Smart Freight Centre

Breakbulk GHG Emissions Accounting and Reporting Guidance

Version 1

March 2024

Suggested citation: Smart Freight Centre. Breakbulk GHG Emissions Accounting and Reporting Guidance 2024

Acknowledgements
This report was written by Marcus Lomax and Rickard Lindström of Smart Freight Centre.

About Smart Freight Centre
Smart Freight Centre (SFC) is a global non-profit organization dedicated to an efficient and zero emission freight sector. We cover all freight and only freight. SFC works with the Global Logistics Emissions Council (GLEC) and other stakeholders to drive transparency and industry action – contributing to Paris Climate Agreement targets and Sustainable Development Goals.

Our role is to guide companies on their journey to zero emission logistics, advocate for supportive policy and programs, and raise awareness. Our goal is that 100+ multinationals reduce at least 30% of their logistics emissions by 2030 compared to 2015 and reach net-zero emissions by 2050.

Contact
Smart Freight Centre
Keizersgracht 560, 1017 EM, Amsterdam, Netherlands
P.O. Box 11772, 1001 GT, Amsterdam, Netherlands
Tel office: +31 6 4695 4405
www.smartfreightcentre.org
info@smartfreightcentre.org

Table of Contents

PROJECT BACKGROUND

Smart Freight Centre (SFC) has conducted this methods development for the breakbulk sector by request from a significant part of the breakbulk shipping industry stakeholders. The main objective was to create a standard methodology for the calculation and reporting of logistics emissions for the breakbulk industry in accordance with and in alignment to the existing industry and international standards namely the GLEC Framework[1] and ISO 14083[2]. This will lead to a unified and transparent GHG accounting and reporting methodology within the breakbulk sector, expected to trigger an increase in reporting and to lay a foundation for a more structured collaboration on GHG emission reduction initiatives in this sector. This includes the calculation and reporting of life cycle emissions in the form of Well-to-Wake (WTW) and CO2 equivalents which can be further split into Well-to-Tank and Tank-to-Wake emissions.

ISO14083 and the GLEC Framework

International standards give consumers and investors more confidence in the products, services and information that they solicit from companies. Regulators and governments count on standards to help develop better and more consistent policy measures and regulations. Companies themselves save time when they can rely on standards, because they don't have to reinvent the wheel.

The GLEC Framework has rapidly become the common industry standard for calculating and reporting emissions for freight transportation and logistics. However, a formal ISO standard ensures a single approach that can be widely accepted by industry, governments and investors. SFC, together with partners, have developed a new ISO Standard 'ISO14083' that covers both passenger and freight transport, in collaboration with the German Institute for Standardization (DIN) which hosts the International Secretariat. The intention is that the principles and methodology for freight transport will be based on, and consistent with, the GLEC Framework. This will emphasize its position as *the* industry reference for logistics emission accounting and reporting across the multimodal supply chain. **ISO 14083** has now **replaced** the existing European standard **EN 16258**[3]**.**

Benchmarking challenges in a diverse shipping segment

Even though part of the idea of having segment specific GHG accounting standards introduced is to increase comparability among industry players, to facilitate benchmarking activities, it's important to notice that unique designs and individual operational conditions brings complexity and decrease utility of benchmarking activities. It may be hard to forecast the GHG emission performance of a vessel, or group of vessels, and transport activity, based on another unique transport activity (cargo type and operational conditions). For instance, cargo space

[1] What is the GLEC Framework? - How to implement items | Smart Freight Centre - How to implement items | Smart Freight Centre

[2] ISO 14083:2023 - Greenhouse gases — Quantification and reporting of greenhouse gas emissions arising from transport chain operations

[3] EN 16258 - European Standards (en-standard.eu)

occupation/density will highly influence the transport efficiency. Still, the ambition is to offer a standard that somewhat increases the comparability and forecasting of GHG emissions.

How this guidance was developed

To reach an agreement, a structured dialogue took place to carefully carve out a GHG accounting and reporting framework that gained acceptance among the sector's various stakeholders. This was done through a series of meetings with breakbulk shipper and carrier stakeholders over the course of Q2, Q3, Q4 2023 and Q1 of 2024. There were also some preparatory work done in Q3 and Q4 of 2022 during which SFC probed the interest, garnered support and started the identification of key methodological challenges. In parallel to group gatherings, written input was requested through emails and questionnaires in order to make sure nothing was overlooked. Overall, the discussions evolved to focus on the capturing of transport activity and fuel consumption in an accurate, consistent and 'fair' manner.

