CDP Technical Note: Measuring emissions intensity of transport movements

CDP Climate Change Questionnaire

Contents

Version

Version	Revision date	Revision summary
1.0	June 8, 2018	First published version
1.1	April 7, 2020	Question numbers updated to align with the 2020 CDP climate change questionnaire.
1.2	January 7, 2021	Minor editorial changes

1. Introduction

1.1 Why measure the emissions intensity of transportation?

For transport service providers and transport original equipment manufacturers (OEMs), the recommended way to calculate and report transport emissions is by using both an absolute figure and an intensity measurement. Absolute emissions are important, as this is the total emissions figure that ultimately needs to be reduced to mitigate climate change. However, often this does not provide sufficient information for the internal and external understanding of a company's greenhouse gas (GHG) efficiency. To that end, intensity metrics need to be used, which have the following benefits:

- Intensity metrics provide insight into the GHG efficiency of an organization and the transport movements that it owns or contracts. They enable the tracking of progress over time and identify gaps and areas of action for increased mitigation effort within distinct and multi-modal transport chains;

- Intensity metrics enable comparison between different modes of transport and allow for a comparison of efficiency against competitors.

1.2 What does that mean for your CDP response?

In practical terms for the transport sector, this implies measuring emissions per unit of goods or per passenger transported, over a set distance, as expressed in tCO_2e, per passenger or ton, per kilometer or mile (i.e. tCO_2e/p.km - mile or tCO_2e/t.km - mile). In the CDP climate change questionnaire, a primary intensity metric is required to respond to the following questions:

- C-TS6.15, where transport service companies are asked to report a primary intensity metric for all transport movements carried out in the reporting year using light duty and heavy duty vehicles (LDV and HDV), aircraft, marine ships and trains, to enable investors and data users to make a comparison between organizations and the different transport modes they are employing;

- C-TO7.8, where OEMs are asked to report a primary intensity metric for vehicles sold in the reporting year. This enables investors and data users to compare the performance of vehicles with a similar purpose, as well as with policy and market trends. It should be noted that this question only applies to final vehicle producers, not to component manufacturers.

1.3 Purpose of this document

This technical note aims to familiarize the reader with the intensity metric as specified in sections 1.1 and 1.2 above. It explains the rationale behind the use of this metric and why CDP is requesting it. It explains the numerator and denominator, and refers to other relevant standards and resources. The technical note references the GLEC framework produced by the Smart Freight Centre, which is a methodology that aims to unify emissions calculations for different goods and modes into one standardized approach (see Box 1) [1].

The technical note is not a step-by-step guide on how to calculate freight emissions. For that, existing methodologies can be used, such as those detailed in the GLEC framework and in Table 1

[1] Smart Freight Centre, "GLEC Framework for Logistics Emissions Methodologies, Version 1.0," 2016, www.smartfreightcentre.org.

below. Companies unfamiliar with reporting transportation emissions are encouraged to refer to these standards to gather data and calculate their emissions. This technical note can then be used to understand how this information can be converted to the right type of intensity metric for reporting in the CDP climate change questionnaire.

Only companies responding to the transport services and transport OEMs sector questions in CDP's climate change questionnaire are required to report transport-specific intensity metrics, and this document will therefore be most useful to them. Other companies, such as shippers of goods, are also invited to do so when they deem it relevant to their business in question C6.10 of the CDP climate change questionnaire regarding emission intensities.

1.4 Technical basis of this document

The most important resource for this technical note is the framework produced by the Global Logistics Emissions Council (GLEC) [2]. The base methodologies for this framework are shown in Figure 1.

GLEC Framework:

The GLEC framework comprises an industry-specific guidance document that is designed to work in conjunction with the GHG Protocol. The framework presents a harmonized approach to calculating both absolute emissions and emission intensity across all transport modes in the CDP climate change questionnaire (both for the transport sector specific questions, and Scope 3 emissions reporting applicable to all companies). Wherever possible, the GLEC framework has aligned its approach to existing sector methodologies that have already been developed and are widely used within the logistics sector, as well as within global GHG accounting. Figure 1 shows the base methodologies that have been identified by GLEC as leading in terms of their consistency, usefulness and current widespread acceptance and use.

