Clean Cargo Working Group Carbon Emissions Accounting Methodology

The Clean Cargo Working Group Standard Methodology for Credible and Comparable CO_2 Emissions Calculations and Benchmarking in the Ocean Container Shipping Sector

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About This Methodology Report

This methodology report was written by Angie Farrag Thibault, project director of Clean Cargo Working Group (CCWG), and members of CCWG, particularly Mads Stensen of Maersk Line and Gorm Kjærbøll of Electrolux, on behalf of all members of the Working Group. It was commissioned and funded by the initiative, though all final content decisions were made by BSR in its role as the secretariat and facilitator of CCWG.

The purpose of this report is to provide a detailed description of the CCWG CO_2 emissions accounting methodology, both for internal use and to promote understanding externally. The CCWG methodology for calculating CO_2 emission factors is the ocean container segment industry standard. We wish to ensure its applicability and proper use for performing emissions calculations, benchmarking, and evaluation of performance.

This methodology is particularly relevant for shipping companies reporting their vessel emissions data, shippers calculating their emissions performance and comparing carrier performance, third parties including classification firms, as well as other modal initiatives and authorities working on emissions accounting in the global transportation industry.

To inform and shape this report, the CCWG secretariat coordinated a drafting committee of members, hosted roundtables to review the details (most recently in Spring 2014), and conducted an internal review with Group members as well as an external review with academic and sector experts. We would like to thank Professors Alan McKinnon, Kuhne Logistics University; Edgar Blanco, MIT; Mr. Magnus Swahn, Network for Transport and Environment; and Ms. Andrea Schön, EcoTransit, for their review and feedback.

This report presents the current methodology as of 2014. Further developments in the methodology and its application are ongoing as the Group continues to work on greater accuracy and consistency. Further integration of best available data is also projected as improved data-capture technology becomes available in the debates over global transport emissions calculations.

Please direct all questions or comments to ccwg@bsr.org.

ABOUT BSR

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ABOUT CLEAN CARGO

BSR's Clean Cargo Working Group (CCWG) is a leading global carrier-shipper initiative dedicated to environmental performance improvement in marine container transport through measurement, evaluation, and reporting. Further information about the Group and its members can be found here.

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1. Objectives

1.1 Introduction

The pressure on shippers, logistics providers, and container carriers to monitor, report, and reduce CO_2 emissions continues to increase. Shippers, who own the cargo, freight forwarders, and container carriers all wish to show their customers, investors, and others their commitment to responsible operations and to reducing their environmental impacts. The need for a platform to develop common industry specific solutions like a common CO_2 emissions calculation methodology is crucial in order to fulfill these ambitions.

The Clean Cargo Working Group (CCWG) provides such a global business-to-business platform for shippers, freight forwarders, and container carriers. CCWG is dedicated to improving environmental performance in container shipping by developing standardized methodologies to measure environmental impacts and easy-to-use tools that meet the needs of shippers, freight forwarders, and carriers and enables them to measure, evaluate, and reduce environmental impacts.

With CCWG methodologies and tools, container carriers can report their CO_2 performance to shippers and freight forwarders in a credible and comparable format based on the only recognized industry standard for calculating CO_2 emissions from container shipping—the CCWG CO_2 emissions calculation methodology ("CCWG CO_2 methodology").

CCWG currently comprises around 40 leading multinational shippers, freight forwarders, and container carriers who have access to the best high-quality environmental dataset in the container shipping industry. The dataset represents more than 85 percent of global container capacity.

This methodology report provides details about the CCWG CO_2 methodology to enable CCWG members, as well as non-members, to understand the CO_2 data calculations and ensure proper application of the CO_2 data.

1.2 Objectives with the CCWG CO2 Methodology

The general objective of the CCWG CO_2 Methodology is as follows: *to establish a robust and user-friendly industry standard on how to collect, calculate, and use CO_2 emission data for ocean container transportation based on actual (primary) operational and static data directly from container carriers, including fuel consumption and distance travelled, as well as other factors defined in table 1 on page 6.*

CCWG promotes the *establishment of ONE common standard for the calculation of CO_2 emissions for ocean container transportation*. Today the CCWG CO_2 methodology is the only existing and broadly recognized industry standard suitable for this purpose. One common CO_2 methodology a) enables high-quality and credible CO_2 calculations, b) avoids confusing and contradictory CO_2 calculations, and c) avoids double reporting for carriers and frees up additional resources for performance improvements.

Applying the CCWG CO_2 methodology provides credibility to the following:

1. **Describing and explaining how CO_2 emission factors are calculated** and how the CCWG CO_2 methodology is aligned with internationally recognized standards such as the GHG Protocol supply chain guideline,

the European EN 16258 standard, and IMOs EEOI guidelines (chapter 2).

2. **Ensuring standardized and comparable CO_2 emission calculations for shippers and carriers** (chapter 3), which encompasses:
   - Calculation of CO_2 emissions from transporting individual or groups of shipments;
   - Calculation of absolute CO_2 footprint for shippers.

