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# Study supporting the Impact Assessment of the CountEmissions EU initiative

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# Content

# Glossary

| Term | Explanation |
|---|---|
| Air pollutant emissions | Emissions of CO, $NO_x$, NMVOCs, $PM_{10}$, $PM_{2.5}$ and $SO_X$, which are harmful to human health, such as causing respiratory conditions, and detrimental to the environment and biodiversity. Air pollution can cause a variety of adverse health outcomes for people, including the risk of respiratory infections, heart diseases, and lung cancer. Air pollution also has an impact on biodiversity and the condition of the environment. |
| Allocation parameters | Parameters that are used to allocate emissions towards individual shipments or passengers. |
| Alternative fuels | A type of motor energy other than the conventional fuels, petrol and diesel. Alternative fuels include electricity, LPG, natural gas (LNG or CNG), alcohols, mixtures of alcohols with other fuels, hydrogen, biofuels (such as biodiesel), etc. |
| Biofuels | Biofuels are fuels derived directly or indirectly from biomass. They can be split up into three categories:<br>1. Solid biofuels (fuelwood, wood residues, wood pellets, animal waste, vegetal material, ...). These are not relevant for transport.<br>2. Liquid biofuels (biogasoline, biodiesel, bio-jet kerosene, ...).<br>3. Biogases (from anaerobic fermentation and from thermal processes). |
| Black carbon | Black carbon is part of fine particulate matter (≤ 2.5 μm) emitted from impartial fossil fuel combustion. Black carbon is a short-lived, only several weeks, climate pollutant with potent global warming potential as well as a negative effect on human health. |
| $CO_2$-eq | A carbon dioxide equivalent or $CO_2$ equivalent, abbreviated as $CO_2$-eq is a metric measure used to compare the emissions from various greenhouse gases on the basis of their global warming potential (GWP), by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential. |
| Default data | Data value drawn from a published source. |
| Emission calculation | Calculation of emissions at the company, vehicle, trip or leg level. Based on collected data on transport performance and energy consumption and/or default data, GHG emissions are calculated. |
| Emission accounting | Accounting of emissions is the quantification of GHG emissions.<br>It involves measurements, calculations, and allocation. Aggregations and/or allocation towards individual shipments or passengers are part of emission accounting. |
| (Emission) measurement | Measurement and collection of primary data used to calculate emissions. Examples are transport distances, fuel consumption and loading factors. |
| Greenhouse Gas (GHG) emissions originating from combustion of fuel and from refrigeration expressed in $CO_2$-eq | A gas that contributes to the natural greenhouse effect. The Kyoto Protocol covers a basket of six greenhouse gases (GHGs) produced by human activities: carbon dioxide ($CO_2$), perfluorocarbons (PFCs), nitrous oxide ($N_2O$), nitrogen trifluoride ($NF_3$), sulphur hexafluoride ($SF_6$), and methane ($CH_4$). |
| Global Warming Potential (GWP) | Index, based on radiative properties of GHG, measuring the radiative forcing following a pulse emission of a unit mass of a given GHG in the present-day atmosphere integrated over a chosen time horizon, relative to that of carbon dioxide ($CO_2$). |

| Term | Explanation |
| --- | --- |
| Great circle distance (GCD) | Transport distance determined as the shortest distance between any two points measured along the surface of a sphere. |
| Life-cycle emissions | A method of assessing the emissions of a product over its entire life cycle. The life cycle generally means the time between manufacturing the product and ultimately disposing of it. The full life-cycle emissions of transport include emissions from productions, use, maintenance and dismissal of vehicles, infrastructure and fuels. |
| Load factors | Ratio of the actual load and the maximum authorised load of one means of transport. |
| Modelled data | Data established by use of a model that takes into account primary data, completed with default data to derive estimates of GHG emissions of a transport or hub operation. |
| Non-$CO_2$ effects at high altitude | Aircraft engine emissions of oxides of nitrogen ($NO_x$), soot particles, oxidised sulphur species, and water vapour which, in addition to $CO_2$, result in and additional climate change effect in case they are emitted at high altitudes. |
| Primary data | Data obtained from a direct measurement or a calculation based on direct measurements. |
| Shortest feasible distance (SFD) | Transport distance determined as the distance achievable by the shortest practical route available according to the infrastructure options for a particular vehicle type. |
| TEU | Twenty-foot equivalent unit, abbreviated as TEU, is a unit of volume used in maritime and rail transport statistics, equivalent to a 20 foot ISO container. |
| Transport chain | Sequence of elements related to freight or a (group of) passenger(s) that, when taken together, constitutes its movement from an origin to a destination. |
| Transport chain element/leg | Section of a transport chain within which the freight or a (group of) passenger(s) is carried by a single vehicle or transits through a single hub. |
| Transport hub | Location where passengers transfer and/or freight is transferred from one vehicle or mode of transportation to another before, after or between different elements of a transport chain. |
| Transport Operation Category (TOC) | Group of transport operations with similar characteristics. |
| Transport service operators | Entities that carry out transport operations involving carriage of freight, or passengers, or both. |
| Transport service organisers | Entities that act as intermediate between transport service users and transport service operators. It can be a travel agency, a tour operator or a freight forwarder. |
| Transport service users | Entity that buys and/or uses a transport service, e.g. passengers, producers and final-customers. |
| Tank-to-wheel, wake or propeller | Tank-to-wheel (TTW) refers to a method used to calculate the energy consumed and GHG emitted from the point at which the transport fuel is transmitted to the vehicle (at the recharging or refuelling station) to the moment of its discharge (consumption of the fuel or electricity, while on the move). |
| Vehicle | Any means of transport, including e.g. vessels and aircraft. |
| Well-to-tank | Well-to-tank refers to a method used to calculate the energy consumed and GHG emitted from the moment of production of a transport fuel (petrol, diesel, electricity, natural gas) to the moment of fuel supply (at the recharging or refuelling station). |
| Well-to-wheel | Well-to-wheels refers to the holistic approach of calculating the energy consumed and GHG emitted by a transport fuel from its production, over its distribution and supply up to its use. This generic term therefore subsumes well-to-tank and tank-to-wheel. |

# Overview of abbreviations

| Abbreviation | Explanation |
|---|---|
| 3PL | Third party logistics |
| CCWG | Clean Cargo Working Group |
| CEN | European Committee for Standardisation |
| $CH_4$ | Methane |
| CNG | Compressed Natural Gas |
| $CO_2$ | Carbon dioxide |
| $CO_2$-eq | Carbon dioxide equivalents |
| CORSIA | Carbon Offsetting and Reduction Scheme for International Aviation |
| CSR | Corporate Social Responsibility |
| CSRD | Corporate Sustainability Reporting Directive |
| CVD | Clean Vehicle Directive |
| DC | Distribution centre |
| DCS | Data Collection System |
| DBEIS | Department for Business, Energy & Industrial Strategy |
| DEFRA | Department for Environment, Food & Rural Affairs |
| EASA | European Union Aviation Safety Agency |
| EC | European Commission |
| EEA | European Environment Agency |
| eFTI | Electronic freight transport information |
| EPA | Environmental Protection Agency (US) |
| ESG | Environmental, Social and Governance |
| ETS | Emission Trading Scheme |
| EU | European Union |
| FQD | Fuel Quality Directive |
| g | Gram |
| GCD | Great Circle Distance |
| GHG | Greenhouse Gas |
| GLEC | Global Logistics Emissions Council |
| Gton | Gigatonne |
| GWP | Global Warming Potential |
| HDV | Heavy Duty Vehicle |
| HFC | Hydrofluorocarbon |
| IATA | International Air Transport Association |
| ICAO | International Civil Aviation Association |
| ICE | Internal combustion engines |
| IMO | International Maritime Organisation |
| IPCC | Intergovernmental Panel on Climate Change |
| ISO | International Organisation for Standardisation |
| IWT | Inland waterway transport |
| JRC | Joint Research Centre |
| kWh | Kilowatt-hour |
| LDV | Light Duty Vehicle |
| LNG | Liquid Natural Gas |
| LPG | Liquified Petroleum Gas |
| MJ | Megajoule |
| MRV | Monitoring, Reporting and Verification |

| Abbreviation | Explanation |
|---|---|
| MS | Member state |
| $N_2O$ | Nitrous oxide |
| NEDC | New European Driving Cycle |
| $NO_x$ | Nitrogen oxides |
| NTM | Network for Transport Measures |
| OEF | Organisation Environmental Footprint |
| OEM | Original equipment manufacturer |
| PEF | Product Environmental Footprint (PEF) |
| Pkm | Passenger-kilometre |
| RED | Renewable Energy Directive |
| SET | Small emitters tool |
| SME | Small and medium-sized enterprises |
| SFD | Shortest feasible distance |
| $SO_x$ | Sulphur oxides |
| TOC | Transport Operation Category |
| TEU | Twenty-foot equivalent unit |
| Tkm | Tonne-kilometre |
| TTW | Tank-to-wheel |
| UN | United Nations |
| Vkm | Vehicle-kilometre |
| WLTP | Worldwide Harmonised Light Vehicle Test Procedure |
| WTT | Well-to-tank |
| WTW | Well-to-wheel |

# Executive summary

The 2020 Sustainable and Smart Mobility Strategy explicitly includes the provision of better information on the greenhouse gas (GHG) performance of individual transport operations as a key instrument to incentivise transport users and operators to lower the GHG impact of their transport decisions. The information has the potential to empower transport users to compare transport modes and operators on their GHG emissions performance. Furthermore, the information might also be used to create a system of credentials for operators, which could then find its way into contractual agreements and procurement processes, but also, for example, into green financing mechanisms or the development of consumer labelling schemes.

In the current ecosystem of transport GHG emissions accounting, different methodologies and data from different sources and of different quality are used by a diversity of organisations. These differences make comparison of GHG emissions figures from transport services complicated and hence hamper the use of this type of information by both transport users and operators. The European Commission has recognised this problem, and it therefore announced the CountEmissions EU initiative, with the aim to establish an EU framework for harmonised accounting of transport and logistics GHG emissions.

The objective of the support study is to provide the Commission with robust evidence on the problem logic, policy options and potential impacts of CountEmissions EU. Based on the evidence collected and the further analysis, a preferred option for the implementation of the initiative on the EU internal market has been identified.