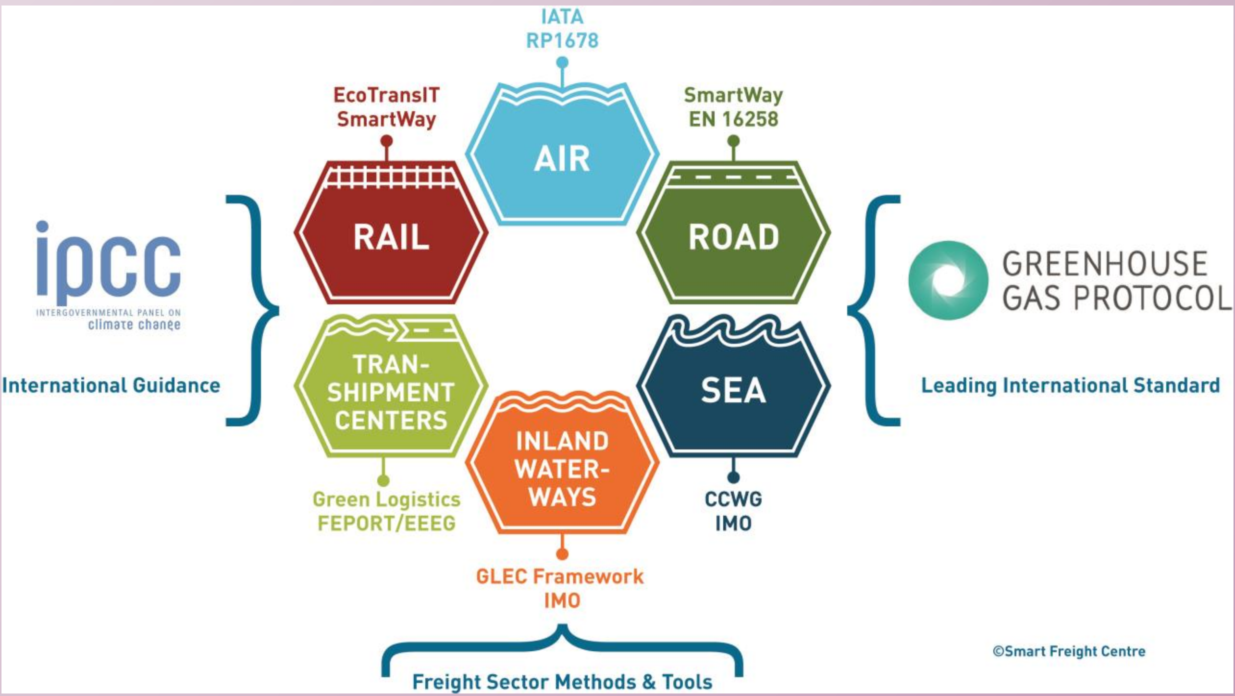

Figure 1: Methodologies identified by GLEC as the basis for their measurement framework

[2] Smart Freight Centre.

2. From absolute emissions to intensity metrics

2.1 Use cases for calculating and reporting emissions

The calculation of emissions from transportation can be used in several ways.

- Corporate carbon footprint: Having information on total fuel use and emissions within the transport chain can be totaled and used as part of the company's Scope 1, 2 and 3 footprints. Reporting emissions from transportation is common practice for most sectors corporate carbon footprints. Transportation is one of the more accessible and established Scope 3 categories to calculate total emissions for;

- Life cycle assessment: Information on transport emissions is key to undertaking life cycle assessments to acquire information for carbon footprints at the product level. Life cycle assessments require more detailed information on the type of transport used, as well as information on distance and load factors. The CDP climate change questionnaire does not request specific information on product-level emissions, therefore this technical note will not further expand on this use-case;

- GHG efficiency of transportation: As explained in section 1.1, intensity metrics capture more relevant information that can be used to benchmark performance and improve efficiency. The following sections will outline what information is required to move from a total carbon footprint to intensity metrics specific to transportation.