3. **Benchmarking carrier's CO_2 performance** (chapter 4), which:
   - Enables shippers to make informed buying decisions in their supply chains and drive further improvements among container carriers;
   - Enables container carriers to make informed decision-making to improve their performance.

CCWG recognizes that this methodology must be sensitive to developments in the industry, so the Group continues to work with industry, academia, and scientists to support the evolution of this standard.

1.3 Basic Principles

While the CCWG CO_2 methodology is based to the extent possible on central principles of internationally recognized standards such as the GHG Protocol supply chain guideline, the European EN 16258 standard, and IMOs EEOI guidelines, it is tailor-made for the container shipping sector.

The basic principles include:

- CO_2 emission calculations should be credible, verifiable, comparable, and as precise as possible, yet simple and practical for carriers and shippers to apply and follow;
- Total CO_2 emissions related to container transportation must be captured (including emissions from empty back haul sailing/repositioning of containers) and allocated to full containers;
- Allocation must to the extent possible be based on capacity-limiting factors, which for container ships can be defined in container (TEU) capacity and Dead Weight Tonnage (DWT) restrictions;
- Comparability of vessel performance is the main objective.

1.4 Boundaries

The current CCWG CO_2 methodology covers container transportation on ocean-going container vessels. It is not applicable to non-containerized cargo transported in bulk, break-bulk, tank, Ro-Ro, and ferry vessels.

For calculation of emissions from other transportation modes, reference is made to the Global Logistics Emissions Council (GLEC). The CCWG is a member of the GLEC, an initiative that unites like-minded groups specializing in CO_2

calculations for other transportation modes aiming to ensure comparable CO_2 calculations across the transportation supply chain[1].

The CCWG CO_2 methodology only includes CO_2 emissions and no other GHG emissions (CO_2 equivalents: CO_2e). Given that all relevant energy consumption from ocean container transportation stems from fuel combustion on vessel engines, CO_2 emissions is an appropriate approximation of total GHG emissions.

The CCWG CO_2 methodology includes CO_2 emissions from tank-to-wheel (TTW, or tank-to-propeller) though not well-to-wheel (WTW, including upstream emissions/energy from “production” of fuel and infrastructure). Detailed global factors for all transport modes to adjust TTW data to include upstream emissions from oil production as well as transport infrastructure are not yet aligned and therefore remain complex to implement at this stage. The CCWG CO_2 methodology may be adjusted in the future to include WTW emissions once consensus across all transport modes is established through processes such as GLEC. At this time, CCWG CO_2 data may be adjusted to include WTW emissions by individual users. In such cases respective users are to specify adjustments and ensure that the adjustments are transparent.

IMO provides default global average WTW CO_2 data for Heavy Fuel Oil (HFO) and Marine Diesel Oil (MDO)[2]. CCWG recommends using these adjustment factors in case a user wants to include WTW emissions. The WTW adjustment factors can be applied by multiplying the TTW CO_2 emissions by the WTW adjustment factor[3]:

- HFO well-to-wheel adjustment factor = 1.086 g CO_2 WTW / g CO_2 TTW
- MDO well-to-wheel adjustment factor = 1.212 g CO_2 WTW / g CO_2 TTW

[1] CCWG are experts in ocean transportation and not necessarily experts in goods transportation on other transportation modes. Therefore CCWG is working on aligning the CCWG CO_2 methodology with other initiatives specializing in CO_2 calculations for other modes. This will enable credible CO_2 calculations across the whole transportation supply chain instead of only focusing on ocean transportation. This will also enable CCWG members to access high-quality data for all transportation modes.

[2] Source: Second IMO GHG Study 2009.

[3] Based on content of fuel-mix data derived from the 2012 reported data set from CCWG carriers, an appropriate average well-to-wheel adjustment factor = 1.088g CO2WTW / g CO2 TTW.

2. CO2 Emission Factors: The CCWG CO2 Measurement

2.1 Emission Factor Definition

To calculate CO_2 emissions from the transportation of a specific container or from a specific amount of cargo a relative CO_2 measure is needed — **an emission factor**. An emission factor is a relative measure for how much CO_2 is emitted per cargo unit transported a certain distance. The cargo unit for container shipping is the transport of a container, and the relative measure used by CCWG is the standard TEU container (see TEU definitions in section 3.3). Emission factors in the CCWG CO_2 methodology are expressed as grams of CO_2 emissions per container transported 1 kilometer (g CO_2/TEU-KM).