## What is the problem?

Based on an extensive desk study and input from a diversity of stakeholders, two problems have been identified that CountEmissions EU can address:

- **Problem 1: Limited comparability of results from GHG emissions accounting in transport and logistics**. The existence of different methodological frameworks and particularly numerous emission default databases and datasets contribute to high variance in the GHG emissions figures of transport services produced. This high variance limits the possibilities to use these figures to effectively manage emissions and/or to use them for application like benchmarking the environmental performances of the services provided by different operators. This problem was broadly recognised by the stakeholders consulted for this study.
- **Problem 2: Limited uptake of emissions accounting in usual business practice**. Despite growing interest of transport stakeholders in GHG transport performance data, the overall uptake of GHG emissions accounting of transport services is still very limited. Most transport users do not receive accurate data on the performance of transport services, and only a small share of the transport operators do calculate GHG emissions of their transport operations. And the majority of the companies which apply GHG emissions accounting, do this at the company or vehicle level and not at the transport service level (while only the latter type of information is relevant to support and influence decisions of users). From all transport operators in Europe, it is estimated that only 1.2% account for GHG emissions at the transport service level.

Five drivers underlying these problems have been identified:

1. No set of common methodological principles to apply GHG emissions accounting, which significantly lowers the comparability of GHG emissions figures.
2. No set of harmonised input data to apply GHG emissions accounting; as primary data is not always available to companies, default emission factors are often required to calculate the emissions of transport services. As the available databases providing these default factors differ in scope and quality, this significantly contributes to the limited comparability of GHG emissions accounting output.
3. Reluctance to reveal sensitive operational data: because of the fear to share commercially sensitive data, particularly freight transport operators may be reluctant to share primary operational data. This lowers the quality of GHG emission figures and may hamper transport users to calculate the GHG emissions figures of their transport services.
4. Lack of trust concerning GHG emissions output data among transport users, making them hesitant to require such figures from transport operators and hence this limits the uptake of GHG emissions accounting in business practice.
5. Perceived complexity and high costs of GHG emissions accounting, which hampers the uptake of GHG emissions accounting by both transport users and operators.

## What should be achieved by CountEmissions EU?

The general policy objective of CountEmissions EU is to "*incentivise behavioural change among businesses and customers to reduce GHG emissions from transport services through the uptake of comparable and reliable GHG emission data.*"
The general objective is supported by the vast majority of consulted stakeholders, for example: 90% (28 out of 31) of the respondents to the targeted survey agreed with the objective.

The specific objectives are:

1. SO1: Ensure comparability of results from GHG emissions accounting in transport.
2. SO2: Facilitate the uptake of the GHG emissions accounting for business and customers.

## What are the available policy options?

Six policy options have been developed to achieve the objectives stated above. These options mainly differ in three ways: the methodology applied (varying between comprehensive and more conducive methodologies); the level of harmonisation of data and complementary measures (harmonising these elements at the EU level or at a more decentralised level); and the extent to which the CountEmissions EU framework becomes mandatory in its application (including for who).

**Policy Option 1** is the most stringent one, mandating all transport operators, organisers and users (except individuals) to account transport GHG emissions and then verify this process using EU accredited third parties. Additionally, a newly developed, very comprehensive methodology framework based on ISO standard 14083[1] (but with additional elements and increased accuracy compared to ISO standard 14083) is prescribed, providing the highest level of guidance to users, and hence ensuring maximum comparability of GHG emissions figures. As in the other policy options, the use of primary data for accounting GHG emissions is encouraged by recognising the higher quality of information provided by

[1] In March 2023, ISO 14083 has been published and has been approved by CEN as EN ISO14083:2023, just before finalisation of this study. In the study, we therefore often refer to ISO 14083 instead of EN ISO14083:2023.

companies that choose to do so. Default emission intensity factors may, however, be used if primary data is not available and can be taken from a centralised EU database. Harmonised calculation tools and data exchange mechanisms are centralised at the EU level.

**Policy Option 2** implements a voluntary framework for GHG emissions accounting, leaving companies and other relevant entities free to choose to apply the CountEmissions EU framework or not. In line with the voluntary character of this policy option, a more conducive reference methodology is applied than in PO1, i.e. ISO 14083. This reference methodology is expected to be the most acceptable to the largest group of stakeholders. Verification of the process and input data is voluntary as well. Supporting tools, like default emissions intensity factors, calculation tools and data exchange mechanisms are harmonised and provided centrally (EU level), providing companies easy access to such tools.

**Policy Option 3** seeks to find the balance between further harmonisation of GHG emissions accounting in the transport sector and the additional administrative burden for transport operators and users. It therefore leaves companies and other relevant entities free to account GHG emissions of their transport services, but if they choose to do so, they have to apply the CountEmissions EU framework. The use of the same comprehensive methodology as in PO1 should ensure a high level of harmonisation of GHG emissions output. At the same time, only large companies are obliged to verify their process and input data using accredited bodies, thus lowering the administrative burden for SMEs. A harmonised default emissions database is developed at the EU level (like in PO1 and PO2), but use of emission intensity factors from sectoral databases (developed according to rules recognised by the EU) is permitted. This provides companies the opportunity to use intensity factors that better reflect the characteristics of their transport operations. The provision of other support tools, for example: calculation tools; is left to the market, but such tools should be certified by EU accredited bodies.

**Policy Option 4** is similar to PO3. The difference is the common reference methodology to be applied. Like in PO2, the more conducive ISO 14083 Standard is applied. This differentiation between PO3 and PO4 provides the opportunity to specifically assess the effect of the reference methodology chosen on the impacts of CountEmissions EU.

**Policy Option 5** is similar to PO3 and PO4. The difference is that the newly developed Product Environmental Footprint Category Rules for transport are set as the reference methodology. The scope of this methodology is broader than the ones applied in PO1–PO4, as it also covers the life-cycle GHG emissions of vehicles and transport infrastructure. This methodology addresses the desire of some stakeholders (i.e. particularly citizens and transport users) to cover these emissions as well. In addition, PO5 brings the fully centralised database of default values for GHG intensity factors, similarly as the one used in PO1 and PO2.

**Policy Option 6** is similar to PO4. The difference is that all transport operators and organisers/users (except passengers) are mandated to account for their GHG emissions. This differentiation between PO4 and PO6 provides the opportunity to assess the trade-offs of applying ISO 14083 with a full obligation to account GHG emissions on businesses involved, compared to the situation where application of ISO 14083 is less strict.

## What are the expected impacts?

It is important to acknowledge that CountEmissions EU is an enabling set of policy measures since it deals with harmonised measurement and calculation of greenhouse gas emissions.

While there will clearly be some direct impacts associated with implementing a harmonised transport emissions accounting framework in the EU, it is expected that the existence of a harmonised framework would enable far greater indirect impacts that will be attributed to the sharing of the information produced (reporting). These indirect positive impacts are, however, outside the scope of this impact assessment.

The significant impacts considered are:
- regulatory costs and benefits;
- GHG emissions savings (primary benefit);
- other external costs of transport (including air quality and accidents);
- innovation and technological development;
- impact on SMEs;
- functioning of the internal market and competition.

All of the impacts depend heavily on the 'uptake' of emissions measurement and calculation. And that is determined by both the regulatory setting (i.e. what is made voluntary and what is made mandatory if anything) and willingness of transport sector actors to take up transport emissions measurement and calculation (i.e. attractiveness).

The estimated costs and benefits associated with each policy option are summarised in Table 1.

**Table 1 – Costs and benefits associated to each policy option compared to the baseline (million €$_{2022}$, NPV over the period 2025-2050)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **Economic impacts** | | | | | | |
| Adjustment costs (National public authorities (including NABs)) | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 |
| Administrative costs (National public authorities (including NABs)) | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 |
| Adjustment costs (EEA) | -3.6 | -3.6 | -3.9 | -3.9 | -3.6 | -3.9 |
| Adjustment costs (EC) | -2.7 | -0.3 | -2.4 | -0.0 | -5.3 | -0.0 |
| Adjustment costs (businesses) | -95,010.8 | -1,084.6 | -1,374.4 | -1,542 | -2,283.7 | -67,927.7 |
| Administrative costs (businesses) | 0.0 | 0.0 | -0.5 | -0.5 | -0.3 | -0.5 |
| Avoided fuel used (operators and passengers) | 10,362.9 | 1,585.5 | 718.3 | 2,415.9 | 630.5 | 10,362.9 |
| Innovation | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social impacts** | | | | | | |
| Reduction in external costs of accidents | 2,760.5 | 424.4 | 192.2 | 645.2 | 168.6 | 2,760.5 |
| **Environmental impacts** | | | | | | |
| Reduction in external costs of GHG emissions | 2,878.9 | 445.4 | 200.0 | 674.1 | 174.9 | 2,878.9 |
| Reduction in external costs of air pollution emissions | 600.6 | 110.8 | 53.1 | 163.5 | 47.0 | 600.6 |
| **Overall net benefits** | | | | | | |
| **Net benefits** | **-78,414.4** | **1,477.3** | **-217.9** | **2,352.1** | **-1,272.1** | **-51,329.4** |
| **Benefit Cost Ratio** | **0.17** | **2.36** | **0.84** | **2.52** | **0.45** | **0.24** |
| **Net benefits SMEs** | | | | | | |
| **Net benefits** | **-83,884** | **493** | **-419** | **919** | **-1,254** | **-66,584** |

* All negative figures are costs, all positive figures are (net) benefits.

## What is the preferred option?

PO4 (i.e. binding opt-in scheme, using ISO 14083 as common reference methodology) has been identified as the policy option best balancing the effectiveness and costs of the CountEmissions EU initiative. As shown above, PO4 results in the highest net benefits of all Pos (about € 2.4 billion NPV over the period 2025-2050). By using the highly acceptable / attractive and collaboratively developed (among key stakeholders) ISO 14083 as reference methodology, a relatively high uptake of emissions accounting at the transport service level can be expected, which results in relatively high benefits in terms of fuel costs savings (about € 2.4 billion NPV), GHG emissions reductions (about € 0.7 billion NPV) and reductions in accident costs (about € 0.6 billion NPV). On the other hand, the costs for businesses is relatively limited (about € 1.5 NPV), which is mainly because GHG emissions accounting is not mandatory. Costs incurred by other stakeholders (for example the EEA) are relatively low and more or less aligned with other options. Finally, no significant issues with respect to coherence with other EU policies have been identified for this policy option.

# 1 Introduction

## 1.1 Background to CountEmissions EU

The European Green Deal aims to accelerate the transition to a climate-neutral economy in the EU in 2050 (EC, 2019). To reach climate neutrality, a 90% reduction in transport emissions is required by 2050 (with an intermediate target of 55% $CO_2$ reduction, compared to 1990 levels, for 2030[2]). In the Sustainable and Smart Mobility Strategy, the European Commission presents its vision on how the European transport system can significantly reduce its emissions for its transition towards a more sustainable sector (EC, 2020d). Providing better information on the greenhouse gas (GHG) performance of individual transport operations is seen as one of the instruments to incentivise transport users (and operators) to lower the GHG impact of their transport decisions[3].

