Ro-Ro GHG Emissions Accounting Guidance

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The Association of European Vehicle Logistics

Smart Freight Centre

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This report was written by Marcus Lomax, Rickard Lindström and Ludovic Laffineur of Smart Freight Centre.

About ECG
ECG is the established European platform for the outbound automotive logistics sector bringing together logistics service providers, manufacturer logistics managers and suppliers to the sector. ECG aims to facilitate non-commercial collaboration between member companies and assist them in sharing best practices in many operational areas, especially the harmonisation of operational standards.

Contact
ECG – The Association of European Vehicle Logistics
+32 2 706 82 80
info@ecgassociation.eu
www.ecgassociation.eu

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

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PART OF A MULTIMODAL PROJECT

Smart Freight Centre (SFC) has conducted this methods development for the Ro-Ro segment as part of a parallel VDA (German Association of the Automotive Industry) and ECG (the Association of European Vehicles Logistics) project on multimodal GHG accounting guidance for the automotive industry. The multimodal guideline establishes roles, responsibilities and sets the standard for the reporting of shipment emissions, transport activity and emission intensities from the transport operators to the cargo owners for all transport modes including Ro-Ro. The main objective of this guidance was to create a harmonized methodology for the calculation and reporting of logistics GHG emissions for the Ro-Ro industry, in accordance with and in alignment to the existing industry and international standards regarding carbon accounting for the Logistics industry, namely the GLEC Framework[1] and ISO 14083[2]. This will lead to a unified and transparent GHG accounting and reporting methodology within the Ro-Ro 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 CO_2 equivalents which can be further split into Well-to-Tank and Tank-to-Wake emissions.

ISO14083 and 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 from 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 will replace the existing European standard EN 16258[3].

Challenges with regards to the ship types under consideration

There have been challenges in calculating the emission-intensity for certain ship categories, most notably for Ro-Ro cargo vessels and Ro-Ro passenger ships. The problems are mainly due to the fact that the aforementioned ship types are typically designed for specific routes (usually with main dimension limitations) and / or to specific transport tasks with tight timetables (for Ro-Ro vessels). Altogether, there is a very high scatter in the ship design speed and actual operation speeds, leading to a wide variation in propulsion power requirements and machinery configurations. Both the UN body governing shipping, the International Maritime Organization (IMO) and the EU have been struggling in

[1] Smart Freight Centre. Global Logistics Emissions Council Framework for Logistics Emissions Accounting and Reporting. (2019). ISBN 978-90-82-68790-3.
[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)

finding ways to report the carbon intensity of those segments of the maritime sector in a 'sufficiently' accurate way.

How this guidance has been developed

The development of this guidance originated as a request from OEMS, the cargo owners, for a harmonized calculation and reporting methodology for Ro-Ro cargo. Ro-Ro was one of the few transport modes up until now that did not have carrier/transport operator specific emission intensity values. This guidance will allow cargo owners to move beyond general scope 3 reporting using industry average default values to carrier specific values for more detailed scope 3 reporting.

In order to come to a consensus, a structured dialogue took place to carefully carve out a GHG accounting and reporting framework to gain sufficient acceptance among the sector's various stakeholders. This was done through a series of meetings with ECG members over the course of Q1 and Q2 2023. In parallel, several bilateral meetings with ECG members took place and 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.

A number of key categories, concepts and parameters were identified and aligned to ensure a common guideline that fully reflects the diverse range of the Ro-Ro sector and the requirements of the aforementioned standards. As an initial phase several rounds of discussions took place with ECG members. The list of key topics that were covered:

- A calculation methodology for Ro-Ro sea transport which takes into account the different types of existing Ro-Ro sea transport for specialized and mixed-use vessels, based on existing industry practice to supplement the approach set out in ISO 14083 where additional specificity is required to reflect Ro-Ro operations;
- A set of TOCs (Transport Operating Categories) specific to Ro-Ro sea transport, reflecting sub-sector specific terminology and the specialized and mixed-use vessel types of Ro-Ro sea transport;
- 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;
- Default emission intensity values for use in situations where scope 3 calculations by Ro-Ro customers are being done without access to primary data. Such default emission intensities are provided by SFC for typical operations, via its GLEC Framework;

The transport operators and participants of the working group have the data at hand which enables the reporting of emissions, transport activity and emission intensity based on primary fuel consumption data. The dialogue led to agreeing on a primary and complementary transport activity measure, the definition of Transport Operation Categories (TOCs) and distance to be used when calculating the intensity measure.