2.2 From Raw Data to a Vessel Specific Emission Factor

The CCWG CO_2 methodology distinguishes between regular containers (dry) and refrigerated containers (reefer) because there is a significant difference between the energy used for propulsion of dry containers and the energy used for propulsion and cooling of reefer containers. The calculation formulas for calculating a vessel-specific emission factor for both dry and reefer containers are as follows:

$$CO2\ dry = \frac{IMO\ Carbonconversion\ \ factor * (Total\ \ fuel\ consumption - Total\ reefer\ \ fuel\ consumption)}{(dist.\ sailed\ *\ vessel\ TEU\ \ capacity)}$$

$$CO2\ reefer = CO2\ dry + \frac{IMO\ Carbonconversion\ \ factor * Total\ reefer\ \ fuel\ consumption(**)}{(dist.\ sailed\ *\ reefer\ TEU\ \ capacity)}$$

(**)

$$Total\ reefer\ \ fuel\ consumption = reefer\ TEU\ capacity * reefer\ consumption\ \ per\ \ year\ (const.) * \frac{days\ vessel\ operated}{365}$$

Table 1: Definitions for criteria and advised sources

Criteria	Factor / definition	Source
IMO carbon conversion factor	Heavy fuel oil (HFO): 3114 g CO_2/kg Diesel/gas oil (MDO/MGO): 3206 g CO_2/kg	IMO
Total fuel consumption (in metric tons)	All types of fuel consumed on all vessel engines (main engine, auxiliary engines, and boilers) both at sea and during port stay for the respective full reporting year	Reported in operators reporting system aligned with the vessels logbook
Distance sailed	Total distance sailed (km) at sea and in ports for the respective full reporting year	Reported in operators reporting system aligned with the vessels logbook
Vessel TEU capacity	The maximum (nominal) number of TEU a vessel can carry defined as “The MAXIMUM number of TEU capable of being loaded onto a specific ship while at STATUTORY summer draft, and complying with the SOLAS safe visibility regulation (Chapter V "Safety of navigation," Regulation 22 "Navigation bridge visibility").	General Agreement, Capacity Plan or other approved vessel documents
Reefer TEU capacity	Number of reefer plugs on the vessel* number of TEU per reefer plug, where:	

	• "number of TEU per reefer plug" = 1.9 TEU/reefer plug	CCWG carrier average
Reefer consumption per year	A constant defined as: 1914 kg/reefer year = 3.8 KW* 0.23 Kg/KWh* 365 days* 24 h/day* 25%, where: • 3.8 KW is the average energy consumption per reefer container • 0.23 Kg/KWh is a conversion constant • 25% is the average reefer plugs utilization per year	CCWG carrier average Conversion constant CCWG carrier average
Days vessel operated	Number of days the vessel is in service during the year	Reported in operators reporting system aligned with the vessels logbook

For inclusion of utilization data see section 3.2

2.3 Data Collection

All carriers submit data annually according to a standardized reporting format coordinated and overseen by the CCWG secretariat, which is responsible for conducting high-level quality checks of the submitted data. The data submission covers the full reporting year and all vessels (owned and charter) operated by the carrier, excluding spot charter vessels hired for less than six months. Carriers report the following raw data per vessel:

» Vessel name/IMO number
» Total fuel consumption split into HFO and MDO
» Actual distance sailed over ground as per logbook
» Nominal TEU capacity (see TEU definition in section 3.3)
» Number of reefer plugs on the vessel
» Days vessel operated
» Trade lane on which vessel is deployed on December 31 of the respective reporting year (e.g., Asia-North Europe) (see section 2.5 for more details)

In addition, all carriers submit the yearly average vessel utilization data per trade lane. This data is used to calculate the industry average utilization factor (see section 3.2).

2.4 Data Verification

The CCWG has developed a "Procedure and Guidance" document to verify the raw data that is reported and which contributes to the calculation of the CO_2 and SOx emission factors. The verification guidelines follow general principles of independent verification and have been developed in collaboration with Lloyds Register, with input from Bureau Veritas and DNV GL (formerly known as Det Norske Veritas and Germanische Lloyd). The scope and boundaries of the audit include:

» The full operated fleet, including both owned and charter vessels, and excluding spot charter vessels hired for less than six months.
» Review of internal processes and systems used by the company to report the data and sample testing the transfer of that data from company systems to the CCWG reporting template.

The verification does not cover the calculations of specific CO_2 emissions, because several other factors may influence this calculation (see chapter 3 for more details on specific CO2 calculations).

The baseline requirement for third parties interested in undertaking this verification work is to be a ship-classification society with experience undertaking such verification.[4] All carriers must disclose whether reported data has been verified or not and which verification company has issued the verification. Carriers are required to submit their verification statement to the CCWG secretariat. CCWG members are able to access verified carrier data from the secretariat.

2.5 Aggregated Emission Factors

The vessel-specific emission factor calculated for each vessel is the most detailed emission factor calculated, but it is not suited for shippers. Shippers have no information about which vessel carries any given container. Instead, the shippers have information about the port of departure and the port of arrival, as well as the trade lane (e.g., Asia-North Europe). As a result, a trade lane-aggregated emission factor is more suitable for shippers.

A main objective of the CCWG CO_2 methodology is to ensure comparability between CO_2 data. Nonetheless, all vessels cannot and should not be compared. Vessels on different trade lanes serve different purposes and operate under different circumstances, including vessel size limitations or commercial issues. Therefore individual vessel CO_2 performance across different trade lanes can vary significantly and cannot easily be compared. Vessels on the same trade lane, however, operate under identical operational and commercial circumstances and in principle deliver the same service to the shipper. Therefore the CO_2 emission performance of these vessels can be compared directly.