Better information on the GHG emissions related to transport services will empower transport users (both shippers/consumers and passengers) to compare transport modes and operators on their GHG emissions performance. The information might also be used to create a system of credentials for operators, which can be envisaged in contract relations and procurement processes, but also, for example, in green financing or the development of consumer labelling schemes.

To fully benefit from the provision of information on the GHG performance of individual transport services, reliable and comparable GHG emissions figures should be available. However, in the current market for GHG emissions accounting different methodologies and data from different sources and of different quality are used by various organisations and schemes.

This fragmented landscape of GHG emissions accounting has been recognised by the European Commission for a long time. The 2011 Transport White Paper, for example, encouraged business-based GHG certification schemes and identified a need to develop common EU standards in order to estimate the GHG emissions of each passenger and freight journey (EC, 2011). Several initiatives have been taken over the last decade to contribute to this aim for further harmonising the application of GHG emissions accounting in the transport sector (Ricardo et al., 2021). For example, the European Committee for Standardisation (CEN) adopted the European Standard EN 16258 (CEN, 2012), which until 2023 was the only standard on GHG emission accounting dedicated to transport services. Additionally, the EU financed two research projects on this topic, i.e. COFRET[4] and LEARN[5]. These projects contributed to the development of the Global Logistics Emissions Council (GLEC) Framework[6] by Smart Freight Centre (SFC, 2019b). The ISO 14083 Standard on

[2] See the Climate Target Plan (EC, 2020c).

[3] Action 33 of the Action plan accompanying the Strategy.

[4] See DLR (2014).

[5] Relevant information on the LEARN project is available here.

[6] A broadly recognised and widely used methodology for harmonised calculation and reporting of the logistics GHG emissions across the multi-modal supply chain. See Annex A in the Annex report accompanying this study for more details on the GLEC Framework.

'Quantification and reporting of greenhouse gas emissions of transport operations' was published in March 2023 and approved by CEN as EN ISO 14083:2023.[7]

Stemming from the Sustainable and Smart Mobility Strategy, the European Commission announced the CountEmissions EU initiative, with the goal to establish an EU framework for harmonised accounting of GHG emissions for transport and logistics.

## 1.2 Objective and scope of the study

The objective of this support study is to provide the Commission with evidence on the problem logic, policy measures, policy options and impacts of CountEmissions EU. Based on this evidence, the preferred option for the implementation of the initiative on the EU internal market shall be identified.

CountEmissions EU aims to incentivise behavioural change among businesses and customers to reduce GHG emissions from transport services through the uptake of comparable and reliable GHG emission data. The initiative focusses on GHG emissions accounting at the transport service level, i.e. the movement by means of transport of a person or shipment from point A to point B. The initiative covers all transport modes, both for passenger and freight transport.

Although CountEmissions EU is focussing on GHG emissions (see Section 6.3.2 for more details), extensions to other types of emissions (air pollutants) or other externalities (e.g. noise, accidents) may be possible in the future. Furthermore, the scope of GHG emissions may also be extended over time. Therefore, the design of the initiative should have a certain level of flexibility, in order to make such extensions feasible.

In this study we distinguish between four different players on the transport market that are relevant with respect to GHG emissions accounting: transport operators, transport organisers, transport users and hub operators. These four types of players are defined in Textbox 1.

**Textbox 1 - Definition of relevant entities on the transport market**

Based on (ISO, 2023), we distinguish the following three entities in the in the transport and logistics market:

1. **Transport service organisers, which include both transport operators** and entities that act as intermediate between transport operators and transport users. Transport operators are the entities that carry out transport operations involving carriage of freight, or passengers, or both. Road carriers, railway operators, airlines or public service providers are examples of transport operators). Travel agencies, tour operators or freight forwarders, on the other hand, are examples of transport service organisers that act as intermediate between operators and users. These entities may subcontract all transport and logistics activities to operators, but some of them also act as operator on specific segments of the transport chain.
2. **Transport users** are entities that buy and/or use a transport service. Users can be a passenger, a firm arranging/buying business travel or a shipper.
3. **Hub operators** are entities that organise the transfer of freight or passengers through a transport hub (e.g. rail station, airport, maritime port, warehouse). Warehouse owners or port managers are examples of hub operators.

[7] EN ISO 14083:2023 was adopted by the CEN just before finalisation of this study. In the study, we therefore sometimes make reference to ISO 14083 where EN ISO 14083:2023 would have been more appropriate in the context of EU policies. Furthermore, we sometimes refer to ISO 14083 as being still in preparation.

Some companies take on several roles in the transport market. For example, large third party logistics (3PL) providers are mainly transport service organisers, but in case they carry out the actual transport themselves, they act as transport operator as well.

## 1.3 Overview of the study

We start this study by providing an overview of the current state of play of GHG emissions accounting in the transport sector (see Chapter 2). Next, the problem definition (Chapter 3), the EU right to act (Chapter 4) and the policy objectives (Chapter 5) are presented. The policy options that could be implemented to achieve the objectives are addressed in Chapter 6. Main economic, social and environmental impacts of these options are assessed in Chapter 7 and compared in Chapter 8. Based on this comparison, a preferred option is selected and assessed in Chapter 9.

Underlying (detailed) assessments as well as background information are included in the Annexes to this report. Detailed factsheets on the current state of play of GHG emissions accounting in the transport and logistics sector can be found in a separate Annex report accompanying this study.

# 2 State of play of GHG emissions accounting in transport

## 2.1 Introduction

This chapter presents an overview of the state of play of GHG emissions accounting in the European transport and logistics sector. To provide some context, we start by presenting a brief (non-exhaustive) historical overview of GHG emissions accounting in transport and particularly initiatives to harmonise these accounting practices (Section 2.2). Second, an overview of the current GHG emissions accounting landscape is presented, discussing relevant standards and methodologies, tools and reporting and policy schemes that are currently applied in the transport sector (Section 2.3). The actual uptake of GHG emissions accounting by the market is addressed in Section 2.4. Finally, the main motivations from transport operators and users to apply GHG emissions accounting are briefly discussed in Section 2.5.

## 2.2 A brief history of (harmonising) GHG emissions accounting in transport

GHG emissions accounting is applied in transport for decades (CE Delft et al., 2014). Around the beginning of this century, several initiatives were launched to harmonise accounting practices. An early effort in this respect is the Greenhouse Gas Protocol launched in 1998 by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (Wild, 2021). The GHG Protocol published the Corporate Standard in 2001 (revised in 2004) providing guidelines for the calculation of GHG emissions at a company level (WRI & WBCSD, 2004). This standard was supplemented by the Scope 3 Standard in 2013 (WRI & WBCSD, 2013), which provides guidance on the way companies should account for indirect emissions from value chain activities (including transport emissions). Also ISO has published several standards for calculating GHG emissions. For example, in 2006 the ISO 14064 Standard was published, providing guidance on harmonising emissions at the company level (ISO, 2006).

It should be noted that neither the GHG Protocol nor ISO 14064 focusses on transport (Davydenko, I. et al., 2014). There were, however, some specific initiatives at the beginning of this century that were targeting transport emissions. For example, in 2004 the US Environmental Protection Agency (EPA) launched the SmartWay programme, aiming to improve fuel efficiency and reduce GHG and air pollutant emissions from the freight transport sector (SmartWay, 2023). As part of this programme, a methodology for GHG emissions accounting has been developed, focussing on North America. The programme has also included a database of primary $CO_2$ emissions data reported by carriers according to the SmartWay 16ethodologyy. This database can be used by the carriers for benchmarking and by shippers and freight forwarders to get market specific GHG values to account the transport activities in their portfolio. In the same period, the Clean Cargo Working Group (CCWG) was initiated, aiming to improve the environmental performance of maritime container transport. Also for this initiative, a specific methodology to account for GHG emissions was developed, amongst others, aligned with the GHG Protocol (BSR, 2015) and more recently with GLEC. Under CCWG, primary data $CO_2$ emissions data are collected from carriers within this scheme, and are used to produce average emission intensity factors for the use by shippers.

At the level of the EU transport sector, however, the development of the European Standard EN 16258 (CEN, 2012) by the European Committee for Standardisation (CEN) in 2012 was a starting point for harmonising GHG accounting methodologies for transport services. The standard provided general principles, definitions, system boundaries, calculation methods and allocation rules[8] in order to harmonise the quantification of energy consumption and GHG emissions of transport services. Up to 2023, it was the only international and multi-modal (i.e. covering road, rail, IWT, maritime transport and aviation) standard available. It has, however, some deficiencies, including a degree of freedom in emission computation (e.g. on the granularity and time aggregation of the calculations), some methodological issues related to the allocation of emissions (e.g. which allocation parameter to use), a lack of guidance on the calculation of emissions at transport hubs, a lack of prescription on information exchange (e.g. reporting formats) and responsibility for the calculations along the transport chain (Auvinen, H. et al., 2014, Davydenko, I. et al., 2014, Ehrler, V. et al., 2016, Kellner, 2016, Auvinen, Heidi et al., 2014). Therefore, a demand for further harmonisation of GHG emissions accounting methodologies remains (Davydenko, I. et al., 2014, Ehrler, V.C. et al., 2018).

Two R&D projects funded by the European Commission have substantially contributed to the further harmonisation of accounting methodologies for GHG emissions in transport. In the COFRET project, which was finalised in 2014, an inventory and review of existing carbon footprint methodologies have been carried out, identifying gaps and ambiguities in these methodologies (DLR, 2014). COFRET also indirectly leaded to the development of the Global Logistics Emissions Council (GLEC) framework by Smart Freight Centre in 2016, as research results and industry relations developed within COFRET formed the basis for the further developments (Ehrler, V.C. et al., 2018). The GLEC framework is partly based on the EN 16258 Standard, but it has further elaborated certain aspects of that standard (Davydenko, I. et al., 2019). Consequently, it presents a first step towards a globally harmonised standard, without being an officially recognised standard (Wild, 2021). In the LEARN project, which was established in 2016 as follow-up to COFRET, the GLEC framework was further developed and tested in about 40 industrial application cases at companies active in different segments (e.g. SME/small/large, carriers, LSPs, freight forwarders, shippers, all modalities, different countries) (SFC, 2019b).