Key concepts and operational circumstances were identified and evaluated from a GHG accounting perspective to ensure a common guideline that fully reflects the diverse breakbulk shipping segment and the requirements of the aforementioned standards – the GLEC Framework and ISO14083. Central topics covered:

- A calculation methodology for breakbulk sea transport which takes into account the different types of existing cargo and vessels for specialized and mixed-use, based on existing industry practices. In other words, focus on ensuring that GHG emission performances are fairly reflected irrespective of cargo and vessel type.
- Decide on a set of Transport Operating Categories (TOCs) that represent a rational categorization of commonly occurring operations.
- The desire to offer a methodology that does not rely solely on cargo mass as the unit for 'quantity of freight' in the calculation of transport activity.
- The calculation of GHG emissions and emission intensities using primary data including all legs and fuel consumption during the identified reporting period.
- Transport Service Providers report transport activity and calculate emission intensities using actual distances (rather than the shortest-feasible-distance (SFD) or the great circular distance (GCD);

Regulations influencing the methods development

Regulations are clearly an incentive for carriers to improve data monitoring and reporting and have been a driver for the reporting of KPIs. In general, shipping emissions accounting under ISO 14083 and the GLEC Framework follow the principles developed by the maritime sector. ISO 14083 and the GLEC Framework are in alignment with the principles of the International Maritime Organization (IMO) Energy Efficiency Operation Index (EEOI) guidelines. The IMO provides guidelines to calculate the EEOI but there is no requirement to report this metric. The EU MRV regulation has gone a step further requiring the reporting of EEOI data which is publicly available (non-anonymized) on an individual ship basis.

Intensity Measures

Good quality primary data is what should be used by transport service providers (carriers) to calculate scope 1 and scope 3 GHG emissions, and what cargo owners commonly aim to collect from transport service providers for their Scope 3 emissions accounting. Scope 3 emissions are generally based on carrier transport activity data in Tonne Kilometers (Tonne-kms), which is a product of quantity (mass) of freight * distance, coupled with primary fuel consumption data. Primary data can range from highly precise information to aggregated values. Primary fuel consumption data is to be measured by the transport service provider's actual fuel consumption over the identified reporting period. To adapt the GHG reporting method to the breakbulk sector's operational and commercial circumstances, it was decided to settle on Freight-Revenue-tonne-kms (FRT-kms" (also called "Freight-tonne-kms" "Revenue-tonne-kms") as the primary measure of transport activity. Freight Revenue Tonnes represent an amount of cargo where both metric tonnes and cubic meters can be included and make up the numerical value. Whether a shipment's transport activity calculation is done by applying the cargo tonnes or cubic meters is determined by which of the two units is the greatest. In other words, if the value of total cargo volume occupied in cubic meters is higher than the total cargo tonnes, then the cubic meters value constitute the basis for calculating freight tonnes <u>for that particular shipment</u>. Similarily, tonnes would be the choice if this value is the greater one. Consequently, when summarizing all laden voyages'/shipments' transport activity into a total transport activity number of FRT-kms, the result will in most cases represent an undefined combined sum of tonne-kms and cubic meter-kms. As mentioned, FRT-kms is the primary measure of transport activity, and, as a result the **<u>primary measure for emission allocation</u>**. The cargo owner(s) may very well then decide to reallocate its share of the emissions into CO2e/Tonne-kms (see reallocation calculation example on page 15) for harmonized multimodal reporting where transport activity and emission intensities are more commonly expressed using a transport activity measure in tonne-kms. This is why it is important for breakbulk transport service providers to report emission intensities and transport activity also in tonne-kms (while FRT-kms remain the allocation parameter and primary transport activity measure).