In light of this, the CCWG has defined 25 trade lanes, which include the main trade lanes in the world (see trade lane definitions in annex 1). The trade lane average emission factor represents the average CO_2 performance of all vessels from a given carrier sailing on a trade lane (e.g., Asia-Europe). When a carrier submits data to the CCWG, individual vessels are divided into a trade lane in order to calculate the trade lane average emission factors.

The principle for calculating the aggregated emission factors from a group of vessels (e.g., all vessels on a given trade lane) is straightforward: <u>Include all relevant vessels and weight the vessel-specific emission factors according to TEU*km.</u>

Carriers serve many shippers who are not part of the CCWG. Hence most CO_2 calculations do not go through CCWG, but directly from the carrier to the shippers. As the objective of the CCWG CO_2 methodology is to standardize CO_2 emission calculations across all shippers, freight forwarders, and shippers, it must be stressed that all carriers should follow the CCWG CO_2 methodology and the above principle for calculating aggregated emission factors when reporting to shippers, including non-CCWG members. Indeed this guarantees the comparability of CO_2 calculations. This also applies if carriers calculate and

[4] Classification societies interested in participating should contact the CCWG secretariat for more details.

monitor aggregated CO_2 emissions factors for specific services and use these in CO_2 calculations for shippers.

Table 2: CO_2 emission factors provided by CCWG to CCWG members

Emission factors	How it is calculated	When this emission factor can be applied	Comments
Vessel-specific emission factor	The specific performance of the individual vessel.	Carriers can benchmark the performance of individual vessels in their fleet. Not relevant for shippers because they do not know the specific vessel the cargo is transported on.	Should only be used by carriers.
Carrier-specific trade lane average emission factor	Average of all vessels operated by the carrier sailing on a specific trade lane weighted according to the TEU*km per vessel.	This information is highly relevant to shippers and should be used to calculate CO_2 emissions from shipments as well as to benchmark trade lane performance between carriers.	(Can be provided by individual CCWG carriers to non-CCWG members.)
Industry average per trade lane	Average of all vessels operated by all carriers sailing on the respective trade lane weighted according to the TEU*km per vessel.	This is the industry average performance per trade lane. This serves as the baseline for benchmarking of carrier performance. This baseline is useful for both carriers and shippers who want to benchmark performance.	Only CCWG can calculate the Industry averages per trade lane. The CCWG CO_2 trade lane averages are publicly available here

2.6 CO_2 Data for Vessel Sharing Agreements (VSA's)

A typical container carrier fleet consists of both owned and charter vessels. Furthermore different container carriers share vessels in Vessel Sharing Agreements (VSA's) to optimize their networks. A service offered by a carrier often includes VSA's. As a result, containers transported with a specific carrier can either be transported on an owned vessel, on a charter vessel, or on a vessel from a competitor as part of a VSA. Carriers already have CO_2 data for owned and charter vessels, but not for VSAs.

Therefore VSAs represent a complex issue when calculating CO_2 emissions from container shipping. In order to ensure a common and credible approach, all carriers in CCWG should follow the below criteria:

1. VSA partners should aim to share vessel-specific emission factors with their VSA partners and apply this data to the CO_2 calculation. Furthermore it is recommended that carriers in a VSA ensure identical emission factors for the services they share.
2. In case it is not possible to get CO_2 data from a VSA partner, the carrier should estimate CO_2 performance based on CO_2 data from a vessel of similar size operated at similar speed. In most cases vessels on a trade lane have similar sizes and operate at a similar speed and can therefore stand in for the missing VSA data. Hence the carrier is able to use its own trade lane average to represent the missing VSA CO_2 data.

The CCWG is working on integrating VSA CO_2 data into its methodology. (VSA CO_2 data is not currently integrated into CCWG reporting.)

2.7 Slot Charter Agreements and Feeder Services

When a container carrier does not have any vessels sailing to a specific region, it is common practice to purchase container slots on another carrier's services. This is called a Slot Charter Agreement. In this case the carrier does not have any CO_2 data representing the actual vessel and/or service and is dependent on data from an external carrier.

It is also common practice in container shipping to use feeder services to call smaller ports, typically either at the end or at the beginning of a container transport. The feeder service can be owned by the carrier, where the feeder vessels are operated by the respective carrier. In this case the carrier already has the emission factor. In other cases the feeder service can be subcontracted and operated by another company, and hence the user is dependent on data from the subcontractor.

In both cases, the user is dependent on an external company. As part of the CCWG CO_2 methodology, CO_2 data for both Slot Charter Agreements and feeder services are to be included in the CO_2 calculations. In order to ensure a common and credible approach, all carriers in the CCWG should follow one of the following criteria:

1. Obtain emission factors from the slot charter partner and/or subcontracted feeder operator for a given container and apply this data in the CO_2 calculation, provided the CO_2 data is of satisfying quality.
2. In case it is not possible to obtain the data from the slot charter partner and/or the subcontracted feeder operator, the carrier should estimate CO_2 performance based on CO_2 data from a vessel of similar size operated at similar speed.
3. In case it is not possible to obtain the data from the slot charter partner and/or the subcontracted feeder operator and if the carrier does not own vessels of the same size operated at an estimated similar speed, the carrier should use the most appropriate trade lane industry average emission factor.[5]

For shippers conducting this calculation, if the location of the transhipment is unknown, the main trade lane emission factor from the first port of loading to the last point of discharge can be applied.

