustion and energy use resulting from all United Nations Framework Convention on Climate Change Kyoto Protocol greenhouse gases (currently, CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3)). The emission factors that underly the Clean Cargo emission intensities include emissions associated with the entire life cycle of the production and use of each energy source.

2025 Methodology update

As of 2026, using 2025 data, Clean Cargo greenhouse gas emission intensities are calculated using actual carrier-reported TEU-km data at vessel level and engine-specific fuel consumption data. This replaces the previous standardized 70% capacity utilization assumption and reflects the continued evolution of the methodology toward more granular, accurate, and primary data-based emissions accounting across trade lanes.

Clean Cargo greenhouse gas emission intensities shown in Table 1:

- For 2021–2024, are calculated based on each vessel's nominal capacity, assuming a 70% vessel capacity utilization factor.
- For 2025, are calculated using actual carrier-reported TEU-km data at vessel level, replacing the previous 70% utilization assumption.
- Differentiate between emission intensities for refrigerated cargo (refrigerated) and non-refrigerated cargo (dry) based on each vessel's nominal refrigerated container capacity and the vessel's reported number of days of operation.
- Reflect emissions associated with the entire life cycle of the fuel consumed in the carriers' vessels (that is, the Figure 1 emission intensities are "Well-to-Wake" intensities).

Note: Due to the methodology change in 2025, values for 2025 are not directly comparable with 2021–2024 values without adjustment. A Clean Cargo industry-aggregated correction factor may be used to support like-for-like comparison across reporting years.Clean Cargo carrier member data used in calculating the emission intensities undergoes third-party verification.

1 Ocean cargo shippers and freight forwarders interested in carrier-specific emissions performance information are welcome to contact Smart Freight Centre at info@smartfreightcentre.org to learn more about becoming an SFC member and signing up for Clean Cargo.

Table 1 Average carrier dry and refrigerated container emission intensities in grams of carbon dioxide equivalent per twenty-foot equivalent unit-kilometre ($gCO_2e_/TEU$-km). Intensities reflect Well-to-Wake emission factors. Values for 2021–2024 are based on the previous 70% vessel capacity utilization assumption, while 2025 values are based on actual carrier-reported TEU-km data at vessel level.