Cargo volume and mass definition

When calculating the volume or mass of cargo when determining the RFT value, the measure includes any cargo handling/carrying structure, e.g. racks, cradles, or other structures in place to fix and handle the cargo. It also includes any packaging provided for transport by the cargo owner. The cubic meter measure is defined (meters) as the *width* * *hight* * *depth* of the overall cargo. The metric tonne is simply the mass in tonnes. See "intensity principles and calculation of GHG intensity values" section for more information on transport service provider's provision of cargo mass values to cargo owners.

The ambition of the breakbulk working group is to use the highest quality emission data from transport service providers and for this to be made available to actors along the same physical supply chain. All emission calculations, including scope 3, should be done using primary fuel consumption to match the cargo owner's solicited cargo transport and the transport service provider's emission performance over the reporting period. In the case that emission data sharing between transport service provider and cargo owner cannot be actioned for any number of reasons, the cargo owner starting on their journey to calculate and report their emissions can use transport activity data coupled with a default emission intensity value representative of average industry operating practices. In this case, the transport activity data applied needs to be calculated using tonne-kms since this is the measure behind the publicly available default emission intensity values. As a starting point, default data with varying levels of precision can provide a general indication of emissions. The source of any default data used ought to be clearly specified by the reporting entity (typically a cargo owner). Please note that the default emission intensity values in the GLEC Framework sourced from the IMO are expressed using tonne-kms as a measure of transport-activity and may not accurately reflect Breakbulk operations. A year after having started to report their Scope 3 emissions, a Cargo owner should not rely on default emission values for scope 3 reporting but request carrier specific emission intensity values for their solicited cargo transport. The commitment remains to report carrier specific emission values based on primary data for the transport service solicited.

It is important to remember that primary data is more representative of actual freight operations than default data. Using default data may lead to results that over- or underestimate emissions compared with actual freight operations. As efforts to improve visibility of the transport chain continue to expand, a company reporting their scope 3 emissions will be able to transition from using default emission intensity data to using and reporting more detailed values based on primary data. Another option is to apply modelled emission intensity values, also in this case primary data generally brings higher accuracy to the result.

Intensity principles and calculation of GHG intensity values

The principle appointed by this standard for calculating GHG intensities is the same logic as behind the Energy Efficiency Operational Indicator (EEOI). This means a leg-by-leg principle is applied, e.g.:

LEG 1: 1,000 Km x 20,000 FRT = 20,000,000 FRT-kms
+
LEG 2: 4,000 Km x 30,000 FRT = 120,000,000 FRT-kms
+
LEG 3: 3,000 Km x 0 FRT = 0 FRT-kms

= **140,000,000** FRT-kms

All (see exception below) fuel consumption at sea and in port, laden and ballast, should be included in the production of the intensity value (total fuel consumption / total transport activity), while only **cargo** should go into the transport activity value, not ballast. Note that also shore side electricity energy consumption should be included in the consumption side of the calculation. Principally, fuel/energy consumption related to maintaining the cargo and/or the vessel in proper condition in port is included on the consumption side of the transport chain intensity calculation.

See GLEC Framework V 3.0 section 3 module 4 for more information on this topic.

Fuel consumption exceptions: if a vessel is "out of service", meaning not in a commercial operation (e.g. due to maintenance), this part of the consumption should be excluded.

Containers are included on "equal terms" as any other cargo, meaning a loaded container should be included in transport activity calculation, and, as such include the total mass (or volume) of the cargo and container needs to be accounted in the FRT calculation and emission allocation but the tonne-km calculation must only include the net cargo mass (excluding the container weight). An empty container however should be fully excluded from the transport activity calculation, meaning neither account for the empty weight of the container nor the volume it occupies. Unless, the empty container is considered cargo whereby the transport service provider has been contracted to transport the empty container by a cargo owner. This principle is applicable to both the tonne and cubic meter based transport activity calculations.

Please note that for the transport service provider, generally, the 'cargo' is quantified as both the *actual cargo* and any *packaging (e.g. a container)*. Therefore, when determining transport activity, the full weight of all those components will most often be included in the calculation ("cargo gross weight"). From the cargo owner's perspective however, only the *actual cargo* is considered the 'quantity of freight' when determining the transport activity. As a result, the cargo owner must be aware that the emission intensity value provided by the transport service provider may represent the 'gross quantity of freight'. It is therefore of paramount importance that the transport service provider communicates to the cargo owner the total Well-to-Wake emissions, the emission intensities in tonne-kms and FRT-kms and the total transport activity values for the cargo owners solicited transport services, with the emission intensities and transport activity in tonne-kms expressed using the net mass of the cargo excluding the container weight or cargo handling equipment.