[5] "Intra Europe," "Intra Asia," and "Intra Americas" trade lanes represent the industry average CO_2 performance for feeder services in the region and are therefore the most relevant industry average emission factors for feeder services.

3. How to Use the CO2 Emission Factors

As part of the CCWG CO_2 methodology, the CCWG wishes to ensure common and consistent use of the CO_2 emission factors and hence to make possible credible and comparable CO_2 calculations and benchmarking. In principle all CO_2 emission calculations should be conducted in exactly the same way in order to guarantee comparable CO_2 emission calculations between carriers. However, due to the complexity of this issue, and to the fact that there are many ways to use the CO_2 emission factors, this is not always possible. Only accurate guidance can avoid misguided data use.

The following presents the basic principles of how to use CO_2 emission factors to calculate CO_2 emissions from container shipments and of how to comply with the CCWG CO_2 methodology. This description should ensure a common, consistent, and comparable calculation approach for all users. The CCWG remains aware that, notwithstanding these guidelines, there are different ways to apply the CO_2 emission factors and to calculate CO_2 emissions. This brings to the fore the utmost importance of transparency when conducting individual CO_2 calculations.

Calculations of CO_2 emissions for shipments are in principle carried out by multiplying the emission factors with the number of TEUs transported and the distances sailed—a straightforward method. However other factors and assumptions influence the CO_2 emission calculation. Therefore *it is crucial that all CO_2 data users, especially carriers, make explicit how the CO_2 calculations are conducted and which assumptions are used in the CO_2 calculations*, as per section 3.1 below. This will provide a transparent calculation approach across all users, and will make clear whether CO_2 data from different carriers can be compared or not. Benchmarking of actual CO_2 emissions is possible only if all conditions in the Carbon Calculation Clause are equal.

3.1 Basis of Reporting Carbon Emissions: The Carbon Calculation Clause

A "Carbon Calculation Clause" is mandatory as part of all CO_2 calculations that follow the CCWG CO_2 methodology. The Carbon Calculation Clause must include the following:

1. Which kind of emission factors are applied for: Owned vessels, charter vessels, VSA's, Slot Charter Agreements and feeder services? (See sections 2.5, 2.6, and 2.7.)
2. Which emission factors are used in the CO_2 calculations: Vessel-specific emission factors or trade lane average emission factors? (See section 2.5.)
3. Whether the CO_2 emission factors have been verified or not and which verifier has issued the verification. (See section 2.4.)
4. Whether the CCWG utilization factor of 70 percent is applied. (See section 3.2.)
5. From which sources are the distances used in the CO_2 calculations identified?
   Are the distances based on:
   - Shortest distance between port of departure and port of arrival? or
   - Actual distance sailed (including port schedule and transhipments)?

   Is the CCWG distance adjustment factor of 15 percent applied in the calculation? (See section 3.3.)
6. Whether the CCWG TEU conversion factors are applied. (See section 3.4.)

7. Whether transhipments (including feeder services) are included. (See section 3.5.)
8. Whether an approach other than the standard TEU=10 ton is applied and why. (See section 3.7.)

3.2 Utilization Factor

In recent years, it has become clear that the previous CCWG CO_2 methodology, which was based on nominal (maximum) capacity of vessels, did not fully account for actual emissions. To address this, the CCWG has collected average vessel utilization data from carriers. Utilization data is the average percentage of container slot occupied with containers. Including utilization data in the CO_2 calculations is a better approach that more accurately reflects the actual number of containers transported. This approach is also better aligned with international standards on CO_2 emissions calculations for transportation.

The CCWG secretariat collects anonymous annual utilization information on each of the 25 trade lanes from carriers. The main criteria for the utilization information collected from carriers can be found in annex 2 together with the aggregated utilization data.

The analysis of the utilization data shows that the average utilization across all the largest trade lanes is close to 70 percent, with some variation from year to year. As a result, the CCWG has adopted 70 percent as an appropriate representative average of the global average utilization. This is also identical with IMO and WSC recommended average utilization.

The 70 percent utilization is a pragmatic solution to a very complex issue. It can be applied across all trades and in all CO_2 calculations and increases the accuracy of the CO_2 calculations compared to using 100 percent utilization (nominal capacity). It also ensures a common and comparable approach across carriers.

In order to apply the 70 percent utilization factor the user should divide the CO_2 emission factors based on nominal capacity by 70 percent.

3.3 Distance Adjustment Factor

When calculating CO_2 emissions for a shipment the "shortest" distance from load port to discharge port is most often identified through a web-based distance calculator and subsequently applied. The accuracy of this method depends on vessels always following the shortest feasible route between load and discharge port. This, however, if often not the case as vessels call several other ports between discharge and arrival port according to the service schedule. Furthermore, vessels often deviate from the shortest route between two ports due to currents, weather, and other factors.