The COFRET project also initiated the International Workshop Agreement (IWA), where a total of almost 70 stakeholders involved in the topic discussed on the development of a framework of requirements for an international standard on calculation of emissions of transport chains. The 2015 published outcome of this work, IWA 16:2015 'International method(s) for a coherent quantification of $CO_2$-eq emissions of freight transport' (ISO, 2015), suggested which of the existing standards and tools should be used as a starting point for further standardisation. It also showed which gaps still needed to be closed. The IWA 16:2015 formed the basis for the development of the abovementioned ISO 14083 Standard on 'Quantification and reporting of greenhouse gas emissions of transport operations' (ISO, 2022). Experts from around the world, as well as many industry stakeholders, have been involved in the development of this ISO Standard, which includes assumptions from the GLEC approach (Wild, 2021). Additionally, ISO 14083 Standard superseded the EN 16258 Standard after the European Committee for Standardisation had transposed it into EN ISO 14083:2023.

[8] Rules to allocate the emissions calculated at the level of a specific transport operation (e.g. a trip) to a specific transport service (delivery of a specific person or good from point A to B).

In addition to these EU/global initiatives, some relevant national initiatives have been launched over the last fifteen years as well. An example of a country-level initiative is the French requirement for $CO_2$ reporting for transport services (both passenger and freight) starting, finishing or passing through France, applicable as from 2013 (ADEME, 2019). This is the only mandatory GHG emissions accounting and reporting scheme for transport services currently existing in the EU. The emission accounting methodology applied in the French scheme is currently based on the EN 16258 Standard. In the Netherlands, the public-private initiative Lean & Green has been established in 2008, stimulating companies to reduce the GHG emissions of their transport activities (Lean and Green Europe, 2022). As part of this programme, companies are incentivised to account for their emissions according to the Top Sector Logistics methodology developed for this purpose (Topsector Logistics, 2022). Over the years, Lean & Green have grown and now cover initiatives in about fourteen European countries.

Next to national initiatives, also some relevant mode-specific initiatives have been implemented over the last decade, particularly in the field of maritime transport and aviation. For example, in 2019 the International Maritime Organisation (IMO) introduced a mandatory fuel oil data collection system (DCS), requiring ships to collect and report data on fuel consumption and traffic performance to the IMO (IMO, 2016). In 2015, the EU adopted the EU MRV regulation which requires operators of large maritime vessels sailing to and from EU port to monitor, report and verify their $CO_2$ emissions (EU, 2015)[9]. Both policies provide a methodological framework that should be applied by ship operators to account for their fuel consumption/GHG emissions. In aviation, such methodologies are developed as well as part of the inclusion of aviation in the EU ETS in 2012 (EU, 2008) and the introduction of the Carbon Offsetting and Reduction Scheme for international Aviation (CORSIA) by ICAO in 2021 (ICAO, 2018). ICAO and IATA (industry body) have also developed standards for the aviation sector that describe in more detail how emissions need to be reported per passenger and per tonne of freight. Furthermore, for specific (service) segments of the transport sector standards/methodologies are developed as well. For example, a CEN Standard for the calculation of the environmental footprint of parcel delivery is currently being developed and intended to be published in 2024 (CEN, forthcoming).

Finally, at a more general level, the development of the Product Environmental Footprint (PEF) and Organisational Environmental Footprint (OEF) methodologies by the European Commission are worthwhile to be mentioned (EC, 2021c). These methodologies were introduced in 2013 in order to harmonise the environmental footprint of products and organisations. Within the PEF/OEF framework specific category rules are developed for specific products/organisations, providing specific guidance on the methodological rules to be used to analyse the environmental footprint of that product/organisation. Up to now, no specific category rules for transport are available, although EASA is considering the development of such rules for the aviation sector (EASA, 2022).

## 2.3 Current GHG emissions accounting practices in the transport sector

In this section we provide an overview of the current GHG emissions accounting practices in the transport sector. We distinguish three elements in the description of the GHG emissions accounting landscape:

[9] Although EU MRV of $CO_2$ emissions from maritime shipping and IMO DCS share some similarities, they are independent policies.

1. **Standards and methodologies** describing how GHG emissions accounting should be executed. In this study, standards are defined as calculation and/or allocation rules that stand on themselves and can be referred to when the rules of the standard are being followed. Methodologies are also a set of rules concerning the calculation and allocation of emissions of transport services, but this set is part of a policy or incentive programme establishing rules for emissions accounting for that respective policy/programme.
2. **Technical support tools** encompass emission databases and calculation tools. Emission databases are those containing energy emission factors (e.g. in g/MJ or g/litre) and/or emission intensity factors (e.g. in g/tkm or g/pkm), providing input for the calculation of GHG emissions of transport and logistic operations. Calculation tools are instruments supporting companies to calculate the emissions of their transport activities. Many of the calculation tools make reference to standards like EN 16528 and the GHG Protocol, or frameworks like GLEC. The other way around, standards and methodological frameworks may incorporate or make reference to specific databases and tools (e.g. the GLEC framework refers to the GLEC emissions database in case users of the GLEC framework are in need of default emissions factors).
3. **GHG emissions reporting schemes and green incentive programs** oblige or promote GHG emissions accounting and often also the reduction of GHG emissions. Although these initiatives often have a broader scope than just GHG emissions accounting, they are relevant as they provide incentives to measure and calculate emissions. Policies from national governments (French Transport Code), the EU (EU-MRV, EU-ETS) and international bodies like IMO (IMO DCS) and ICAO CORSIA), for example, require actors in the transport sector to account emissions, and in case of CORSIA, to offset them eventually. Greening programmes have a more voluntary character, but in general go further in their ambition and commit participants to reduce GHG emissions.
The greening programmes are often motivated by goals such as the Paris agreement, but are also initiated by specific policies (e.g. Objective $CO_2$ is initiated by the obligation of transport operators in France to account $CO_2$ emissions according to the French Transport Code).

## 2.3.1 Standards and methodologies

### Overview of relevant standards and methodologies

Based on an initial desk study, the results of the exploratory stakeholder interviews and discussions with the Commission, the most relevant standards/methodologies for GHG emissions accounting in the transport sector have been identified (see Table 2). A detailed analysis of each individual standard and methodology can be found in the Annex report accompanying this study. In this section, we discuss the main overall conclusions of this analysis.

**Table 2 - Overview of the main standards and methodologies for GHG emissions accounting in the transport sector**

| Standard/methodology | Transport modes covered | Geographical coverage | Type of instrument |
|---|---|---|---|
| Corporate Value Chain (Scope 3) Standard of the GHG Protocol | All modes | World-wide | Standard |
| CEN Standard EN 16258 | All modes | EU | Standard |
| ISO 14083 | All modes | World-wide | Standard |
| Product Environmental Footprint (PEF) | All modes | EU | Legislation with methodology |

| Standard/methodology | Transport modes covered | Geographical coverage | Type of instrument |
|---|---|---|---|
| Article L. 1431-3 of the French transport code (Objectif $CO_2$) | All modes* | France | Legislation with methodology and programme (Objectif $CO_2$) |
| Parcel Delivery Environmental Footprint | All modes involved in parcel delivery | EU | Standard |
| GLEC framework v1.0 | All freight modes* | World-wide | Methodology framework |
| SmartWay program | All freight modes* | North America | Programme and methodology |
| Top Sector Logistics Method | All freight modes* | EU (mainly applied in NL) | Methodology |
| Clean Cargo Working Group Carbon Emissions Accounting Methodology | Sea transport of containers | Worldwide | Programme and methodology |
| EU MRV | Sea shipping | EU | Legislation with methodology |
| IMO DCS | Sea shipping | World-wide | Legislation with methodology |
| CORSIA | Aviation | World-wide | Programme and methodology |
| ICAO/IATA RP1678 | Aviation freight | World-wide | Standard |
| IATA Recommended practice per-passenger $CO_2$ calculation methodology | Aviation passenger | World-wide | Standard |
| EU ETS aviation | Aviation | EU | Legislation with methodology |

* Pipeline transport is not (explicitly) included.

As shown by Table 2, there are six standards/methodologies that cover all transport modes (of which the future Parcel Delivery Environmental Footprint specifically covers parcel delivery transport). Most of them have a global scope[10], with the exception of Article L. 1431-2 of the French Transport Code, which applies a national scope. As mentioned in Section 2.2, the latter methodology is based on the EN 16258 Standard. It is, however, expected that EN 16258 will be replaced by the ISO 14083 Standard[11].

In addition to the standards/methodologies covering the entire transport sector, there are also three relevant methodologies for GHG emissions accounting in freight transport: GLEC, SmartWay and Top Sector Logistics Methodology. Where GLEC has a global scope, SmartWay is particularly focussing on North America. Finally, the Top Sector Logistics Methodology was initially developed for the Dutch transport sector, but its scope has been enlarged over the years to other EU countries as well.

Finally, there are also some mode-specific standards and methodologies, particularly for aviation and maritime transport. These are developed by international public authorities (i.e. EU MRV, IMO DCS, CORSIA and EU ETS for aviation) or industrial entities (i.e. CCWG, ICAO/IATA RP1678, IATA Recommended Practice Per-Passenger $CO_2$ Calculation Methodology). All of them apply a global or EU scope.

[10] Meaning that they provide guidance on how to account for emissions at a global level.

[11] Source: interview with representative of ADEME.

## Descriptive analysis of the various standards and methodologies

Based on the detailed analysis of the individual standards and methodologies (see the Annex report accompanying this report), we have investigated how their various methodological elements differ or align in a practical application. The main results are briefly summarised in Table 3 below and the full analysis is presented in Annex A.2.