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 the GLEC Framework follows the principles developed by the maritime sector. The GLEC Framework is 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. On many occasions during the meetings' discussions reference was made to the EU MRV regulation.

Intensity Measures

Good quality primary data is what should be used by a transport or logistics operator to calculate scope 1 GHG emissions, and what cargo owners commonly aim to collect from transport operators (carriers) for their Scope 3 emissions accounting. Scope 3 emissions are generally based on carrier transport activity data in Tonne Kilometers, 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 operator's actual fuel consumption over the identified reporting period.

The ambition of the Ro-Ro working group is to use the highest quality emission data from transport operators 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 operator's emission performance over the reporting period. In the case that emission data sharing between transport operator 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. 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). 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 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.

Outcome

It was determined that tonne-km should be the primary measure of transport activity for sea and across all transport modes. However, there was a clear desire to develop and agree on a complementary GHG intensity measure. Further, it was clear that such a measure, more or less, ought to reflect cargo volume and/or areas, as a complement to the purely mass based measure of tonne-km . Main rational is that Ro-Ro vessels often are limited by volume or area capacity rather than cargo mass. A complementary measure is supposed to be an additional KPI that widens the understanding of a vessel Transport Operating Category's (TOC's) GHG intensity performance. SFC perceived the elaborative discussions as a desire for introducing a fairer benchmark into a shipping segment (Ro-Ro) that serves many different transport needs.

Especially for Ro-Pax ships, the chosen method of allocation of emissions will have large impact on the resulting emission intensity value for both freight and passenger transport. Since the choice was to avoid disproportional allocation of emission to either passengers or cargo, it was decided to choose the method that offers the fairest allocation of emissions.

ISO 14083 permits the use of a transport activity measure that is also directly relevant to the sector in question. Based on ISO 14083, the measure of 'quantity of freight' or alternative to mass which serves the Ro-Ro industry is a value that is a combination of mass and volume. This alternative to mass is referenced in ISO 14083 as **Standard Passenger-equivalent** presented below (right hand side). In order to avoid confusion this unit, was renamed to **cargo equivalent units (CEU)** for the Ro-Ro methods standard.

Table G.5 — Standard passenger-equivalent values for Ro-Pax ferries

Passenger transport		Freight transport	
	peq		peq
Individual passenger (including luggage)	1,0	Small van	1,3
Passenger car	1,3	Large van	3,5
Bus/coach	10,0	Rigid truck	10
Caravan, small	1,1	Articulated truck	18
Caravan, medium	2,3	Unaccompanied trailer	14
Caravan, large	3,5		
Mobile home	3,5		
Motorcycle	0,3		
NOTE The passenger-equivalent values contained are based on a combination of mass-based (including the mass of passenger decks) and volume-based equivalence. Using these two inputs appears to provide a balanced outcome that does not unduly favour either passengers or freight at the allocation stage.			

The number of passenger equivalents of a passenger vehicle shown in Table G.5 excludes the passengers transported meaning that the total number of passenger equivalents for a car carrying three passengers is 4,3, i.e. 1,3 for the car itself plus three for the passengers.

The GHG activity data and hence the GHG emissions shall subsequently be calculated at the level of an individual passenger for a passenger transport chain, or a consignment for a freight transport chain, in accordance with the standard rules for passenger or freight transport, respectively.

From the perspective of the Ro-Ro passenger operator, the mass used in the calculation of GHG emissions represents:

- for freight: the total mass of the vehicle including each consignment.

- for passengers travelling in a vehicle: the mass of the vehicle plus the mass of the passengers and any accompanying luggage;
- for foot passengers: the mass of the passengers and their luggage.

NOTE: The number of passenger equivalents of a passenger vehicle shown in the table excludes the passengers transported meaning that the total number of passenger equivalents for a car carrying 3 passengers is 4,3 - i.e. 1,3 for the car itself plus 3 for the passengers.