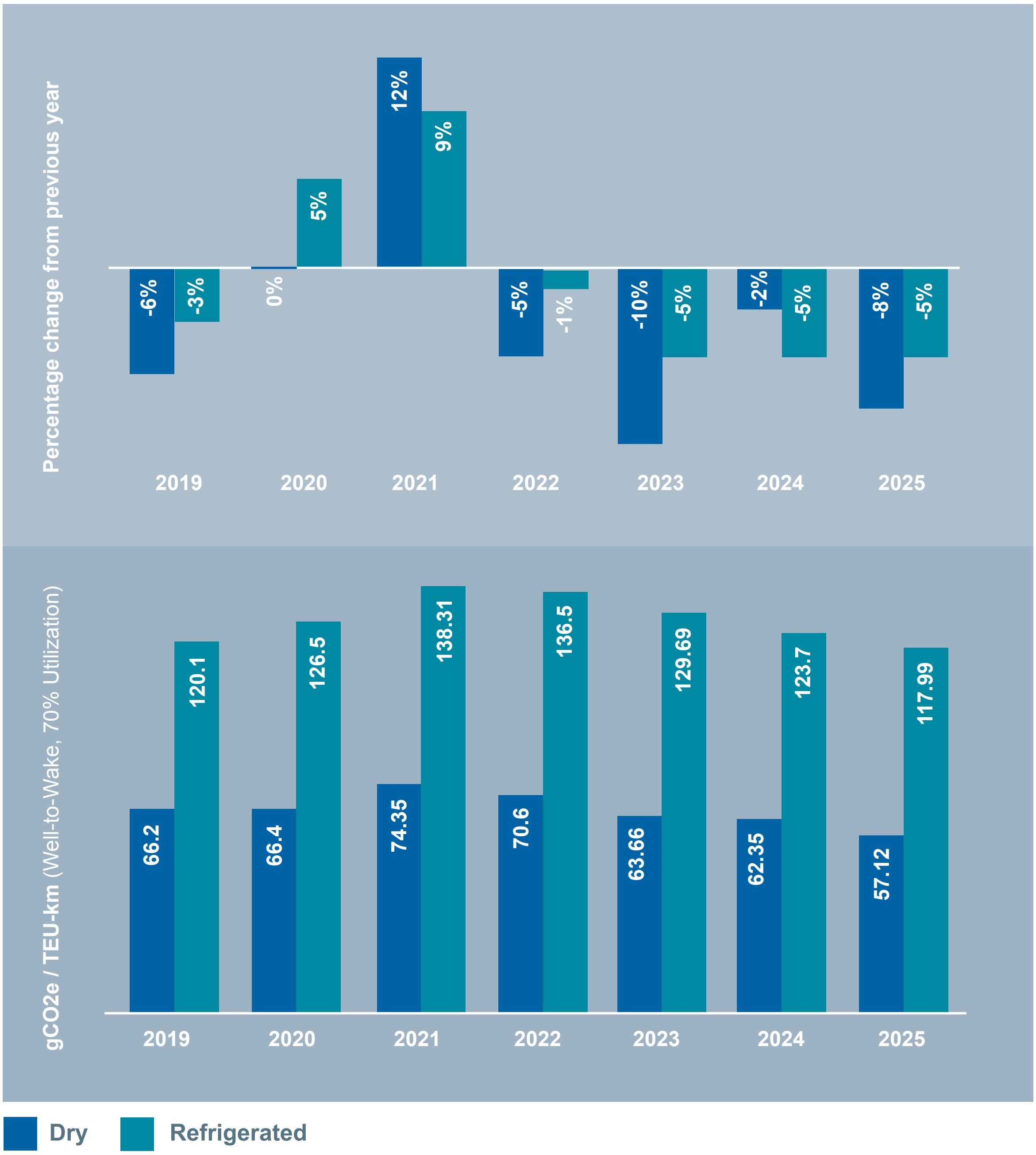
TRADE LANE	2025 Number of vessels: 4464		2024 Number of vessels: 4342		2023 Number of vessels: 4,098		2022 Number of vessels: 3,971		2021 Number of vessels: 3,737	
	Dry	Refrigerated	Dry	Refrigerated	Dry	Refrigerated	Dry	Refrigerated	Dry	Refrigerated
Asia to-from Africa	91.6	175.8	76.7	140.2	72.3	140.6	83.8	151.0	87.7	155.4
Asia to-from Mediterranean/Black Sea	44.7	105.2	45.4	101.2	42.1	109.0	48.7	114.5	48.0	111.4
Asia to-from Middle East/India	73.4	148.2	68.2	131.0	64.2	127.9	68.6	133.1	73.7	137.5
Asia to-from North America East Coast/Gulf	53.5	120.4	51.3	106.5	54.1	114.0	63.1	123.4	64.7	120.4
Asia to-from North America West Coast	57.4	121.0	58.3	116.9	56.8	120.7	65.7	131.7	71.3	138.2
Asia to-from North Europe	42.2	104.1	40.8	96.2	38.7	100.6	39.6	102.1	42.3	102.0
Asia to-from Oceania	95.4	171.9	83.4	148.8	85.0	152.4	96.0	165.6	100.7	168.6
Asia to-from South America (Including Central America)	64.0	135.3	58.9	118.3	61.0	120.7	70.8	127.3	71.5	125.9
Europe (North and Med) to-from Africa	124.0	234.1	82.5	153.8	89.4	163.9	99.7	172.7	102.2	174.0
Europe (North and Med) to-from S America (Inc Cent America)	104.5	202.6	74.9	141.6	71.7	138.3	81.6	142.8	79.6	139.7
Europe (North and Med) to-from Middle East/India	71.3	146.8	63.8	121.1	54.6	121.1	63.2	129.5	68.5	132.6
Europe (North and Med) to-from Oceania (via Suez/via Panama)	124.5	208.7	79.0	136.4	78.6	139.6	81.9	141.4	82.8	139.5
Mediterranean/Black Sea to-from North America East Coast/Gulf	92.2	174.7	82.6	150.7	80.4	152.0	92.0	167.0	88.4	154.0
Mediterranean/Black Sea to-from North America West Coast	95.4	195.0	68.4	140.2	56.4	130.6	48.9	122.8	62.3	131.1
North America East Coast/Gulf/West Coast to-from Africa	175.0	319.7	103.9	176.3	111.3	180.1	131.7	192.2	134.2	193.5
North America East Coast/Gulf/West Coast to-from Oceania	105.8	207.0	73.7	129.5	74.1	133.1	80.0	145.1	109.7	173.7
N America E Coast/Gulf/W Coast to-from S America (Inc Cent America)	116.3	215.4	91.6	165.2	84.1	152.6	88.1	153.3	91.6	156.5
N America E Coast/Gulf/W Coast to-from Middle East/India	89.3	151.8	73.3	126.8	72.8	135.0	75.3	138.6	79.9	137.7
North Europe to-from North America East Coast/Gulf	89.6	165.7	78.4	142.3	78.0	143.6	88.9	160.6	92.2	159.5
North Europe to-from North America West Coast*	110.4	194.8	84.9	155.1	–	–	76.4	142.0	88.6	170.0
South America (Including Central America) to-from Africa	210.6	341.5	117.7	200.1	101.0	174.9	138.2	206.6	110.6	186.8
Intra Africa	222.3	428.1	116.8	229.2	115.1	214.0	133.7	224.9	135.2	233.0
Intra North America East Coast/Gulf/West Coast	304.8	414.2	200.0	256.4	214.5	294.5	202.9	283.0	171.5	233.7
Intra South America (Including Central America)	172.5	313.2	100.0	180.6	100.1	176.3	116.4	193.0	108.4	176.0
South East Asia to-from North East Asia	100.4	185.0	94.4	164.1	90.1	157.8	98.6	169.6	98.1	168.3
Intra North East Asia	126.6	235.0	94.5	174.2	100.7	177.1	110.7	184.8	118.9	187.8
Intra South East Asia	150.8	267.6	118.0	197.9	116.1	195.2	125.2	202.1	117.4	193.2
North Europe to-from Mediterranean/Black Sea	105.3	199.7	94.0	165.5	64.4	131.0	73.1	140.5	104.2	173.9
Intra Mediterranean/Black Sea	194.7	376.4	139.5	255.5	137.5	240.2	158.8	264.8	148.2	250.2
Intra North Europe	171.9	299.8	150.7	248.5	141.3	234.9	140.3	232.9	143.3	233.2
Intra Middle East/India	153.	277.8	99.6	180.7	106.3	187.2	117.6	197.1	126.1	223.2
Other	76.1	158.2	72.0	140.8	84.9	162.9	85.9	164.3	106.7	179.2
Average Across all Trade Lanes	69.7	144.0	62.4	123.7	63.7	129.7	70.6	136.5	74.4	138.3
Average with correction factor of 1.22	57.1	118.0								