Consequently, and since CO_2 emission factors are based on the actual distance sailed, it is necessary to adjust the "shortest" distance in the CO_2 calculations to ensure alignment with the actual distance sailed. However, the complexity of using actual sailed distance for every port pair combination in the CO_2 emission calculation is much too high; not only are there thousands of port pair combinations but vessel routings often change.

As a result, CCWG members are currently conducting several analyses to identify distance adjustment factors to reflect the difference between the shortest distance and the actual distance. We aim to apply a distance adjustment factor to all CO_2 emission calculations over time, which will be used by multiplying the "shortest" distance.

The analyses to date indicate that the difference between the shortest distance and the actual distance on all the largest trade lanes is around 15 percent across trades, with some variation from trade to trade. Fifteen percent as a distance adjustment factor across all trade lanes is a pragmatic solution to a very complex issue. In addition, using a single global adjustment factor across all trade lanes will increase the average accuracy of the CO_2 calculations compared to using the shortest distance. It will also ensure a common and comparable approach across users. **To apply such a distance adjustment factor, the user should multiply the shortest distance used in all CO_2 calculations by 15 percent, including distances for VSA's, Slot Charter Agreements and feeder services**. (See annex 3 for more details.)

The CCWG will pursue its analyses to investigate whether 15 percent is a reasonable distance adjustment factor in the coming years, resulting in many potential adjustments.

3.4 TEU Conversion Factor

There exist different sizes of containers. When using containers other than a TEU the CO_2 calculation must include a conversion factor to reflect this. The unit used when identifying the nominal capacity of container vessels is TEU (10-foot-equivalent). In general the CCWG considers a FFE (40-foot-equivalent) as two TEUs.

The standard container height behind the TEU vessel capacity is 8 feet 6 inches. The vessel intake of high cube (HC) 9-foot-6-inch containers is less than for the 8-foot-6-inch standard containers, and because a significant amount of containers delivered today are HC 9-foot-6-inch containers, this configuration is highly relevant to the calculation of CO_2 emissions. The following conversion factors from container sizes to TEU equivalents are used in the CCWG CO_2 methodology and should be applied in all CO_2 emission calculations. The conversion to TEU equivalents is carried out by multiplying the different containers in question by the conversion factors below:

Table 3: TEU conversion factors

Container size	TEU conversion factor (TEU equivalents)
20' ST (TEU 8'6") + 20' HC (only a small minority)	1.0
40' ST (FFE 8'6")	2.0
40' HC (FFE 9'6") + 45' and 48'	2.25

(ST = Standard, HC = High Cube. The 20' HC as well as 45' and 48' represent only a small minority of containers.)

3.5 Volume vs. Weight

The CCWG CO_2 methodology considers all containers to have an equal average cargo net weight of 10 ton per TEU as a default figure, which represents an approximate CCWG average. Using an equal average cargo net weight of 10 ton per TEU as a default figure is a pragmatic solution to a complex issue.

In some cases the 10-ton per TEU assumption is not appropriate. In such cases another approach is acceptable only if the user clearly describes the method employed to deviate from the TEU=10 ton and explains the rationale for using a different approach. This is included in the overall reporting, as per the Carbon Calculation Clause.

3.6 Transhipments

Transhipments (when a container is loaded from one vessel to another including feeder service) are to be included in CO_2 calculations. Consequently, users must apply the specific emission factors before and after the transhipment. CO_2 emissions from the terminal handling are not available and are considered insignificant, which explains why terminal handling is not included. Emissions from reefer containers while at terminal are not considered either.

3.7 Examples of How to Calculate CO_2 Emissions Based on CCWG Emission Factors

A shipment covering five 40-Foot-Equivalent High Cube containers (FFE HC) is transported from Shanghai, China to Bergen, Norway.

Identify the CO_2 performance: Carrier X is responsible for the shipment. The shipment is transported on a main service from Shanghai to Rotterdam operated by Carrier X. All vessels on the service are operated by Carrier X and consist of five owned vessels and five charter vessels. No VSA CO_2 data is used in the calculation. Carrier X has had their CO_2 data verified by an external verification company, Verifier Y.

From Rotterdam to Bergen Carrier X use a subcontracted feeder service. The feeder service is not operated by Carrier X, but Carrier X did not manage to get CO2 performance data from the feeder company. Therefore, Carrier X has to estimate the CO2 performance for the feeder service based on performance of similar vessels sailing at the same speed.

» Carrier X’s trade lane emission factor on Asia-North Europe is 45 g CO_2/TEU km.
» The feeder service CO_2 performance is estimated to be 90 g CO_2/TEU km. This is based on the CO_2 performance of a vessel of similar size operated an estimated similar speed operated by Carrier X.

Identify the transported distance: The web-based distance calculator dataloy.com is used to identify the distance:
» From Shanghai to Rotterdam = 19,668 km
» From Rotterdam to Bergen = 1,007 km

Utilization data: CCWG utilization average of 70 percent utilization is applied in the CO_2 calculation.