**Table 3 - Main results of comparison of standards/methodologies**

| Methodological element[a] | Comparison of standards/methodologies |
|---|---|
| | **Scope** |
| Type of emissions | – All standards/methodologies include $CO_2$-emissions.<br>– Eight out of sixteen standards/methodologies include also other greenhouse gases ($CO_2$ eq).<br>– Two (ISO 14083 and GLEC) out of sixteen standards/methodologies give guidance on accounting global warming effects of black carbon.<br>– Non-$CO_2$ products (e.g. water vapour, contrails, $NO_x$) at high altitudes of aviation are not included by any of the standards/methodologies. |
| Activity boundaries | – All standards/methodologies include vehicle propulsion emissions.<br>– Auxiliary activities of the vehicle (cooling, cranes) are included by thirteen of sixteen standards/methodologies.<br>– Emissions from leakage of fuel (e.g. evaporation during fuelling) are covered by seven out of sixteen standards/methodologies.<br>– Emission at transport hubs are included by six of sixteen standards/ methodologies.<br>– Eight of sixteen standards/methodologies include emissions from energy provision (well-to-tank emissions).<br>– Emission from production and dismantling of energy production infrastructure is explicitly included by ISO 14083 and PEF/OEF, and as an option under the GHG Protocol.<br>– Only the PEF/OEF framework includes total life-cycle emissions (including vehicle production, infrastructure, etc.). |
| Intended user | – All standards/methodologies are to be used by transport service operators.<br>– Ten of sixteen methods are to be used by transport service organisers.<br>– Nine of sixteen methods are to be used by transport service users. |
| | **Emissions calculation** |
| Granularity of calculation | – All standards/methodologies facilitate calculation of total emissions of a transport service operator, organiser or user.<br>– Nine of the sixteen standards/methodologies require or recommend emission calculation at the level of a Transport Operation Category (between two hubs)[b].<br>– Seven of the sixteen methods give the guidance to calculate at individual trip level. |
| Data requirements | – All standards/methodologies give guidance on calculations with primary data[c] from the transport operator.<br>– Five of the standards/methodologies allow calculations based on primary data only.<br>– Five of the standards/methods allow the use of modelled or default data[d], but explicitly require that the source of the default values is clearly reported (and the use of default data is justified).<br>– Two of the standards/methodologies only allow the use of approached emissions models in case primary data is not available. |

| Methodological element[a] | Comparison of standards/methodologies |
|---|---|
| | – Four of the standards/methodologies do not provide strict guidance on the use of default/modelled data (except that some require that the data is taken from public sources). |
| **Emission allocation** | |
| Method for allocation of emissions to individual transport services | – Eight of sixteen standards/methodologies have no allocation method, as they do not focus on emissions at service level.<br>– Eight of sixteen standards/methodologies allow allocation on tonne-kilometre of passenger-kilometre basis (with kilometre either based on real distance, over shortest feasible distance (SFD) or great circle distance GCD)[e]. The Top Sector Logistics Method applies tonne-kilometre based on great circle distance (GCD) as the only allocation method. The other seven methods allow multiple allocation methods and leave the choice to the user.<br>– Six of sixteen standards/methodologies allow other allocation parameters next to tonne-kilometre or passenger-kilometre as well (e.g. number of passengers or number of trips). |

[a] More information on the various methodological elements can be found in Annex C.3.
[b] Transport Operation Category refers to a group of operations of a certain transport operator, with similar characteristics (e.g. the final leg from a distribution centre to clients, or the trip between two hubs).
[c] Primary data (actual data) refers to data obtained from a direct measurement or a calculation based on direct measurement. Primary data may include measured fuel/energy consumption data as well as transport performance data (e.g. actual distance, number of passengers/amount of freight transported, etc.).
[d] Modelled data refer to data established by use of a model that takes into account primary data and/or default emission data of a transport or hub operation. Default data refer to (average) figures taken from a published source.
[e] Great circle distance (GCD) refers to the shortest distance between two points on the surface of a sphere, measured along the surface of the sphere. Shortest feasible distance (SFC) refers to the shortest feasible route between two points.

The results shown by Table 3 clearly show that there are significant differences with respect to the scope and design of methodological elements between the various standards/methodologies. For example, there are wide differences between the type of emissions covered, as half of the standards/methodologies only cover $CO_2$ emissions while the other half cover other GHG emissions as well.

If we distinguish between the mode-specific standards/methodologies and the standards/methodologies covering all (freight) modes (see Table 2), we see some clear patterns for these two groups:

1. The mode specific standards/methodologies are mostly focussed on transport operators who have to account for $CO_2$ emissions from combustion (no other GHG emissions or well-to-tank emissions) based on primary fuel data from an operator. Only the methodologies applied for CORSIA and EU ETS for aviation allow the use of non-primary data, but require operators to make use of a specific emission model for that purpose. These methods (except ICAO/IATA RP1678 and IATA Recommended Practice Per-Passenger $CO_2$) do not include specific allocation methodologies as they are focussed on emission accounting by transport operators at the company level (and hence no rules to allocate these emissions at company level to individual transport services are required).
2. The standards and methodologies covering all (freight) modes have a broader scope in general. They all (except SmartWay) include the total of GHG emissions from combustion and energy provision (well-to-wheel emissions). Most of them (except the GHG Protocol and the general PEF/OEF framework) also include allocation methodologies to allocate emissions to specific transport services. All these standards

and methodologies prefer calculations based on primary fuel and transport data, but also allow the use of modelling or default data, especially for transport service users (e.g. shippers).

But even within these two groups of standards/methodologies, there are significant differences, as is shown clearly in Annex A.2. For example, the standards/methodologies covering all (freight) modes differ with respect to the allocation approaches that are allowed. For example, only the Top Sector Logistics Methodology chooses a single allocation method based on tonne-kilometre based on great circle distance (GCD) between origin and destination, while the concept ISO Standard allows the use of tonne-kilometre (or passenger-kilometre) based on the shortest feasible distance (SFD) between origin and destination as allocation parameter as well. Other standards/methodologies (like GLEC and CEN 15628) allow a much broader set of allocation parameters (under the condition it is clearly reported which allocation approach is applied).

For freight transport, the GLEC framework has recognised (most of) these differences between methodologies/standards. In that framework, different approaches on many of the methodological elements are allowed as long as it is clearly reported which approach is followed. This contributed to a further harmonisation of GHG emissions accounting practices in the freight sector, particularly as GLEC is widely used by freight transport users/operators (see Section 2.4.2). The ISO Standard is intending to go a step further, as it will make a choice on the design of most methodological elements (for both freight and passenger transport). There are, however, a few exceptions. For example, with respect to the allocation parameter, ISO will allow the use of both SFD or GCD kilometres (see Section 6.3.2 for a more detailed discussion on the methodological elements for which ISO leaves room to transport operators/users to make their own decisions).

## 2.3.2 Technical support tools: Calculation tools and databases

### Overview of main support tools

Two types of support tools are considered in this section: calculation tools and emission databases providing emission intensity factors (e.g. in gram per tonne-kilometre or gram per passenger-kilometre). The most relevant calculation tools and databases have been identified based on an initial desk study, results of the exploratory interviews and discussions with the Commission. These are presented in Table 4. A more detailed description of each individual tool can be found in the Annex report accompanying this study.

**Table 4 - Overview of the main support tools GHG emissions accounting in the transport sector**

| Support tools | Geographical coverage |
|---|---|
| **Calculation tools** | |
| BigMile | Global |
| CarbonCare | Global |
| Carbon Visibility/Transporeon | Global |
| EcoPassenger | European |
| EcoTransIT | Global |
| Eurocontrol small emitters tool | European |
| GHG Protocol Calculation Tool for transport | Global |
| GreenRouter | Global |
| Logec | Global |

| Support tools | Geographical coverage |
|---|---|
| NTMCalc | Global |
| REff Tool | Global |
| Seaexplorer | Global |
| SNCCF | National |
| TK'Blue | Global |
| TRACKS | Global |
| **Emission intensity factor databases** | |
| ADEME database | National |
| DBEIS/DEFRA database | National |
| GLEC database | Global |
| STREAM database | National |

As for the calculation tools, most of them have a global scope. Emission databases, on the other hand, often have a national scope, reflecting the differences in emission intensity figures (in g per vkm, pkm or tkm) between countries (because of differences in climate, environmental specificities, composition of the vehicle fleet, etc.). As for the calculation tools, the majority is focussed on freight transport, sometimes covering a specific mode (e.g. such as Seaexplorer), but more often all freight modes. There are, however, also calculation tools available that cover all transport modes for both freight and passenger transport (e.g. NTMCalc and CarbonCare). The emission databases normally cover all modes for both passenger and freight transport, except for GLEC that only covers all modes for freight transport.

It should be mentioned that the options provided by the various calculation tools differ widely. Some of them are mainly meant to calculate emissions based on default data, while other tools aim to support users in their GHG emissions accounting by automating calculations based on primary data and allocating the emissions to specific transport services. We refer to the Annex report accompanying this study for more details of the specifications of each of the calculation tools.

## Descriptive analysis of the main support tools

In Table 5 the main results from the descriptive analysis of the support tools are presented, mainly focussing on the scope applied by the tools. More detailed results can be found in Annex A.3.

**Table 5 - Main results of comparison of support tools**

| Methodological element[a] | Comparison of support tools |
|---|---|
| **Scope** | |
| Type of emissions | – All support tools include $CO_2$ emissions.<br>– Sixteen out of nineteen support tools include also other greenhouse gases ($CO_2$-eq).<br>– Non-$CO_2$ products (e.g. water vapour, contrails, $NO_x$) at high altitudes of aviation are included by only six of the support tools (CarbonCare, EcoTransit, GHG Protocol Calculation Tool, ADEME database, GLEC database, STREAM database.<br>– Black carbon emissions are not considered by any of the tools. |
| Activity boundaries | – All support tools include vehicle propulsion emissions. |

| Methodological element[a] | Comparison of support tools |
|---|---|
| | – Auxiliary activities of the vehicle (cooling, cranes) are included by nine of nineteen support tools. For seven tools it is unclear whether auxiliary activities are included.<br>– Emission from leakage of fuel (e.g. evaporation of during fuelling) are included by six of nineteen tools. For three tools it is unknown.<br>– Emissions at transport hubs are included by thirteen of nineteen support tools. For one tool it is unknown.<br>– Eighteen of nineteen support tools specifically include emissions from energy provision (well-to-tank emissions).<br>– None of the support tools include total life-cycle emissions (including vehicle production, infrastructure, etc.). |
| Intended user | – Thirteen of nineteen support tools are to be used by transport service operators.<br>– Eighteen of nineteen support tools are to be used by transport service organisers/users. |
| **Emissions calculation** | |
| Alternative fuels | – Thirteen of nineteen support tools specifically include alternative fuels. For five tools it is unknown. |
| **Alignment and verification** | |
| Alignment with standards and methodologies | – Five of fifteen calculation tools are aligned with EN 16258 only.<br>– Four of fifteen calculation tools are aligned with both EN 16258 and GLEC.<br>– Three of fifteen calculation tools are aligned with EN 162589, GLEC and GHG Protocol.<br>– Two of fifteen calculation tools are aligned with GLEC and GHG Protocol.<br>– One of fifteen calculation tools is aligned with GHG Protocol only. |
| Certification of support tool | – Five out of nineteen tools have received certification for one or multiple of the standards and methodologies. |

[a] More information on the various methodological elements can be found in Annex C.3.