Transport Operation Categories (TOC)

The rationale behind Transport Operation Categories is to find the most appropriate grouping of vessel operations that share similar characteristics and reflect the identified transport activities in a manner that enables cargo owners to select a representative emission intensity value to apply for their scope 3 foot printing, as opposed to applying a value ‘diluted’ by vessels and voyages not relevant for the cargo owner concerned. There may be some degree of dilution which inevitably needs to be accepted for the sake of practicality. Likewise, dilution/lower granularity may be a well-informed deliberate decision in cases where granularity ambitions are low and simplicity prioritized. In the elaborative discussions and assessment in finding the most suitable TOC’s, below categorization’s were identified:

- Voyage basis
- Vessel basis
- DWT category basis
- Full fleet

Description

Voyage basis

TOC defined as a single vessel on a single voyage (including intermediary port calls). Specific voyages/legs are selected for aggregation. Suitable, for instance, when operations are scattered in terms of space, time, and vessel deployment but high granularity is desired. Fuel consumption and transport activity are summarized from the selected voyage’s operational data. See section on reporting period and “ballast leg(s) inclusion and assignment” below.

Vessel basis

TOC defined as a single vessel’s aggregated operational and emission data over the reporting period (typically 12 months). See section on reporting period and “ballast leg(s) inclusion and assignment” below.

DWT category basis

A group of vessels operational and emission data aggregated over the reporting period (typically 12 months). DWT is the determining factor for vessel selection. There are four DWT categories (TOC 1 – 4) to apply, those are (DWT value): TOC 1 = 0 – 9,999. TOC 2 = 10,000 – 34,999. TOC 3 = 35,000 – 59,999. TOC 4 = >59,999. This categorization is derived from IMO’s 4th GHG study. Operational data from each respective DWT category is aggregated separately. See section on reporting period below.

Full fleet

All vessels in the fleet are selected for aggregation. See section on reporting period below.

Ballast leg(s) inclusion and assignment

The guiding principle is that all operations should be accounted for, meaning all fuel consumption from laden and ballast voyages need to be included in the GHG emissions intensity calculation(s). It is therefore of importance to include the emissions of ballast voyages when calculating the TOC's emission intensity. This inclusion of ballast emissions can be accounted as follows:

Voyage basis

Voyage basis aggregation refers to when operational and emission data of a single voyage forms the basis of the emission intensity of the TOC. The TOC is defined as a single vessel on a single voyage (including intermediary port calls). All ballast legs related to the voyage are to be included. Generally, if preceded by a ballast leg, it's associated fuel consumption and emissions is allocated to the rest of the transport chain. (See example 4.4 on p.119 of GLEC Framework V3.) In this context, a transport chain is defined as a consecutive series of loading and discharge operations, whereby a (or multiple) cargo owner(s) charter a Breakbulk ship, and this may or may not be preceded by a ballast leg.

Vessel basis

When the TOC is defined as the operations of a vessel of the reporting period. Assigning ballast leg emission is straightforward. All ballast leg emissions of the specific vessel during the reporting period are included in the calculation of the emission intensity of the TOC. If a laden or ballast leg crosses over two reporting periods, the Estimated Time of Departure (ETD) shall determine the reporting period to which it belongs.

Fleet and DWT basis

Same logic as for "vessel specific basis", applied for all vessels in the fleet or the DWT grouping to form a fleet or DWT based Transport Operation Category (TOC.)

Vessel integrated cargo handling gear

Fuel consumption related to cargo handling in port should in principle be assigned to the calculation related to "hub activities". This is typically a separate part of the cargo owner's scope 3 calculations constituting a separate element in the cargo owner's overall multi-modal transport chain. ISO14083 and the GLEC Framework offers guidance with regards to accounting for emission and activity data related to hub operations. In the breakbulk sector it is very common for vessels to integrate cargo handling gear. However, it became clear during the working group's methodological development that it is often hard to separate the fuel consumption induced by cargo handling from the propulsion related one. Therefore, it is of high importance that the carrier informs the cargo owner, whether cargo handling fuel consumption is part of the vessel (or other TOC category) GHG intensity value. If the fuel consumption due to cargo handling in port is part of the vessel/TOC operational intensity value this will increase the emission intensity value. The cargo owner as a result will either not need to account for the hub operation related to the maritime container terminal operation and/or transshipment or modify the value associated with any transshipment if this is already taken into account in the breakbulk operation.