The CEU is intended to satisfy the need for a complementary value that does not rely exclusively on mass but also takes into account length, width and height which reflects the space that cargo occupies on a Ro-Ro vessel. The ISO CEU list above can be applied. A revision and update list will be expanded on by a number of pilot OEMs and developed and published by ECG/VDA to reflect additional vehicles and other Ro-Ro cargo types. Such process ought to be conducted at a multimodal level since cargo/passenger equivalent units is a measure for multimodal application just as tonne-km. An alternative to the expansion of the CEU list is to apply the formula itself directly, this provides an unlimited granularity and does not rely on a future revision for its application for other cargo types. The CEU formula is as follows:

CEU = (0,00041 x mass (kg)) + (0,019756 x volume (m^3))

(Volume = cargo width x cargo height x cargo length (measured at the widest, highest and longest points of the cargo (cubical principle))

Intensity principles and calculation 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 tonnes = 20.000.000
+
LEG 2: 4.000 Km x 30.000 tonnes = 120.000.000

= 140.000.000 TonneKm

All (see exception below) fuel consumption 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.

There is no issue with a simplified EEOI approach, as long as such simplification delivers the same result (same 'correctness') on the transport activity part of the calculation. E.g., a Ro-Pax service on a regular schedule might conduct the transport activity calculation using the ***average leg distance*** times ***total cargo*** *transported.*

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. This applies also for any possible (for some reason) transport activity being conducted during the same period.

Containers are included on "equal terms" as rolling cargo, meaning a loaded container should be included in transport activity calculation, and, in such loaded condition include the weight of the container ('empty weight') itself. However, an empty container should be fully excluded from the transport activity calculation, meaning neither account for the empty weight of the container. This principle is applicable for both the TonneKm and CEUkm transport activity calculations. In the CEU calculation case, the volume part of the CEU formula is applied just as for rolling cargo (see section CEU calculation above). Equal terms above refer to loaded containers being included in the transport activity parameter, but also to the fact that 'empty weight' (if loaded) is included. Just as a trailer and truck are included and considered 'cargo', not only the vehicles loaded onto the trailer.

Please note that for the transport operator, the trailer, the truck and the actual cargo is considered for quantifying 'quantity of freight' when determining transport activity. From the cargo owner's perspective however, only the actual cargo is considered as 'quantity of freight' in determining their respective transport activity. This means that the emissions allocated to the cargo are the same for the transport operator and the cargo owner but the 'quantity of freight' it is allocated to differs. As a result, the cargo owner must be aware that the emission intensity value provided by the transport operator represents the 'gross quantity of freight'. It is therefore of paramount importance that the transport operator provides the cargo owner with the Well-to-Wake emissions, the emission intensity, the transport activity, the gross 'quantity of freight' and the distance associated with the cargo owners solicited transport service.

With the associated distance and emissions being the same and only the 'quantity of freight' differing between the Transport Operator and the cargo owner, the transport-activity and emission intensity can be recalculated for the cargo owner's scope 3 emission reporting using 'net cargo' as the quantity of freight in the measure of transport activity.

Transport Operation Categories

The development of Transport Operation Categories (TOCs) specific to the Ro-Ro industry is key to enable cargo owners to select the most accurate emission intensity for the transports and apply in their scope 3 footprinting, as opposed to applying a value 'diluted' by different vessel types not relevant for the cargo owner concerned. Defining the ship types under consideration according to their size, volume, trade pattern cargo type specifics etc. is not a straightforward task. Post elaborative group and bilateral discussions the TOCs selected were inspired by the EU MRV and IMO ship type classification to align with existing standards but also to reflect the operations of the methods development working group, the categories selected are: **Vehicle Carrier (PCC+PTCC), Con-Ro, Ro-Ro ('Ro-Ro cargo'/'high and heavy') and Ro-Pax**. These TOCs will serve as the level of aggregation of carrier performance data in addition to a Global fleet average. Meaning, that **all vessels within a fleet** are grouped based on vessel type, each individual vessel's operational data is then added to a TOC average (transport activity weighted average) calculation. E.g., (**vessel 1** fuel consumption + **vessel 2** fuel consumption) / (**vessel 1** transport activity + **vessel 2** transport activity) = **TOC average intensity value.**