* None of the Clean Cargo Ocean Container Carriers reported vessels on this tradelane in 2023

Figure 1 2018–2025 trend in global average Clean Cargo carrier emission intensities, expressed in gCO_2e/TEU-km using Well-to-Wake emission factors and a 70% vessel capacity utilization basis. The 2025 values have been recalculated to a 70% basis from actual carrier-reported TEU-km data using the Clean Cargo industry-aggregated correction factor of 1.22.

Emission Intensity Trends

Clean Cargo carrier GHG emission intensities for 2025, when averaged across all reporting carriers and trade lanes and recalculated to a 70% vessel capacity utilization basis using the Clean Cargo industry-aggregated correction factor of **1.22**[2], were approximately **8.4% lower for dry containers** and **4.6% lower for refrigerated containers** compared with 2024 emission intensities.



2 The correction factor is calculated at the aggregated Clean Cargo level using data from participating carriers that provided consent for this purpose.

Overall trends

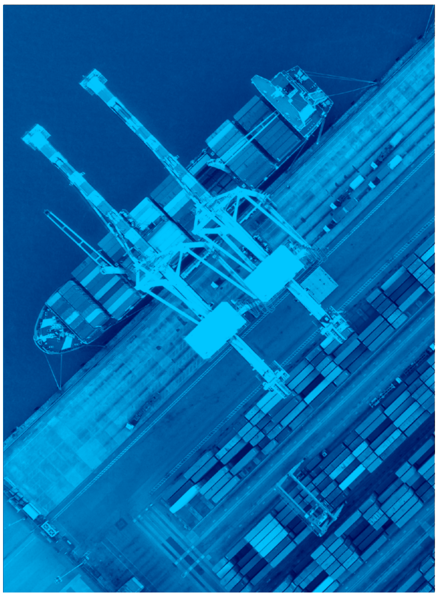
Potential Drivers of the Intensity Changes

In 2025, container shipping continued to operate under challenging conditions, with geopolitical tensions, volatile trade flows, and the ongoing disruption to Red Sea transits sustaining a complex operational environment across the year. Despite this, global container shipping emission intensities improved compared to levels recorded in 2024, when Cape of Good Hope rerouting had driven emissions performance to its worst point in recent years. The gradual operational adaptation to longer routing, combined with the entry of new, fuel-efficient tonnage into the market, were the primary factors behind this recovery. Fleet growth outpaced demand through much of the year, pushing carriers to deploy capacity management tools - including slow steaming, blanked sailings, and service adjustments that, while commercially defensive, also contributed to lower emissions per container transported on a significant number of trades.