Reporting period and vessel inclusion

The reporting period occurs on a calendar year basis, meaning the data collected will represent the past calendar year's operational data. This is similar to the reporting period used in the Sea Cargo Charter (SCC)[4] and Clean Cargo[5]. In the future, the reporting period may move to a quarterly basis to the carrier performance data from 2025 onwards to meet the desires of shippers requesting higher reporting frequency in their scope 3 foot printing. Naturally, the voyage based TOC reporting will not by default represent a full calendar year but instead a specific and punctual transport operation. The other TOC's are principally produced by aggregating all operations from the full past calendar year.

All owned, managed and operated vessels should be included in the reporting. A shipper applying a GHG intensity value in its scope 3 calculations might (depending on ambition on granularity) need to be informed whether any potential transshipments have been part of the cargo movements or not.

Distance measure

Distance to apply in GHG intensity calculations

The distance by which a shipment is transported is measured from the point where the cargo is first loaded onboard the vessel to where the cargo is unloaded at its final port destination. While this may seem simple, especially in light of developments in GPS and telematics systems, finding distance is part of what makes logistics GHG accounting a complicated endeavor. Many shipments involve multiple transport legs and modes; some are handled by multiple carriers. Sometimes there are intermediate stopovers in locations that reflect a carrier's transport network rather than the most direct route. Sometimes routes are modified due to weather, tides, construction or traffic conditions, information that may or may not be known to other parties. This is complicated further by goods traveling on shared transport assets, where shipments are consolidated to increase vehicle loading and hence efficiency, but may lead to longer distances being travelled than would be the most direct route for an individual shipment. Distance information should be collected for each transport leg, either through direct measurement or estimation and represent the overall route as far as possible. The transport

---

[4] Sea Cargo Charter is a maritime organisation set up to help signatories understand their operating carbon footprint and determine whether their overall emissions intensity aligns with IMO targets to reduce absolute emissions from global activity by 50% compared to 2008 levels

[5] Clean Cargo | Smart Freight Centre

activity distance is the actual distance, meaning the actual distance travelled between port a and D including intermediary stopovers.

Distance to apply in scope 3 'footprinting' calculations

Distance information should be collected directly or indirectly (e.g., via a Logistics Service Provider) from the carrier(s) concerned and represent the overall route as far as possible. It is of fundamental importance (provided high accuracy is aspired to) that the distance measure applied in scope 3 application is the same as applied the GHG intensity calculation. To bring about an accurate end-result, there ought to be an information link between the carrier and cargo owner to ensure the <u>real route (and actual distances)</u> between port of origin and port of destination is reflected in the distance number. As mentioned above, a carrier who applies the actual distance will still need to ensure the overall route (e.g. port A-C-D-E) is reflected since actual distance refers to the actual distance travelled between a port of origin and port of destination including intermediary port stopovers/port calls.

Breakbulk carriers report emission intensity value and transport activity using actual distances for the transport service they provide to cargo owners and freight forwarders. If the working group were to produce emission intensity values for general scope 3 reporting for the wider public, then emission intensity values would need to be provided using the shortest feasible distance or the great circular distance or actual distance adjusted with a distance adjustment factor. This is due to the fact that actual distances are only typically known by carriers and therefore relies on a direct information link between carrier and cargo owner.

ISO 14083 reporting requirements at a Transport Service Level

The report needs to identify 1) Transport Chain Elements (TCEs) or Transport Chain(s) covered in the report. 2) State that the report was done in reference to ISO 14083:2023.3) The total WTW emissions (broken down into TTW as well).4)The total WTW emission intensity(also in TTW) in Kgs or Tonnes of CO2e/FRT-km and Kgs or Tonnes of CO2e/tonne-km (stating the type of transport activity distance - actual). 5) Reference to Breakbulk accounting and reporting guidance. 6)The transport activity in FRT-kms and tonne-kms as described in the methodology (stating the transport activity distance – actual). 7) Any omissions of GHG sources and state reason and impact of any associated omissions.