Appointing TOC and fleet-wide averages as the data aggregations is a key component of this Ro-Ro methodology guidance. However, there are cases where individual vessel level intensity values make more sense, such as in time- and bareboat chartering situations. TOC and fleet-wide averages form the basis for the exchange of performance data between transport operator and cargo owner. Vessel level intensity outputs may be resorted to, but the concerned transport operator needs to clearly state which aggregation level is behind the value provided.

See 'Deep-sea versus short-sea' section below

A TOC aggregation should make a distinction between short- and deep sea vessels. This is to increase accuracy and relevance of a TOC average intensity number when applied by a cargo owner in scope 3- or benchmarking situations. This means that there are eight distinct categories for data aggregation. The main reason for this is to allow cargo owners to more easily identify the most accurate TOC GHG intensity value representing their operations. The reporting carrier is the one to determine which ships that falls under short-sea and which under deep-sea.

TOC definitions:

Vehicle carrier: a multi-deck roll-on-roll-off cargo ship designed for the carriage of empty cars and truck
Ro-pax ship: a ship, which carries more than 12 passengers and which has roll-on/roll-off cargo space on board
Ro-Ro cargo: a ship designed for the carriage of roll-on-roll-off cargo transportation units or with roll-on-roll-off cargo spaces.
Container/ro-ro cargo ship (Con-Ro): a hybrid of a container ship and a Ro-Ro cargo ship in independent sections;

Reporting period and vessel inclusion

In practice, for high frequency, regular, repeatable, or short duration transport, it is common for the operator to aggregate a year's worth of operational data for transport operations that occur during that time period. This has the benefit of removing seasonal fluctuations from the reported results that can obscure more significant long-term trends.

It was agreed that the reporting period will start on a calendar year basis, meaning the data collected for the reporting will represent the past calendar year's operational data. This is similar to the reporting period used in the The Sea Cargo Charter (SCC)[4] and the Clean Cargo Working Group[5]. This will move to a quarterly update to the carrier performance data from 2025 onwards to align with the multimodal project's ambition and decision for more regular updates to the emission values used for scope 3 reporting.

Owned, managed and operated vessels should be included in the reporting. This means, a cargo owner 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.

[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

Distance measure

Distance to apply in GHG intensity calculations

The distance by which a shipment is transported is measured from the point where the shipper hands it over to the carrier and ends with the hand-over of the shipment to another carrier or the end receiver. 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.

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) that the distance measure applied in scope 3 application is the same as applied the GHG intensity calculation. To bring about a reasonably accurate end-result, there ought to be an information link between the carrier and cargo owner to ensure the actual route between port of origin and port of destination is reflected in the distance number.

A carrier who applies the 'Shortest Feasible Distance' (SFD) (appointed as default procedure by ISO14083) will still need to ensure the overall route (e.g. port A-C-D-E) is reflected since SFD refers to the 'shortest feasible distance' between a port of origin and port of destination including intermediary port stopovers/port calls.

Maritime transport operators currently report transport-activity and emission intensities using actual distances rather than SFD. It is therefore imperative that the distance measure applied by cargo owners for scope 3 reporting matches the distance used by the transport operator to ensure that the distance used for calculating transport activity and for calculating GHG emissions match. As a result, it is important that transport operators share the Well-to-Wake emissions, the emission intensity, the transport-activity, but also the actual distance travelled and 'quantity of freight' separately so that the cargo owner's transport-activity and emission intensity can be recalculated using the 'quantity of freight' of the actual cargo (net cargo) and the actual distance.

Fuel emission factors (carbon conversion factors)

Fuel emission factors play an important role in the calculation of transport emissions. They are used to convert the fuel and energy used to power freight transportation into greenhouse gas emission values. Emission factors are a key part of any carbon footprinting exercise. The emission factor associated with fuel purchased on any particular day at a particular location has a natural variability associated with it, depending upon factors such as the nature of the original feedstock, the locations of production and consumption and the distribution mechanisms used, the energy inputs to and the nature of the production processes used, etc. In general, conventional (fossil) fuels tend to be blends that originate from a mix of sources and processes developed to ensure that they fit within the tolerances of the prevailing local fuel quality standards.