2.2 Reporting emissions per ton-kilometer or passenger-kilometer

The transport services and transport OEM sector questions in CDP's climate change questionnaire request companies to report primary intensity metrics. These metrics measure the efficiency of transportation based on the actual work being done[3]. The amount of work done comprises the goods and/or passengers moved and the distance, from origin to destination, that these goods and/or passengers are moved. For the organization, the efficiency of total work done is determined by combining total of transported units and the distance travelled with these units.

The work done is expressed as a common unit in tons of CO_2e per unit of goods/passengers, per unit of distance. This is expressed as:

$$Emissions\ per\ unit\ of\ work\ done = \frac{\sum tCO2e}{\sum t.km}$$

In the rest of the document, for purposes of conciseness only the ton-kilometer (t.km) metric is used as an example, but tons can be substituted by passengers and kilometers by miles.

Numerator: $\sum tCO_2e$

In this metric, the numerator in tons of CO_2e is equal to the total emissions from transportation associated with the total ton-kilometers or passenger-kilometers that represent the work. This can be calculated using standardized methods such as the World Resources Institute (WRI) GHG

[3] Igor Davydenko et al., "Towards a Global CO_2 Calculation Standard for Supply Chains: Suggestions for Methodological Improvements," *Transportation Research Part D: Transport and Environment* 32 (October 1, 2014): 362–72, https://doi.org/10.1016/j.trd.2014.08.023.

Protocol [4], using fuel data, or can be estimated from standardized factors if the total work done is known.

Denominator: ∑ t.km

Each element of the ton-kilometer metric is explained below, in line with the GLEC framework.

Ton

"Mass, volume and density are common attributes of freight. Despite the pros and cons of each, weight is more widely used and was thus selected for use in the GLEC Framework; the most common unit is the metric ton. In circumstances where the weight is not known, convention is well established, or the operational characteristics dictate that an alternative unit for the amount of goods transported is required, then a conversion factor would be required to convert the amount of goods into a mass equivalent for the purposes of comparison. The basis for the weight to be included is the actual weight and not proxies such as 'chargeable weight'; additionally, the weight should include the product and packaging provided for transport by the shipper. Additional packaging or handling equipment used by the carrier or LSP should not be included in the total weight."

Kilometer

The distance unit is the kilometer (which can be converted to or from miles as needed for application). Distance can be determined using the following approaches:

- *"Great circle distance (GCD), also known as direct distance "as the crow flies"*
- *Shortest feasible distance (SFD), as produced by a route planning software package, which may or may not take account of physical restrictions on a vehicle for example weight and height restrictions*
- *Planned distance: the shortest planned distance related to real operating conditions. This is a modification of the theoretical SFD. For road, this takes into account weight and height restrictions and typical operational choices taken to avoid congestion hotspots such as urban centers or local/small rural roads by using highways, unless required for a collection or delivery*
- *Actual distance travelled, e.g. based on knowledge of actual routings or odometer readings*

In general, the other approaches underestimate the distance travelled in comparison to the actual distance. Therefore, a correction factor may be applied to the GCD, SFD or planned distances as an approximation of actual distance travelled where it is not known. The correction factor should be mode-specific to reflect how direct the route network is. The appropriate approach for calculating distance varies by mode […].

SFD, planned distance and actual distance are often used to estimate fuel used in the actual transport of combined shipments, of routed trips."

Figure 2 shows how this calculation is carried out to gather the emissions intensity, that covers all transport movement made using aircraft. As a minimum, the questionnaire for transport OEMs asks responders to calculate this as an average of all vehicles of a certain mode (LDV, HDV, Aircraft, Marine ships, Trains) produced and marketed by the company.

Reporting average figures across all vehicles of a certain mode may or may not be suitable to a company's products or the vehicles that it uses, if those vehicles within a mode are very different from each other. For example, for a trucking company that uses only heavy trucks that are of a similar weight and size, the mode-average across all Heavy Duty Vehicles will be a strong metric.