Fuel emission factors (carbon conversion factors)

GHG emission factors play a crucial role in the calculation of transport GHG emissions and the calculation of carbon footprints. They provide a consistent metric to convert the fuel and energy used on board to transport freight into greenhouse gas emission values.

It is vital that GHG emission factors are based on the most credible sources. For example, the shipping industry mainly focuses on the values published by International Maritime Organization (IMO). However, until now the approach of the IMO has been to publish only tank-to-wake (TTW) values.

The IMO recently decided to move to a WTW (well-to-wake) reporting basis as part of its updated decarbonization strategy. The IMO has been working on well-to-tank (WTT) emission factors that can be combined with its existing tank-to-wake (TTW) emission factors in order to provide a full WTW view of GHG emissions.

This work lags behind the decision by several organizations and groups (incl. this Breakbulk working group) to use well-to-wake (WTW) factors to calculate emission intensity values. Nonetheless, the IMO's change of perspective should be welcomed.

The current status of the process is set out in MEPC 80/7/4, the Final Report of the Correspondence Group on Marine Life Cycle Analysis. Annex 1 to MEPC 80/7/4 contains draft guidelines on the calculation of life cycle GHG intensity of marine fuels and initial proposals for default values and accepted ranges for a small number of the 128 pathways identified therein. The fact that only a small number of the fuel pathways are represented in this way, largely due to a perceived lack of sufficient data, suggests that the process still has some way to go. The IMO lifecycle assessment guidance (MEPC 80/7/4) is due to be finalized and published at MEPC81 (scheduled for Q2 2024). This document will provide a widely accepted framework for defining emission factors which will become the standard for the maritime industry; however, the timing of this publication implies that it will not be available for the next reporting period. Once this is published, it may still not be a definitive answer to emission factor definition as further changes are expected as this is an evolving topic and the IMO guidance is scheduled to be reviewed every 3 years to ensure it is kept up to date and in alignment with other related initiatives.

In the absence of IMO published WTW emission factors, the emission factors used is recommended to be based on Global Logistics Emission Council (GLEC) Framework. The GLEC Framework has itself recently been updated to make use of the best available sources in line with the approach developed for, and described in, Annex J of ISO 14083.

These emission factors are derived from the North American and European Life-cycle Inventory (LCI) databases and their supporting literature recommended in ISO 14083 and the GLEC Framework v3, namely:

- for North America the 2022 update to the GREET model, which is used as a de facto standard lifecycle emission inventory database for transport calculation throughout the US and as a basis for many international regulations and initiatives;
- for Europe the primary sources are the Ecoinvent lifecycle database (v3.9.1) and work by IFEU et al. that is related to the implementation of the European Commission's renewable energy directive.

These values have been supplemented by additional data, primarily from JEC (a collaboration between the European Commission's Joint Research Centre, EUCAR (the European Council for Automotive Research and development) and Concawe (the European oil companies‟ association for environment, health and safety in refining & distribution)), and Fuel.EU maritime for Europe, to provide emission factors for a more complete list of fuels relevant to the maritime sector.

However, there are clearly identifiable differences between the North American and European values which may result from real geographical variations in input data and fuel production processes, but which may also be due to methodological inconsistencies. There are also differences within the European values that depend on the available source and result directly from:

- Ecoinvent being progressive in terms of including the latest knowledge about the extent of fugitive emission in the WTT phase of fossil fuels; resulting in higher WTT values.
- Ecoinvent not currently presenting a full set of maritime fuel emission factors, which is what introduces the need to fall back on the less up-to-date values within the Fuel.EU maritime dataset.

In the short term it is thought (position of SFC and Breakbulk working group) being best, i.e. pragmatic, to adopt a single set of emission factors for use - irrespective of geography. With this in mind, and keeping the logic that transparency will be key to ensure legitimacy and credibility for any pragmatic way forward, we propose the following cascading order of priority in coming up with a set of default emission factor values:

1. Emission factors for conventional liquid fuels in MEPC 80/7/4 should be used, where available;

2. All other emission factors should be taken from the Fuel EU/ecoinvent;

3. Any emission factors not available from 1 or 2 should be taken from the GREET database.

Whilst this approach is biased towards European values, it does provide simplicity in not having two lists based on geography. Therefore we believe the values presented in the following table represent the best currently available set of emission factors.