As a result, it is not standard practice to try to put an exact figure on every batch of fuel. Instead, it is accepted practice to use representative values with the understanding that emissions will, over time, average out and match the representative value (assuming that it is well calculated). The potential feedstocks and production processes for conventional fuels are relatively well known and as a result there tends to be a relatively low variation in values quoted for these fuels. In contrast 'new fuels', including some renewable fuels and fuels quoted as having low GHG emissions, tend to have greater variability in potential production process and feedstock combinations, with resulting greater variability in the full life cycle emissions.

Bearing this in mind it is vital that emission factors are based on the most credible sources.

The IMO recently decided to move to a (well-to-wake) WTW reporting basis as part of its updated decarbonization strategy. 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, but initial proposals for default emission factors and accepted ranges for only a small number of the 128 fuel pathways identified therein. 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, it is not clear how many fuels will be provided with emission factors when it is published. Furthermore, it will not be a definitive answer to emission factor definition as further changes are expected in this evolving subject area 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, and as a short-term solution, we believe that it would be 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 maritime/ecoinvent lifecycle database (v3.9.1) and work by IFEU et al. that is related to the implementation of the EC's renewable energy directive;
3. Any emission factors not available from 1 or 2 should be taken from the GREET database.

The majority of the resulting values have been developed in the context of updating the GLEC Framework to make use of the best available sources in line with the approach developed for, and described in, Annex J of ISO 14083.

This approach has recently been adopted by the Poseidon Principles, Sea Cargo Charter and Clean Cargo.

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 us 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.

Values are presented in the following table that show CO_2e emissions for the WTW and TTW phases of the fuel cycle. Emission values are shown by mass of fuel and per unit of energy content.

FUEL EMISSION FACTORS – Primary List

Fuel	WTW Emissions (kg CO_2e / kg fuel)	TTW Emissions (kg CO_2e / kg fuel)	WTW Emissions (g CO_2e / MJ fuel)	TTW Emissions (g CO_2e / MJ fuel)	Lower Heating value (MJ/kg)	Source
Heavy Fuel Oil (HSHFO)	3.76	3.16	93.5	78.6	40.2	MEPC 80/7/4
Heavy Fuel Oil (VLSFO)	3.84	3.16	95.5	78.6	40.2	MEPC 80/7/4
Light Fuel Oil (ULSFO)	4.06	3.21	95.3	75.4	42.6	Ecoinvent 3.9.1 cut-off
Liquefied Natural Gas (Otto dual fuel slow speed engine)	4.05	3.24	82.5	66.0	49.1	Fuel EU maritime amended
Liquefied Natural Gas (Otto dual fuel slow speed engine)	4.47	3.66	91.0	74.5	49.1	Fuel EU maritime amended
Liquefied Petroleum Gas (Butane)	4.05	3.00	88.0	65.2	46.0	Ecoinvent 3.9.1 + fuel EU maritime
Liquefied Petroleum Gas (Propane)	4.02	2.97	87.4	64.6	46.0	Ecoinvent 3.9.1 + fuel EU maritime
Methanol (Natural gas feedstock)	1.50	1.11	75.0	55.5	20.0	GREET (USA)

Another subject for future revision will be where the emission reduction is (or will be) assigned to a specific cargo owner/shipper or LSP, and consumption of renewables not assigned (and will not be) to a specific cargo owner/shipper. Renewable fuels assigned to a specific cargo owner/shipper or LSP ought to, in a future split reporting system, be given a fuel emission factor representing a fossil fuel to avoid double counting of GHG reductions. For the time being, all renewable fuels consumed should be assigned a fuel emission factor representing a fossil fuel. If coherence with this Ro-Ro methods standard is aspired, the fuel category 'blends' (see below) emission factor should be applied for all renewable fuels consumed. This to avoid double counting of GHG reductions.