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[4] World Resources Institute, "Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard," 2017.

However, for a company that operates both long-haul HDV trucks and small last mile delivery trucks, the average will be very much influenced by the make-up of the fleet between these two types. Therefore, the organization is then encouraged to calculate and report separate figures: one for long-haul heavy duty trucks, and one for smaller last mile delivery trucks. For aircraft operators, a similar principle exists between intercontinental and national/regional flights, which are operated on different types of aircraft with different efficiencies. In any case of a split between types, organizations should ensure that the intensity calculation covers as much of the company's operations as possible.

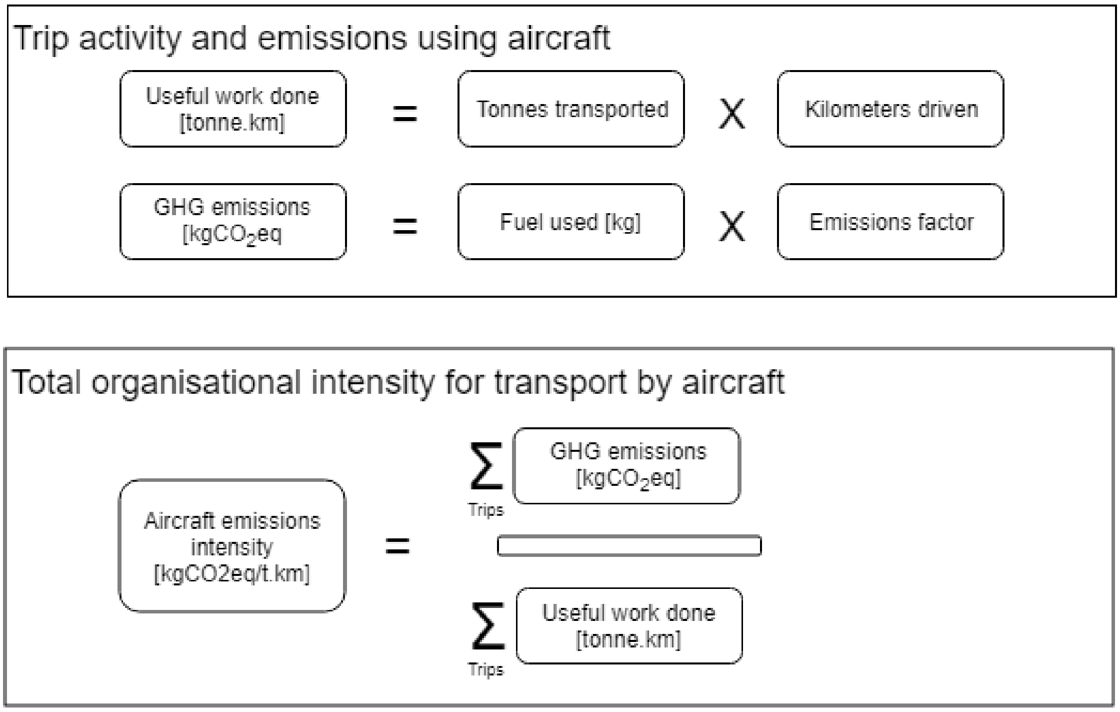

Figure 2: Calculating emissions intensity, example flowchart for aircraft operators transporting freight.

3. Resources for calculating primary intensity metrics

3.1 Transport Services

For the purposes of reporting to CDP, transport service companies, are defined as companies whose primary activity is the carrying of goods or passengers, or providing logistics services by subcontracting transport movements, respectively named ‘carriers’ and ‘logistics service providers’ (LSPs). In the CDP climate change questionnaire, companies are asked to calculate their primary intensity per transport mode, in t.km or p.km, and supply the primary data points in useful work done, as well as total transport-related GHG emissions (top panel in Figure 2).

How to use existing standards to calculate intensity metrics

It is expected that many organizations may not yet be familiar with reporting emissions per unit of work done. However, many standards, guidance documents and recommended practice already use this metric and have incorporated it in full.