From Table 5 it can be concluded that there are similarities, but also significant differences between the tools:

- Most tools do cover $CO_2$-eq emissions, but only a few (mainly the emission databases) cover the emissions of non-GHG emissions emitted on high altitudes.
- All tools cover emissions from vehicle propulsion and many (but not all) the emissions from logistic hub activities. Well-to-tank emissions are covered by almost all tools. Emissions from auxiliary activities and leakages, on the other hand, are only covered by a minority of the tools. There is, therefore, a difference in scope between the various tools.
- Almost all tools are intended to be used by transport users, while more than 50% of the tools can be used by operators/organisers as well.
- The majority of the (calculation) tools are aligned with a current standard or methodology (i.e. EN 16258, GLEC of GHG Protocol), although there are some exceptions (e.g. EcoPassenger). The freight oriented tools are mainly aligned with GLEC. Because of this alignment with various standards/methodologies, the differences between these standards/methodologies, as discussed in Section 2.3.1, are reflected by the tools as well.
- Certification of tools is not applied on a large scale. Only GLEC has certified some calculation tools.

### 2.3.3 GHG emissions reporting schemes and green incentive programs

#### Overview of main GHG emissions reporting schemes and green incentive programs

Table 6 provides an overview of the main reporting schemes and green incentive programs identified. These schemes/programmes have been identified based on an initial desk study, results of the exploratory interviews and discussions with the Commission. The overview provided below is not intended to be exhaustive, but instead focusses on the main schemes and programmes currently available. More detailed information on these schemes/ programmes can be found in the Annex report accompanying this report.

**Table 6 - Overview of the main GHG reporting schemes and green incentive programs accounting in the transport sector**

| Reporting schemes and green incentive programmes | Transport modes covered | Geographical coverage | Type of initiative |
|---|---|---|---|
| CCWG | Maritime container shipping | Global | – GHG emissions accounting;<br>– Benchmarking of GHG performance. |
| GLEC | All freight modes | Global | – GHG emissions accounting. |
| French Objectif $CO_2$ | All freight modes and public transport | National | – GHG emissions accounting;<br>– GHG reduction strategies. |
| Lean & Green | All freight modes with focus on continental transport | European | – GHG emissions accounting;<br>– GHG reduction strategies;<br>– Benchmarking of GHG performance. |
| SmartWay | All freight modes except maritime transport | National | – GHG emissions accounting;<br>– Benchmarking of GHG performance. |
| TK'Blue | All freight modes except logistics | European | – GHG emissions accounting;<br>– GHG reduction strategies;<br>– Benchmarking of GHG performance. |

All these schemes/programmes are targeting freight transport, although there are differences in scope. Some (e.g. GLEC, Lean & Green) cover all freight modes, while the Clean Cargo Working Group (CCWG) only covers maritime container transport.
The geographical scope also differs, ranging from national schemes (e.g. Objectif $CO_2$ and SmartWay) to global schemes (GLEC, CCWG).

As shown by Table 6, all schemes/programs stimulate GHG emissions accounting. However, some of the schemes offer services using the results of GHG emissions accounting as well. CCWG, Lean & Green, SmartWay and TK'Blue, for example, benchmark the carbon intensity of transport activities of participants (anonymously) to the performance of other participants. In this way participants are informed how they perform compared to other transport operators/users. Additionally, some of the schemes incentivise participants (e.g. by awarding labels) to develop and implement emission reduction measures.
For example, in the Lean & Green programme participants can earn stars depending on their reduction levels and associated efforts.

### Descriptive analysis of main GHG emissions reporting schemes and green incentive programs

Table 7 provides an analysis of the various GHG reporting schemes and green incentive programs. A more detailed analysis can be found in Annex A.4.

**Table 7 - Analysis of the main GHG reporting schemes and green incentive programs accounting in the transport sector**

| Methodological element[a] | Comparison of GHG reporting schemes and green incentive programs |
|---|---|
| **Scope** | |
| Intended user | – All reporting schemes and incentive programs are to be used by transport service operators, users and organisers. |
| **Content** | |
| Calculation tool | – Four of six reporting schemes and incentive programs contain a calculation tool. |
| Reporting requirements | – All reporting schemes and incentive programs have reporting requirements. |
| Verification of input/ calculations mandatory | – Two of six reporting schemes and incentive programs require verification of input data or calculations. |
| **Alignment** | |
| Fixed calculation method(s) | – All reporting schemes and incentive programs require calculations to be done via specific methodologies. |
| Alignment with standards and methodologies | – Three of six reporting schemes and incentive programs are aligned with EN:16258.<br>– Three of six reporting schemes and incentive programs are aligned with GLEC.<br>– One of six reporting schemes and incentive programs are aligned with GHG Protocol. |

[a] More information on the various methodological elements can be found in Annex C.3.

All these schemes and programmes aim to harmonise and incentivise the use of emissions accounting in transport. For that purpose they include specific methodological guidance and reporting requirements. The methodological guidance provided is often aligned with a general standard or a methodology. For example, the CCWG initiative applies its own methodology, but this methodology is based on GLEC and the GHG Protocol. Most of the programmes/schemes (except CCWG and GLEC) do also offer specific calculation tools, that may support participants in their accounting exercises. Finally, Objectif $CO_2$ and Lean & Green also launched a certification scheme in order to improve the reliability of the GHG emission figures provided by their participants. Certification of output is voluntary within the GLEC framework.

## 2.4 Application of GHG emissions accounting in the EU transport market

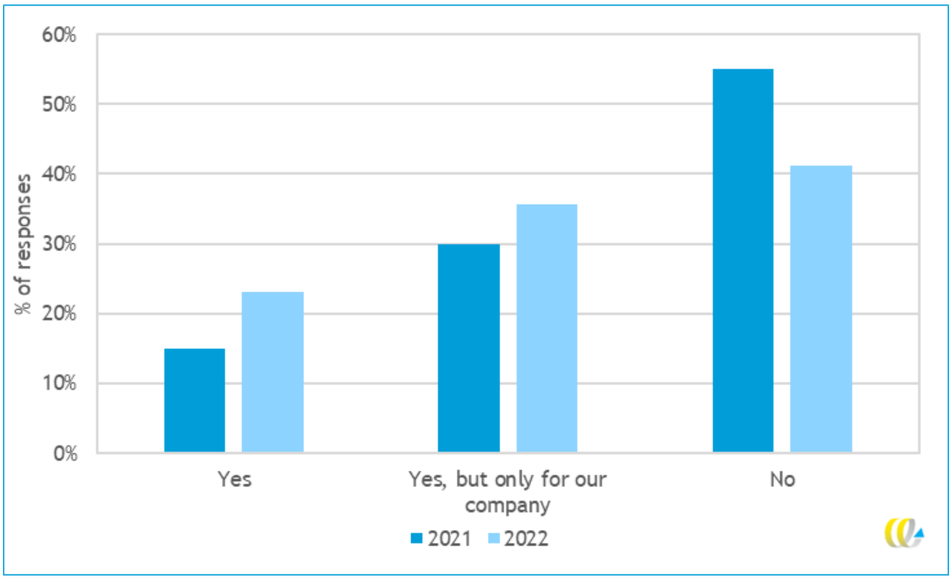
### 2.4.1 Current uptake of GHG emissions accounting

Empirical evidence on the current level of uptake of GHG emissions accounting by the market is rather poor. However, this section gives an overview based on the information that is available. Most detailed information is available for road freight transport, as for this segment several recent surveys have been carried out. Also for maritime transport and aviation some empirical data is available from existing policies like EU MRV for $CO_2$ of maritime transport, CORSIA and EU ETS for aviation. On the other hand, for IWT, rail transport and road passenger transport little empirical evidence is available and we have to fully rely on inputs from the stakeholder consultation.

## Road transport

According to surveys carried out by Transporeon among 340 (mainly EU) road carriers and shippers, about 60% of carriers are in 2022 capable to calculate GHG emission at the company level, and 23% even at a more disaggregated level (see Figure 1).

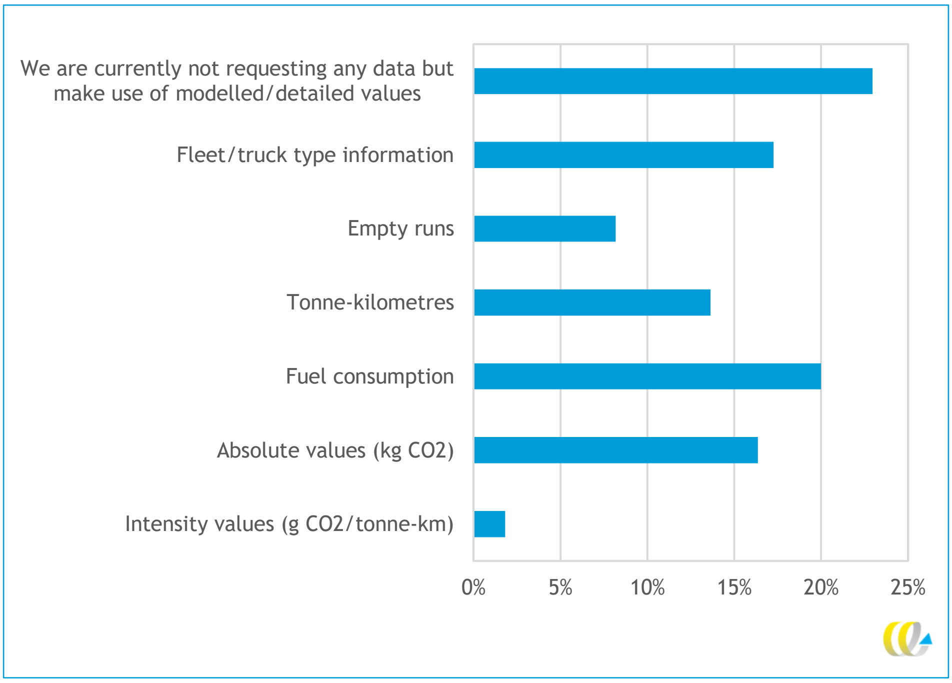
**Figure 1 - Capability to calculate transport related emissions by road carriers in 2021 and 2022**




Source: (Transporeon et al., 2022).