We propose that once IMO fixes on a full set of WTW values then these values will take precedence. It is likely, subject to SFC and Breakbulk working group gaining a full and proper understanding of the approach used by IMO, that the internal consistency that will come with such a development will be highly beneficial and is probably the best way forward in the medium term.

Fuel	WTW Emissions ($KgCO_2e$ / Kg fuel)	TTW Emissions ($KgCO_2e$ / Kg fuel)	Source
Heavy Fuel Oil (HSHFO)	3.76	3.16	MEPC 80/7/4
Blends (VLSFO)	3.84	3.16	MEPC 80/7/4
Ultra-Low Sulfur Fuel Oil	4.06	3.21	Ecoinvent 3.9.1 cut-off
Liquefied Natural Gas	4.05	3.24	Fuel EU maritime amended
Liquefied Petroleum Gas (Butane)	4.05	3.00	Ecoinvent 3.9.1 + fuel EU maritime
Liquefied Petroleum Gas (Propane)	4.02	2.97	Ecoinvent 3.9.1 + fuel EU maritime
Methanol	1.50	1.11	GREET (USA)
Other	3.84	3.16	MEPC 80/7/4

Where:

- *Heavy Fuel Oil* means residual marine fuel comprised of greater than 2.5% sulfur by mass. This is usually low sulfur fuel oil – 3.5% sulfur (LSFO).
- *Blends* means marine fuel oil blends comprised of 0.1 to 0.5% (inclusive) sulfur by mass. It is also called as Very low sulfur fuel oil (VLSFO).
- *Ultra-Low Sulfur Fuel Oil* means a distillate or residual fuel oil comprised of less than 0.1% sulfur by mass. Ultra-low sulfur fuel oil includes light fuel oil (LFO), marine diesel oil (MDO) and marine gas oil (MGO).
- *Liquified Natural Gas* means fossil based liquified natural gas. Emission factor for Otto dual fuel slow speed engine is applied.
- *Liquified Petroleum Gas* means fossil based liquified petroleum gas as butane or as propane.
- *Methanol* means natural gas based methanol.
- *Other* means the fuel is assigned the “Blends” emission factor. When a carrier has burned a lower emission marine fuel, the carrier must report the fuel using this “Other” category. Default emission factors for these lower emission fuels are still being determined. Additionally, there is an increasing use of lower emission marine fuels whose emission profile is allocated by a carrier to a specific customer or customers. In these situations, the emission factor of the fuel actually used on a vessel cannot be captured in the general reporting without causing potential erroneous double counting of the emission profile of the lower emission marine fuel. By reporting these fuels in the “Other” category, the risk of erroneous double counting of the emission profile of the lower emission fuel is reduced. When emission factors for the most common lower emission fuels are settled it is recommended to introduce a reporting practice that ensures non-customer assigned emission reductions are captured in the carriers’ GHG intensity numbers. This could be done by a ‘split reporting system’ where any lower emission fuel consumption bunkered on behalf of the carrier itself is reported separately, while customer specific emission reductions are still reported as conventional fossil fuel. This ensures no double counting and fair representation of the carriers’ own/in-house efforts in the GHG intensity numbers.