TEU conversion: five FFE HC container corresponds to five* 2.25 TEU/FFE HC = 11.25 TEU

The CO_2 calculation: The calculated CO_2 emissions for the shipment:
» (45 g CO_2/TEU km* 11.25 TEU* 19,668 km) / 70% = 14.2 ton CO2
» (90 g CO_2/TEU km* 11.25 TEU* 1,007 km) / 70% = 1.5 ton CO_2
Total: 14.2 ton CO2 + 1.5 ton CO2 = 15.7 ton CO_2

Carbon Calculation Clause:

Carrier X states that the CO_2 calculation is based on the CCWG CO_2 methodology. Therefore as the final step Carrier X issues a Carbon Calculation Clause:

1. CO_2 emission factors are based on owned and charter vessels, but do not include VSA or Slot Charter Agreement CO_2 data. CO_2 data for subcontracted feeder services is estimated based on vessels operated by Carrier X.
2. CO_2 emission factor for operated vessels is based on trade lane average emission factors. Emission factor for foreign feeder vessels is based on estimates from vessels from Carrier X operated vessels.
3. The data behind the CO_2 emission factors have been externally verified by Verifier Y.
4. The CCWG utilization factor of 70 percent has been applied in the CO_2 calculation.
5. Dataloy.com has been used as the source for the estimated distances used on the calculation. The distances are based on shortest distance between departure and arrival ports. The interim CCWG distance adjustment factor of 15 percent has not been applied in the calculation.
6. The CCWG TEU conversion factors have been applied in the CO_2 calculation.
7. Transhipments including feeder services are included in the calculations.
8. The standard approach of TEU=10 ton applies for the calculation.

3.8 A Simple Guide to Calculate the Absolute CO_2 Footprint for Shippers

When a shipper wants to calculate its company CO_2 footprint, it may use the CO_2 trade lane average emission factors. The method is straightforward:

1) Map your trade lanes.
2) Identify the number of containers on each trade lane (conversion into TEU's).
3) Identify the distance traveled on each port pair per trade lane.
4) Multiply the relevant trade lane average emission factors with the number of containers and the identified distance.
5) Sum up the trade lane CO_2 emissions.
6) If you state that the calculations follow the CCWG CO_2 methodology, you must explain how your calculations are conducted according to the Carbon Calculation Clause (section 3.1).

While in practice the calculation is somewhat more complex, a simplified example is provided below:

Table 4: Simplified example

Trade lanes	Number of containers (TEU)	Distance traveled (km)	CO_2 emission factors (g/TEU km)	CO_2 emissions (ton)
Asia-North Europe				
○ Shanghai-Rotterdam	150	20,000	47	141
○ Hong Kong-Bremerhaven	30	18,500	47	26
Asia-US WC				
○ Hong Kong-Long Beach	70	12,000	59	50
Europe-Africa				
○ Rotterdam-Lagos	40	8,000	77	25
Total company CO_2 emissions				**242**

4. How to Ensure Proper Benchmarking of Carrier Performance

With reference to the explanation in section 2.5, specific vessel performance is not relevant for the shipper or the logistic provider, whether for CO_2 calculations or for benchmarking of carrier CO_2 performance. On the other hand, the trade lane performance is highly relevant for this purpose.

Indeed, average trade lane performance for the carrier is important for informed decision-making for shippers and freight forwarders and hence must be the foundation for benchmarking performance between carriers.

The CCWG CO_2 trade lane averages represent the industry average performance on respective trade lanes and therefore forms an industry baseline against which the carriers trade lane performance can be benchmarked.

Hence a shipper and a freight forwarder should compare individual carrier performance per trade lane to the trade lane average performance.

For an example please see the CCWG publication "How to Calculate and Manage CO2 Emissions from Ocean Transport" here

Annex 1: Trade Lane Definitions

Table 5: List of defined trade lanes

	Trade lane
1	Asia-Africa
2	Asia-South America
3	Asia-Oceania
4	Asia-North Europe
5	Asia-Mediterranean
6	Asia-North America EC
7	Asia-North America WC
8	Asia-Middle East/India
9	North Europe-North America EC (incl. Gulf)
10	North Europe-North America WC
11	Mediterranean-North America EC (incl. Gulf)
12	Mediterranean-North America WC
13	Europe (North & Med) - Middle East/India
14	Europe (North & Med) - Africa
15	Europe (North & Med) - Oceania (via Suez/via Panama)
16	Europe (North & Med) - Latin America/South America
17	North America-Africa
18	North America EC-Middle East/India
19	North America-South America (EC/WC)
20	North America-Oceania
21	South America (EC/WC) - Africa
22	Intra-Americas (Caribbean)*
23	Intra-Asia*
24	Intra-Europe*
25	Other

* “intra” trade lanes are primarily made up by feeder services sailing within the region. This means that the “intra” trade lanes represent the industry average feeder service CO_2 performance in the region. CCWG is in the process of further refining the “intra” trade lanes in order further to improve the approach.

Selecting trade lanes for carriers reporting vessels to the CCWG:

» Vessels should be reported based on the string they were on as of December 31. If the vessel is no longer in use or idling it should be reported based on the last string on which it operated.