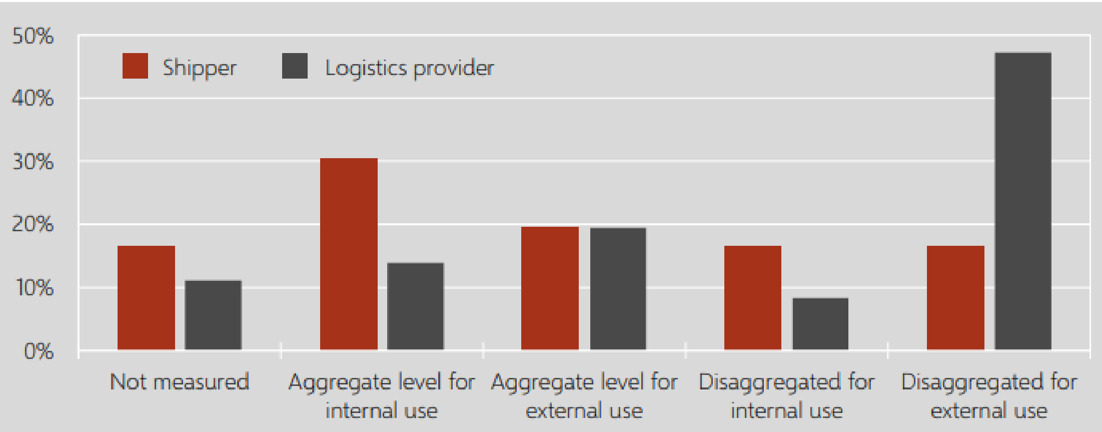
Compared to 2021, the uptake of GHG emissions accounting by road carriers has increased significantly, showing increased interest from road carriers in GHG emissions accounting. This is at least partly explained by increasing demand from shippers for this kind of information from their carriers. According to Transporeon et al. (2022) the share of carriers reporting that they were asked about emissions by more than 10% of their customers rose from less than 30% to almost 50%. However, the level of detail of the information that shippers request from transport operators is often still low: next to many shippers who do not request any data at all, there is a significant share who only request the fuel use (see Figure 2). However, there are also shippers that request more detailed information such as fleet/truck type information and empty runs. This illustrates that there currently are large differences between shippers with respect to the level of detail and quality of their GHG emissions accounting process. This is also illustrated by Figure 3, which shows (based on a survey among more than 90 large shippers and service logistics providers) that there is large variation in the level of aggregation in the GHG emissions calculations performed by shippers and logistic service providers.

**Figure 2 – What information are shippers requesting from subcontracted carriers in 2022?**




Source: (Transporeon et al., 2022).

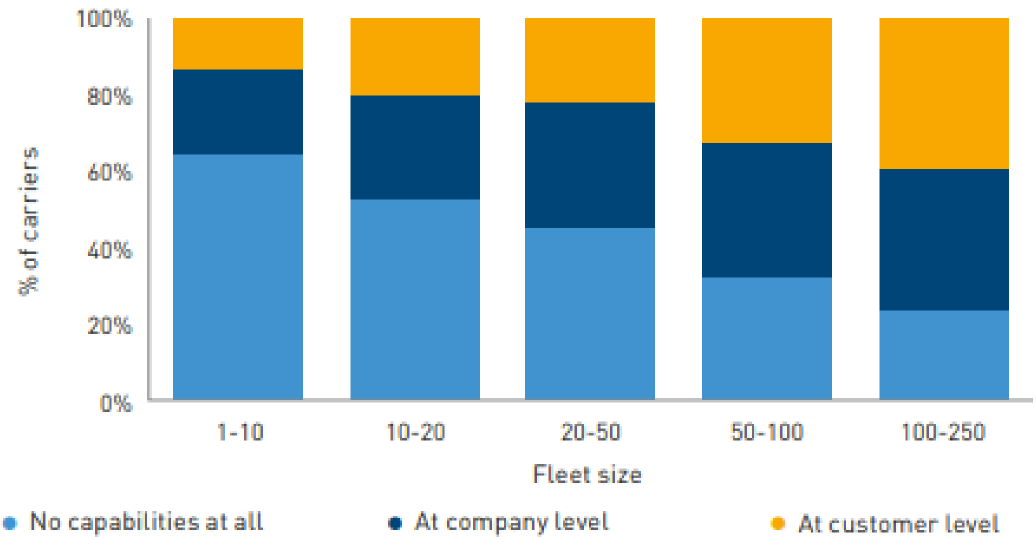
**Figure 3 – Share of shippers and logistic service providers that are able to calculate their emissions**




Source: (McKinnon, A. & Petersen, 2021).

There seems to be a significant difference in the uptake of GHG emission accounting between large and small carriers, as becomes clear from Figure 4. Larger carriers are more likely to account for their emissions and also more likely to do so in a detailed manner. This picture was confirmed in the stakeholder interviews by one standardisation body, one public authority and two transport associations, who added that an important reason for small companies to not account for their emissions is that they are lacking a specialised staff to invest the time to fully understand frameworks such as GLEC. Furthermore, an operator of a freight greening programme as well as an individual shipper indicated in the stakeholder interviews that smaller companies tend to feel less external pressure to report their emissions. More specifically, they argued that shareholder pressure is an important reason for publicly traded companies to report their emissions. Also, one transport association indicated in the stakeholder interviews that companies are often more motivated to calculate their emissions if this leads to useful insights to optimise their operations. Small companies, however, relatively often calculate their emissions using simple methodologies with default factors, which means that the outcomes often are not detailed enough for this purpose.

**Figure 4 - Capability of carriers to calculate transport related emissions - fleet size breakdown**

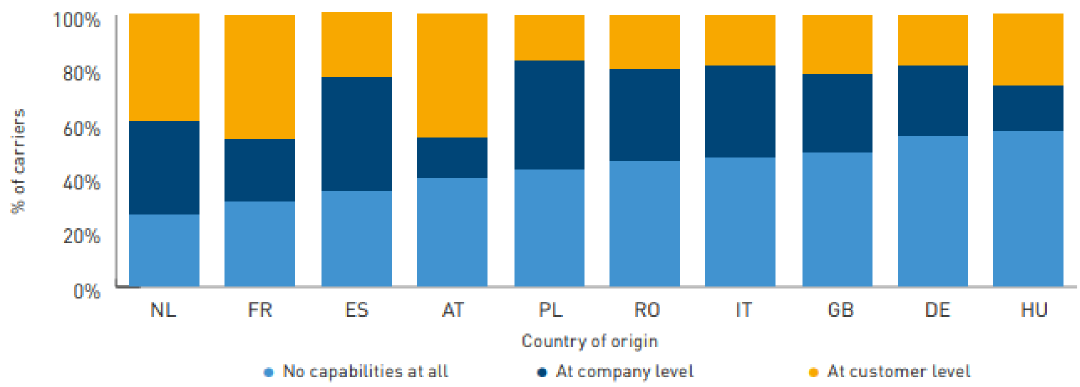



Source: (McKinnon, A. & Petersen, 2021).

Next to differences between large and small road carriers, there is also a significant difference in the uptake of GHG emission calculation per geographic region, as is illustrated by Figure 5. The difference in uptake can partly be explained by national or regional incentive programmes (such as Lean & Green in the Netherlands) or national legislation (Article L1431-3 of the French Transport Code[12]). One transport association indicated in the stakeholder interviews that in general the uptake is higher in Northwestern Europe compared to Southern Europe.

[12] As the French legislation obliges the calculation of GHG emissions of transport services, an even higher uptake might have been expected. However, from the stakeholder interviews it became clear that the effectiveness of this policy is low because of a lack of enforcement.

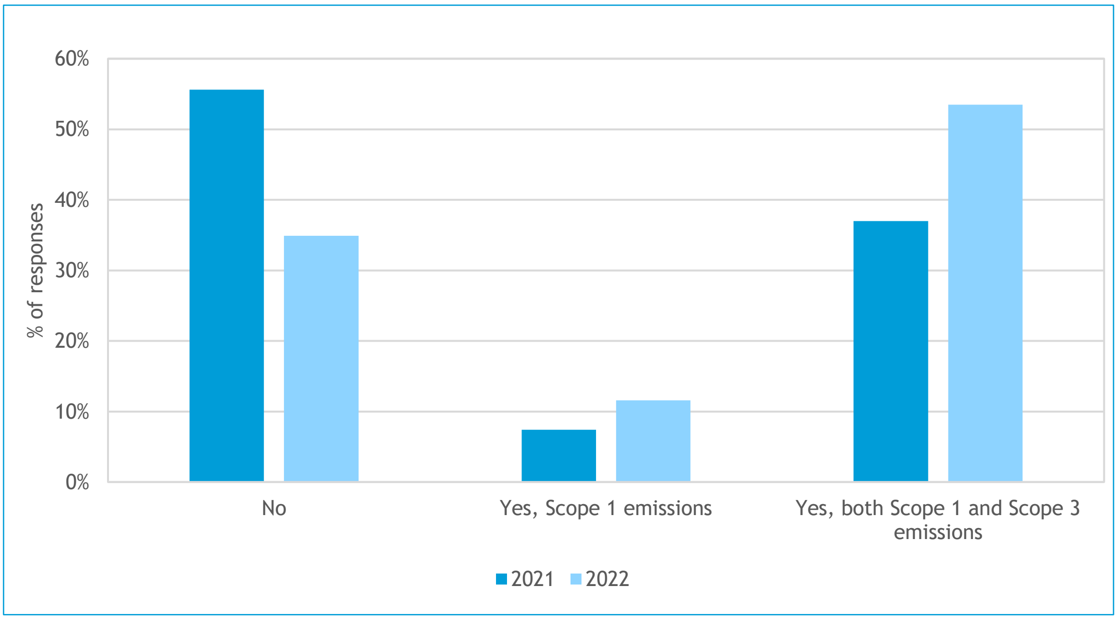
**Figure 5 – Capability of carriers to calculate transport related emissions per country**




Source: (Tolke & McKinnon, 2021).

Finally, Transporeon et al. (2022) also investigated (by applying a survey) the capabilities of shippers to account for their GHG emissions. Although these shippers may not only make use of road transport, it probably will be the main transport mode for them. As shown by Figure 6, more than 60% of the shippers are capable to account for their emissions, of which the majority cover also Scope 3 (Corporate Value Chain) emissions. As for the road carriers, the share of shippers able to do these kinds of calculations grow significantly between 2021 and 2022.

**Figure 6 - Capability to calculate transport related emissions by shippers in 2021 and 2022**




Source: (Transporeon et al., 2022).

The main road passenger vehicle categories used to offer transport services are busses, coaches and taxis. One public authority indicated in the stakeholder interviews that most taxi operators do not calculate their emissions. Furthermore, this public authority indicated that it is more common for bus operators to calculate emissions, but that the emissions are often not communicated to passengers. No quantitative indication on the uptake of GHG emissions accounting for these vehicle types was found in the literature. However, based on the information that we do have there seems to be a significant potential for improvement of the uptake of GHG emissions calculation in road passenger transport.