Biofuels/efuels	Feedstock/Remarks	GREET (USA) kgCO$_{2e}$/kg of fuel			EUROPE kgCO$_{2e}$/kg of fuel			Source
		WTT	TTW	WTW	WTT	TTW	WTW	
Ethanol E100	Mixed feedstock	n.a.	n.a	n.a	1.29	0.00	1.29	IFEU et al, amended
Biodiesel	Waste feedstock mix	n.a.	n.a.	n.a.	1.27	0.00	1.27	IFEU et al, amended
HVO	Waste feedstock mix	n.a.	n.a.	n.a.	1.26	0.00	1.26	IFEU et al, amended
Bio Methanol	Waste wood	0.21	0.00	0.21	n.a	n.a	n.a	GREET
Bio Methanol	Black liquor	0.62	0.00	0.62	n.a	n.a	n.a	GREET
Bio-LNG	Otto dual fuel (medium speed)	n.a.	n.a.	n.a.	1.44	0.95	2.39	Ifeu et al. amended, FuelEU Maritime amended, MEPC 80/7/4
Bio-LNG	Otto dual fuel (slow speed)	n.a.	n.a.	n.a.	1.44	0.54	1.98	Ifeu et al. amended, FuelEU Maritime amended, MEPC 80/7/4
Bio-LNG	LNG diesel	n.a.	n.a.	n.a.	1.44	0.09	1.53	Ifeu et al. amended, FuelEU Maritime amended, MEPC 80/7/4
Bio-LNG	LBSI	n.a.	n.a.	n.a.	1.44	0.03	1.47	Ifeu et al. amended, FuelEU Maritime amended, MEPC 80/7/4
eMethanol	W/ H_2 recycling	0.06	0.00	0.06	n.a	n.a	n.a	GREET

Notes:

* denotes methane slip taken from MEPC 80/7/4

Intensity and scope 3 calculation examples

Intensity calculation

The calculation logics will be the same irrespective of TOC categorization. Ballast leg assignment will be vital keeping track of in case of a voyage based TOC aggregation. In the other TOC cases (vessel, DWT, fleet) all ballast legs goes into one calculation (one fuel consumption assignment) only.

<u>Freight-Revenue-tonne-kms (FRT-kms)</u>

Leg 1: 0 FRT x 4,000 km = **0** (ballast)

Leg 2: 20,000 FRT x 3,500 km = **70,000,000**

Leg 3: 25,000 FRT x 1,800 km = **45,000,000**

Total <u>FRT-kms</u>: **115,000,000**

<u>Fuel consumption</u>

Total consumption in tonnes Leg 1 + Leg 2 + Leg 3**: HFO 1,300 + ULSFO 2,900**

Total CO_2e in tonnes: (1,300 x 3.76) + (2,900 x 4.06) **= 16,662**

<u>Intensity</u>

Gram CO_2e per <u>FRT-kms</u>: (16,662 x 1,000,000) / 115,000,000 = **145**

Scope 3 calculation

If multiple cargo owners are having their cargo transportation taking place somewhere along the ***identified transport chain****, all of them will apply the same intensity value (in above example 145gCO_2e/FRT-kms) representative for the chain as a whole. In other words the intensity value calculated summarizing all consumption including related ballast leg(s) and the full transport activity performed along the chain in the unit of FRT-kms.*

Tonne-km based calculation

A cargo owner deploying a ***Breakbulk vessel*** *from port A to D. The carrier informs the cargo owner that the Actual Distance is applied for the intensity calculation. The carrier also informs the cargo owner about this Actual Distance from port A to D, in this example being 17,000 km.*

The cargo owner had 80 tonnes of cargo onboard transported from port A to D. The freight tonne value for the same transport is 105.

Emissions allocated to the cargo owner: 105 x 17,000 = 1,785,000 FRT-kms. 1,785,000 x 145 / 1,000,000 = ***258.8*** *tonne CO2e.*

Emissions per tonne cargo: 258.8 / 80 = ***3.24*** *tonne CO2e*

*TonneKm carried out on behalf of the cargo owner**:** 80 x 17,000 =* ***1,360,000***

Emission intensity in ***gram CO_2e per tonne-kms****: 258.8 / 1,360,000 x 1,000,000 =* ***190***

By SFC suggested developments and revisions

- Formation and establishment of a Breakbulk buyer-supplier initiative that follows this reporting standard in unity, maintain and develop its methods, and potentially report via a central platform to both minimize efforts of bilateral sharing, and, minimize risks of non-standard compliant reporting procedures
- A third-party verification scheme
- Tracking of Breakbulk industry averages over time to relate to international targets
- Annual revision of Fuel Emission Factors (including renewable fuels/low emission fuels)
- Introduction of a ‘split reporting system’ enabling renewable fuels to be reflected in cases where bunkering is done on behalf of the carrier itself (not assigned to specific cargo owners/shippers or LSPs)