» If the vessel is on a string that contains multiple trade lanes, each trade lane in the string should be reported for the vessel.

» A vessel should be included on specific trade lanes as follows:

  - A vessel operates on intra-regional trade lanes (intra-Americas, intra-Asia, intra-Europe) if 75 percent or more of a vessel’s port calls are within that region.

- A vessel’s string endpoints (turnaround points) should be included.
- Regions containing more than 20 percent of a vessel’s total port calls should be included.

Table 6: Definition of what countries and ports are in each region

Trade regions	Countries in the region	Sample ports in the region
Africa	Angola, Cameroon, Kenya, Namibia, Nigeria, Somalia, Senegal, South Africa, Tanzania, Mauritania, The Gambia, Guinea-Bissau, Cape Verde, Guinea, Sierra Leone, Liberia, Côte d'Ivoire, Ghana, Togo, Benin, Gabon, Sao Tome & Principe, Equatorial Guinea, Congo, Democratic Republic of the Congo, Mozambique, Madagascar, Seychelles, Comoros, Mauritius	Luanda, Douala, Mombasa, Tripoli, Cape Town, Durban, Dakar, Douala, Walvis Bay, Port Elizabeth, Dar es Salaam, Mogadishu
Asia	Japan, Korea, China, Taiwan, Philippines, Vietnam, Malaysia, Cambodia, Thailand, Indonesia, Singapore, Burma, Brunei, East Timor, Philippines, Russia (Pacific)	Singapore, Shanghai, Yantian, Dalian, Busan, Hong Kong, Shekou, Surabaya, Kobe, Port Kelang, Manila, Kaohsiung, Laem Chabang, Ho Chi Minh
Mediterranean/Black Sea	Italy, Spain, Portugal, France (Mediterranean), Greece, Turkey, Russia, Ukraine, Libya, Slovenia, Croatia, Montenegro, Albania, Bulgaria, Romania, Russia (Black Sea), Georgia, Cyprus, Syria, Lebanon, Israel, Tunisia, Algeria, Morocco, Malta, Gibraltar	Gioia Tauro, Algeciras, Lisbon, Odessa, Istanbul, Novorossiysk, Genoa, Barcelona
Middle East/India	Pakistan, Sri Lanka, Bangladesh, India, United Arab Emirates, Oman, Saudi Arabia, Bahrain, Qatar, Kuwait, Iraq, Egypt, Jordon, Djibouti, Sudan, Yemen, Eritrea, Iran, Maldives	Port Qasim, Nhava Sheva, Jeddah, Jebel Ali Dubai, Salalah, Colombo, Mina Sulman, Chittagong, Port Said, Chennai, Bandar Abbas, Aqaba, Shuwaikh, Swakin, Latakia, Abu Dhabi, Hodeidah
North America EC/Gulf	Canada (East Coast), United States (East Coast and Gulf Coast), Mexico (East/Gulf Coast), Cuba, Haiti, Dominican Republic, Bahamas, Caribbean island nations	Miami, Savannah, Charlestown, Houston, Newark, Montreal, Toronto, Veracruz
North America WC	Canada (West Coast), United States (West Coast), Mexico (West/Pacific Coast)	LA / Long Beach, Oakland, Tacoma, Vancouver, Lazaro Cardenas
North Europe	Sweden, Norway, Denmark, Netherlands, Belgium, United Kingdom, France (Atlantic), Russia (North European), Finland, Estonia, Latvia, Lithuania, Poland, Germany, Ireland	Rotterdam, Bremerhaven, Antwerp, Felixstowe, Gothenburg, Copenhagen, Le Havre, Oslo, Vyborg, Hamburg, Southampton
South America (incl. Central America)	Guatemala, Honduras, Belize, Costa Rica, Nicaragua, El Salvador, Panama, Colombia, Venezuela, Brazil, Uruguay, Argentina, Chile, Peru, Ecuador, Guyana, French Guiana, Suriname	Itaguai, Itajai, Santos, Rio Grande, Parangua, Buenos Aires, Buenaventura, Iquique, Antofagasta, Callao, Guayaquil, Valparaíso
Oceania	Australia, New Zealand, Papua New Guinea, Pacific island nations	Auckland, Melbourne, Sydney, Adelaide, Brisbane, Fremantle

Annex 2: Main Criteria for Reporting Aggregated Utilization Data Collected from Carriers

Main criteria for the utilization information collected from carriers:

» It should be calculated based on the two key limiting factors and be an average of these. The limiting factors are:
  - Utilization of TEU slots (See section 3.4 for TEU definitions) and
  - Deadweight restrictions.

» It should be based on a round-trip average (meaning that CO_2 emissions are an average from both head haul and back haul).

» It should be based only on full containers (i.e., not include empties — meaning that CO_2 emissions from empty back haul sailing and repositioning of containers will be allocated to full containers).

» It should include lost slots from oversized cargo.

» It should consider all slots on operated vessels only (i.e., exclude VSA slots on other carriers' vessels).

Where fewer than three carriers have reported on a trade lane, the global weighted average is applied.