The continued uptake of alternative fuels further supported intensity improvements. LNG-fuelled vessels consolidated their role in the active fleet, and methanol propulsion gained ground as a growing number of dual-fuel newbuilds entered service, contributing to a gradual reduction in the average carbon intensity of the deployed fleet. At the same time, trade policy disruptions - most notably the successive rounds of US tariff announcements - introduced abrupt shifts in cargo volumes and fleet deployment patterns that periodically pushed emissions upward on specific trades, particularly where carriers responded by increasing sailing speeds to reposition tonnage or meet frontloaded demand. These countervailing pressures meant that emissions performance varied significantly across trade lanes throughout the year.

The regulatory environment in 2025 was marked by both significant progress and unresolved uncertainty on the path toward decarbonization. In April, at MEPC 83, IMO Member States approved a set of mid-term GHG reduction measures combining a global fuel standard with a GHG pricing mechanism, advancing the regulatory framework further than at any previous session. However, the formal adoption of these measures, originally scheduled for an extraordinary MEPC session in October 2025, was deferred by one year to allow for further consultations among Member States, leaving the industry without the binding long-term regulatory signal it had anticipated.

Work on implementation guidelines continued in the interim, and the tightened CII reduction factors for 2027–2030 adopted at MEPC 83 entered the regulatory baseline. The continued operation of EEXI and CII requirements across the fleet maintained the established pressure on vessel-level carbon efficiency, though the absence of a confirmed adoption timeline for the broader framework introduced a degree of uncertainty into industry decarbonization planning that had not been present at the close of 2024.



Fuel Mix and Consumption Trends

In 2025, the Clean Cargo reporting fleet continued to consume conventional fossil fuels as its primary energy source, with very low sulphur fuel oil (VLSFO) and high sulphur heavy fuel oil (HSHFO) together accounting for the substantial majority of total reported consumption. Both categories grew year-on-year, broadly consistent with overall fleet expansion and the sustained effect of longer Cape of Good Hope routings on total fuel demand. Low sulphur fuel oil variants (LFO ULSFO and LFO VLSFO) declined notably compared to 2024, suggesting a continued consolidation of the reporting fleet around VLSFO as the primary compliant conventional fuel, likely reflecting both regulatory alignment with IMO sulphur limits and newbuild fuel system preferences.

Among alternative fuels, liquefied natural gas (LNG) remained the dominant non-conventional energy source and posted the largest absolute growth year-on-year, reflecting the progressive entry into service of LNG dual-fuel vessels across the reporting membership. Biodiesel consumption increased sharply compared to 2024, indicating growing engagement with bio-blend compliance strategies, while methanol - both fossil-derived and in its bio-based form - recorded meaningful growth from a very low base, consistent with the first commercial deployments of methanol-capable newbuilds in the fleet. Bio-LNG similarly expanded, albeit from negligible prior-year volumes. Hydrotreated vegetable oil (HVO) declined modestly, and liquefied petroleum gas (LPG), in both butane and propane variants, recorded no consumption in either year.

Taken together, the 2024–2025 comparison points to two concurrent trends:

- Aggregate fossil fuel consumption grew, driven by fleet expansion and the additional distance demand imposed by continued Cape of Good Hope rerouting - both factors explored in the preceding section.
- While alternative fuels continued to represent a small fraction of total consumption, the direction of travel across nearly every non-conventional category was consistently positive. Notably, LNG growth was structurally driven by newbuild deliveries rather than operational substitution, lending it greater durability as a trend.
- The emergence of bio-methanol consumption, absent from the dataset entirely in 2024, marks a meaningful threshold, reflecting the first commercial deployments of methanol dual-fuel vessels within the reporting membership.
- The sharp rise in biodiesel consumption, while in part a response to tightening CII compliance requirements, nonetheless translated into a tangible reduction in carbon intensity across the blended fuel volume consumed. Across these categories, the 2025 data suggests that the

fuel transition within the Clean Cargo fleet, though still in its early stages, is broadening in both the number of alternative fuel types in active use and the scale of their deployment - a trend that, if sustained, should contribute progressively to lower emission intensities in the years ahead.