The GLEC framework, as briefly explained in Box 1, is targeted at carriers, LSP’s, as well as shippers (organizations who purchase transport services for their goods and/or passengers). Furthermore, the framework is built on a large number of existing standards that your organization may already use to calculate your transport emissions in Scope 1, 2 and 3. Figure 1 shows which standards are adopted and built on in the GLEC framework, and using one of these standards, companies may use the GLEC framework to take the step from these standards to calculating your emissions intensity in tCO_2e per t.km or p.km.

For example, for marine shipping companies, the Clean Cargo Working Group (CCWG) standard for container shipping can be used to calculate an emissions intensity in tCO_2e/20ft.km, or 20 foot container-kilometer. A standard conversion factor of 1 20ft container = 10 tons may be used to convert this to an intensity in tCO_2e/t.km. Please refer to the mode-specific guidance of the GLEC framework for examples for LDV, HDV, Rail and Aviation as well. The following table lists the standards that the framework is built on and links them to CDP’s transport services questionnaire, with a short overview of the steps necessary to gather the data and calculate the desired metric per work done.

Table 1: Linking CDP transport modes to industry standards and methodologies

<table>
<tr><th>Transport mode</th><th>Standard/methodology</th><th>Steps to get to metric per unit of work done</th></tr>
<tr><td rowspan="2">LDV/HDV (Light/Heavy duty vehicle)</td><td>EN 16258</td><td>No major modification necessary</td></tr>
<tr><td rowspan="2">SmartWay</td><td rowspan="2">No major modification necessary</td></tr>
<tr><td rowspan="2">Rail</td></tr>
<tr><td>EcoTransIT</td><td>No major modification necessary</td></tr>
<tr><td rowspan="2">Marine (Sea)</td><td>CCWG (Clean Cargo Working Group)</td><td>Convert units to ton-kilometer (convert using standard weight factor)</td></tr>
<tr><td>IMO Energy Efficiency Operational Indicator (EEOI)</td><td>No major modification necessary</td></tr>
<tr><td>Air</td><td>IATA Recommended Practice 1678 (RP 1678)</td><td>Already largely aligned, using metrics per ton and passenger-kilometer. Upscale CO_2 to CO_2e</td></tr>
</table>

3.2 Transport OEMs

Transport OEMs are asked to calculate an intensity metric as part of their Scope 3 emissions breakdown. Many OEMs, especially auto manufacturers, are already calculating an intensity metric in the form of CO_2 or CO_2e per vehicle-kilometer. This metric however is not sufficient for reporting to question C-TO7.8, which asks for an intensity metric per unit of work done, as described in this document.

Please note that this does not mean you are unable or discouraged to report emissions per vehicle kilometer or mile, rather that this data belongs in a different question, namely C-TO8.5. In this question, you can select the appropriate numerator and denominator to report your data in C-TO8.5. It is expected that for the first year of reporting, OEMs may not be ready to report a Scope 3 emissions intensity figure in passenger- or ton-kilometer for their entire fleet. In this case, you are encouraged to start with the reporting of emissions per vehicle kilometer in C-TO8.5, and then move to C-TO7.8.

Ton- or passenger-kilometer vs. vehicle-kilometer

The difference between measuring CO_2 or CO_2e per vehicle-kilometer and the ton- or passenger-kilometer metric that is desired is the load factor. This is a factor that converts the travel of one vehicle to the total weight of goods in tons, or the number of passengers it carries. For example, for light duty vehicles, the average load factor for passenger cars is between 1.2 and 1.7, depending on the country [5]. Transport OEMs may have to use assumptions such as this to gather an expectation on how their vehicles will be utilized (the level of work that will be done with them).

It is important that this assumption is not equal to the maximum load factor but reflects some expectation as to actual load factor. Service companies can also use assumptions and are likely to start with those when not familiar with the t.km metric, however they are encouraged to try and gather primary data on the actual ton-kilometers that is independent of their vehicles, following the schematic in Figure 2.

[5] EEA, “Occupancy Rates of Passenger Vehicles” (European Environment Agency, 2015).