NOTE: The development of the set of fuel emission factors for renewables to apply is still underway. Until settled and introduced into this Ro-Ro guidance, all renewables 'must' be reported under the BLENDS category.

Intensity and scope 3 calculation examples

Intensity calculations

Ro-Ro, Con-Ro and Vehicle carriers

Tonne-km

Leg 1: 15.000 tonnes x 3.000 km = **45.000.000**

Leg 2: 30.000 tonnes x 2.000 km = **60.000.000**

Leg 3: 0 tonnes x 3.000 km = **0**

Total tonne-km: **105.000.000**

Fuel consumption

Total consumption in tonnes Leg 1 + Leg 2 + Leg 3: **VLSFO 1.250 + ULSFO 2.500**

Total CO_2e in tonnes: (1.250 x 3,84) + (2.500 x 4,06) **= 14.950**

Intensity

Gram CO_2e per tonne-km: (14.950 x 1.000.000) / 105.000.000 = **142,38**

CEUkm

Leg 1: 5.000 CEU x 3.000 km = **15.000.000**

Leg 2: 10.000 CEU x 2.000 km = **20.000.000**

Leg 3: 0 CEU x 3.000 km = **0**

Total CEU: **35.000.000**

Fuel consumption

Total consumption in tonnes Leg 1 + Leg 2 + Leg 3: **VLSFO 1.250 + ULSFO 2.500**

Total CO_2e in tonnes: (1.250 x 3,84) + (2.500 x 4,06) **= 14.950**

Intensity

Gram CO_2e per CEU-km: (14.950 x 1.000.000) / 35.000.000 = **427,14**

Ro-Pax

Tonnekm **(cargo freight)**

Leg 1: 15.000 tonnes x 3.000 km = **45.000.000**

Leg 2: 30.000 tonnes x 2.000 km = **60.000.000**

Leg 3: 0 tonnes x 3.000 km = **0**

Total tonne-km: **105.000.000**

Fuel consumption

Total consumption in tonnes Leg 1 + Leg 2 + Leg 3**: VLSFO 2.500 + ULSFO 5.000**

Total CO_2e in tonnes: (2.500 x 3,84) + (5.000 x 4,06) **= 29.900**

Share of transport activity assigned to cargo freight: 70 %

CO_2e in tonnes allocated to cargo freight: 28.125 x 0,7 = **20.930**

Intensity

Gram CO_2e per tonne-km: (20.930 x 1.000.000) / 105.000.000 = **199,33**

CEUkm **(cargo freight)**

Leg 1: 5.000 CEU x 3.000 km = **15.000.000**

Leg 2: 10.000 CEU x 2.000 km = **20.000.000**

Leg 3: 0 CEU x 3.000 km = **0**

Total CEU: **35.000.000**

Fuel consumption

Total consumption in tonnes Leg 1 + Leg 2 + Leg 3**: VLSFO 2.500 + ULSFO 5.000**

Total CO_2e in tonnes: (2.500 x 3,84) + (5.000 x 4,06) **= 29.900**

Share of transport activity assigned to cargo freight: 70 %

CO2e in tonnes allocated to cargo freight: 29.900 x 0,7 = **20.930**

Intensity

Gram CO_2e per CEU-km: (20.930 x 1.000.000) / 35.000.000 = **598**

Scope 3 calculations

Tonne-km based calculation

*A cargo owner deploying a **vehicle carrier** 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 the Actual Distance from port A to D, in this example being 15000 km.*

This distance doesn't necessarily need to reflect the Actual Distance of the actual shipment of this particular cargo owner's cargo but may instead represent an 'average Actual Distance' for this route (port A to D) for the carrier in question.

The cargo owner had 50 tonnes of cargo onboard transported from port A to D.

TonneKm carried out on behalf of the cargo owner**:** 50 x 15.000 = **750.000**

Tonne CO_2e footprint (**142,38** x 750.000) / 1.000.000 = **106,79** tonnes of CO_2e

(A CEU-km based calculation would be carried out using the same logic)

Suggested developments and revisions

- Formation and establishment of a Ro-Ro buyer-supplier initiative that follow 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 Ro-Ro industry averages over time to relate to international targets
- 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)