- Separately, Clean Cargo tracks low-emission fuel volumes allocated through voluntary market mechanisms. These volumes declined notably year-on-year and are reported separately from the general fuel consumption categories discussed above. This distinction is important because voluntary market allocations follow a different accounting logic and must be kept separate to avoid double counting with broader biofuel and low-emission fuel consumption reported in the general fuel mix.

Port Pair Emission Intensity Analysis, 2024–2025

The 2025 Clean Cargo port pair dataset covers over 42,000 origin-destination combinations, spanning 679 origin and 673 destination ports, representing approximately 1.4 million recorded trips, a modest increase in both coverage and trip volume compared to the 2024 dataset, which comprised around 40,700 port pairs across 667 origin ports. The expansion of the dataset between years reflects an increase in the number of active trade routes captured, with approximately 12,300 port pairs appearing in 2025 that were not present in 2024, and around 10,900 pairs recorded in 2024 not appearing in 2025.

The following key observations emerge from the comparative analysis:

1. The intensity distribution shifted toward higher values.
The intensity distribution shifted toward higher values in 2025, reflecting both operational disruptions on key trade lanes and the methodology change from a fixed 70% utilization assumption to actual carrier-reported TEU-km. In 2024, most trip volume was concentrated in port pairs below 150 gCO_2e/TEU-km WTW; in 2025, while high-frequency pairs in the sub-100 range increased substantially, a greater share of port pairs recorded intensities in the 150–300 range, partly because port pairs with lower actual TEU-km relative to the previous assumed basis naturally show higher emission intensities.

2. A minority of port pairs drove meaningful intensity improvements. Among high-frequency matched pairs, those recording intensity reductions were concentrated on intra-European short-sea routes - including corridors connecting Northern European hub ports such as Hamburg, Gothenburg, and Rotterdam - suggesting targeted efficiency gains on specific feeder trades rather than broad fleet-wide improvement.

3. The most significant intensity increases on matched pairs were concentrated in specific trade corridors. Port pairs connecting Caribbean island ports with US East Coast gateway ports, and Central American feeder services to Port Everglades, recorded among the sharpest year-on-year intensity increases, likely reflecting vessel deployment changes and lower load factors on these trades.

4. The busiest port pairs remained the most efficient. The highest-frequency origin-destination combinations in 2025 - concentrated on intra-Asian corridors and Asia–Northern Europe deep-sea trades - continued to record the lowest intensity values in the dataset, reinforcing the structural relationship between vessel size, load factor, and emissions efficiency on high-volume trades.

5. Reefer intensity consistently tracked at approximately 85–90% above dry cargo intensity. This premium remained stable across geographies and trade distances in both years, confirming it as a structural rather than operational characteristic of refrigerated cargo transport.

6. Short-sea and feeder trades remained the highest-intensity segment in both years. Western Mediterranean feeder operations - notably services linking Spanish mainland ports with the Canary Islands - and North African feeder routes to Southern European hubs continued to record the highest intensity values in the dataset in 2025, a pattern consistent with 2024.

7. New pairs entering the 2025 dataset showed a higher average intensity than the matched pair base. The approximately 12,300 port pairs appearing for the first time in 2025 recorded a mean intensity above the fleet-wide trip-weighted average, suggesting that newly captured routes tend to be shorter, lower-volume, or served by less efficient tonnage than the established pair base.

8. Total trip volume grew modestly year-on-year. The approximately 5% increase in total recorded trips between 2024 and 2025, combined with fleet growth documented elsewhere in this report, is consistent with higher overall fuel consumption in absolute terms even where per-unit intensity figures vary by trade lane.

9. No high-frequency pair exceeded 200 gCO_2e/TEUkm in either year. Among port pairs recording 500 or more trips, all fell within the lower half of the intensity distribution in both 2024 and 2025, confirming that the most heavily utilised corridors in the Clean Cargo dataset are consistently served by more efficient operations regardless of year.

Smart Freight Centre

Using the 2025 Emission Performance Intensities

For further information on how to apply the 2024 Clean Cargo greenhouse gas emission intensities in greenhouse gas emission footprint calculations, please see the Global Logistics Emissions Council Framework.

Information

For more information on Smart Freight Centre or Clean Cargo, please visit our website at www.smartfreightcentre.org

You can also contact Smart Freight Centre directly by email at info@smartfreightcentre.org