## Aviation

Airlines have to monitor and report on the tank-to-wheel $CO_2$ emissions of (part of) their flights due aviation being included in the EU ETS (see Annex D in the Annex report accompanying this study) and the future CORSIA. These requirements apply to both passenger aviation and air cargo. Also, IATA has developed a standard for the allocation of emissions to passengers and freight (IATA, 2022). One transport association indicated that over 90% share of airlines calculate and report $CO_2$ emissions, a finding that was confirmed by an interviewed research institute. The latter interviewee added that the main reasons for this high uptake were the EU ETS regulation and the fact that fuel is the main cost for airlines, which makes measuring of fuel use (and greenhouse gas emissions) attractive from an efficiency perspective.

Because of the emission scope applied by CORSIA and the EU ETS for aviation, tank-to-wheel reporting is most common in aviation, as was confirmed by an interviewed transport association. This interviewee, however, indicated that there is a minority of airlines that does report well-to-wheel $CO_2$ emissions. Also, this transport association indicated that only a small minority currently reports $CO_2$-eq emissions and an even smaller minority of about ten large airlines also calculates life-cycle emissions. Furthermore, the emission accounting currently most often focusses on the total $CO_2$ emissions of flights and does not necessarily produce $CO_2$ emission estimates per passenger.

According to a consumer and passenger association interviewed, the methodologies which are used in the current environmental labelling practices in the aviation sector are questionable. Additionally, a transport association indicated that the methodologies that are used for the calculations are not often publicly available.

## Maritime transport

Due to the EU MRV for $CO_2$ of maritime transport and the IMO Data Collection System (DCS) for fuel consumption, ship operators are obliged to monitor and report on the tank-to-wheel $CO_2$ emissions of maritime vessels. Therefore, about 55% of the ships calling at EEA ports are obliged to monitor and report their $CO_2$ emissions (EC, 2020a). These are all ships above 5,000 gross tonnes. Together, these ships are expected to cover about 90% of the $CO_2$ emissions of maritime transport in the EU. The current policy frameworks focus on the tank-to-wheel $CO_2$ emissions. Therefore, calculation of well-to-tank emissions as well as other greenhouse gases than $CO_2$ is not as common yet. The scope of these policies is both passenger and freight transport.

Furthermore, the Clean Cargo working group has established a method for GHG emissions calculation in the container shipping sector, which is a widely recognised standard (see Annex A in the Annex report accompanying this study). The Clean Cargo Group represents most large maritime carriers and freight forwarders as well as a substantial number of large shippers (SFC, ongoing)[13]. This method also applies a tank-to-wheel $CO_2$ emissions scope.

### Inland Waterway Navigation

According to specific information provided by a Dutch transport association, which represents a large share of the EU IWW fleet, the share of vessels for which emissions per tonne-kilometre are calculated in the Netherlands was (roughly) estimated at about 15%[14]. The share of vessels that calculate emissions is relatively higher for container shipping. Furthermore, it is apparent that most shippers should know their yearly fuel use because they register how much fuel they purchase. Therefore, total yearly $CO_2$ emissions could easily be calculated. However, most shippers do not register the amount of tonne-kilometre, which makes the calculation of emissions per tonne-kilometre difficult. This only happens when shippers specifically demand for this information, which currently still is rare.

One transport association argued in the stakeholder interviews that, when emissions are calculated in the inland shipping sector, there is often a link with emission accounting frameworks that are used, such as the Green Award (Green Award, ongoing) the Dutch Performance Label (Binnenvaart Emissie Label, ongoing) and the German Energy Index for Inland Shipping (EnergieEffizienz von Binnenschiffen). It was argued by this same transport association that there seems to be a high level of fragmentation of GHG emission accounting methodologies in the inland shipping sector, and that an EU-wide standard could significantly improve the harmonisation accounting practices within this sector.

### Rail transport

One transport association informed us in the stakeholder interviews that the majority of rail companies (which together accounted for 97% of passenger rail traffic and 54% of freight rail traffic in 2020 in the EU) report energy consumption and well-to-wheel GHG emissions to the UIC (International Union of Railways). This reporting follows a standardised methodology[15], requiring rail companies to report emission figures at the company level, broken down to passenger/freight, electric/diesel and high speed/intercity/regional transport.

This same transport association argued that the high share of greenhouse gas emission calculation and reporting (to UIC) in the rail sector can be explained by the motivation of the sector to promote the rail sector as a sustainable mode of transport. This same transport association indicated that some rail companies have integrated a carbon footprint journey calculator on their websites and report it to the rail customers.

## 2.4.2 Uptake of specific standards/methodologies and calculation tools

Empirical evidence on the uptake of specific standards and methodologies (see Section 2.3.1) is not available. However, from the stakeholder consultation it became clear that the GLEC framework is currently most often used for accounting GHG emissions in freight

[13] In 2014, the CCWG members represented 85% of the container shipping sector (SFC, ongoing). We are not aware of a more recent estimate.

[14] The EU average might be slightly lower, since the capability to calculate GHG emissions in the Netherlands in general are above the EU average (see for example Figure 5).

[15] This methodology is specified in UIC: Environment Strategy Reporting System: Methodology and Policy 2012.

transport (this was mentioned by three transport associations, two freight transport service users and two operators of freight greening programmes in the stakeholder interviews). One of the interviewed freight transport service users even mentioned that GLEC is recognised as the industrial standard for logistics emissions calculations. However, the stakeholder consultation also shows that still other standards/methodologies are used. For example, an interviewed shipper indicated that their GHG emissions calculations are based on the GHG Protocol methodology. Also four out of 23 (17%) respondents of the stakeholder survey indicated that their GHG emissions calculations were based on the GHG Protocol. Mode-specific methodologies (e.g. EU MRV of $CO_2$ emissions of maritime transport, CORSIA) were mentioned as leading principles by the three interviewed transport associations representing the aviation and maritime transport sector. Finally, from the interviewed stakeholders, eleven respondents (with wide variance in their backgrounds) explicitly mentioned that the upcoming ISO Standard 14083 is expected to become the main standard for GHG emissions accounting for transport over the next years.

The stakeholder analysis also provide some evidence that particularly large companies develop in-house calculation models, while smaller companies more often rely on external calculation tools offered by third parties (mentioned by one transport association and an operator of a freight greening programme; there were also three large companies explicitly stating in their interview that they developed their own calculation model).
The stakeholder consultation did not provide clear evidence on which (external) calculation tools were most often used by transport operators/users.

### 2.4.3 Coverage of GHG emissions of transport by CountEmissions EU

As CountEmissions EU targets transport services, GHG emissions from private transport modes are not (directly) addressed by this initiative. In this section, we investigate which share of the GHG emissions of transport are (potentially) within the scope of CountEmissions EU.

Table 8 gives an overview (based on available information) of the estimated share of transport activities and associated GHG emissions per transport mode that is within the scope of the CountEmissions EU initiative[16]. The total amount of GHG emissions that are directly targeted by the CountEmissions EU initiative roughly equals about 0.55 Gton of $CO_2$ eq, which is about 50% of the total transport emissions. We calculated this percentage based on the share of emissions per transport category coming from transport services (see Table 8) and the share of the emissions of that transport category within the entire transport sector (based on (EC, 2021a) and (EEA, 2022))[17]. The majority of this $CO_2$-eq emissions are from road freight transport and busses (38%), aviation (28%) and waterborne (27,2%). The transport emissions that are not within the scope of the CountEmissions EU initiatives are mostly from passenger cars (84%).

[16] The estimates for heavy goods vehicles, busses/coaches, railways, navigation and aviation are reasonably certain. The estimates for passenger cars and light commercial vehicles are more uncertain, because of the limited statistics about the share of these vehicle categories that is used for transport services.

[17] This is a rough estimation, amongst others because the Scope of the maritime and aviation sectors in CountEmissions EU may differ from the Scope on which the GHG emissions estimates are based (bunker fuel sales).

**Table 8 - Rough estimation of the share of transport activities that are within the scope of CountEmissions EU**

| | | Within scope | Not within scope | Estimate of the share of emissions within scope |
|---|---|---|---|---|
| Road transport | Passenger cars | Taxis | All passenger cars for personal use | 1,4% [a] |
| | Light commercial vehicles | LCVs in use by transport operators | LCVs for commercial use or for services | 22% [b] |
| | Heavy goods vehicles | All HGVs | | 100% |
| | Bus/coach | All busses/coaches | | 100% |
| | Other road transport | | Mostly outside of scope | 0% |
| Railways | | All rail transport | | 100% |
| Waterborne transport | | All waterborne transport | | 100% |
| Civil aviation | | All civil aviation | | 100% |

[a] This is an estimate based on the share of kilometres driven by taxis of the total passenger car transport performance in the Netherlands in 2019 (CBS, 2022). We here assumed that this percentage is representative for the EU average.

[b] This is an estimate based on the share of LDV kilometres for freight transport or post-delivery compared to the total (which also includes private use, construction and services, which are not within the CountEmissions EU scope) in the Netherlands (Buck et al., 2017).

## 2.5 Motivations to apply GHG emissions accounting

Transport operators and users may have various motivations to apply GHG emissions accounting. Figure 7 shows the relevance of some potential motivations according to the stakeholders who completed the stakeholder survey.

As can be seen from Figure 7, the respondents to the survey indicated that *environmental awareness* is the most important motivation to account for emissions (22 out of 22 respondents consider it important or very important). This motivation is recognised by the evidence from the literature. For example, (Dobers, K. et al., 2019) points out that the existence of corporate sustainability programmes (CSPs), which are often translated into a set of sustainability performance and improvement targets, are an important driver for the application of GHG emissions accounting. Underlying drivers of these CSPs are company's value system and strategy, the management's belief in the company's environmental responsibility and the company's value system displayed toward customers and third parties. The latter driver was also recognised by several of the stakeholders interviewed (two experts, two operators of freight greening programmes and one individual shipper). Particularly large (consumer-facing) shippers are under increasing pressure from their customers (but also NGOs and their own employees) to define sustainability targets and provide regular updates about the progress in these decarbonisation efforts (see also Figure 8). However, to put these findings into perspective, one individual shipper informed us that still only a small part of their customers is interested in emissions reporting. As the case study carried out for DHL Express (see Annex E.2.6) shows that the demand from customers for emission figures is still limited (although increasing over the most recent years).

**Figure 7 - Stakeholder survey results on motivation to measure transport emissions**

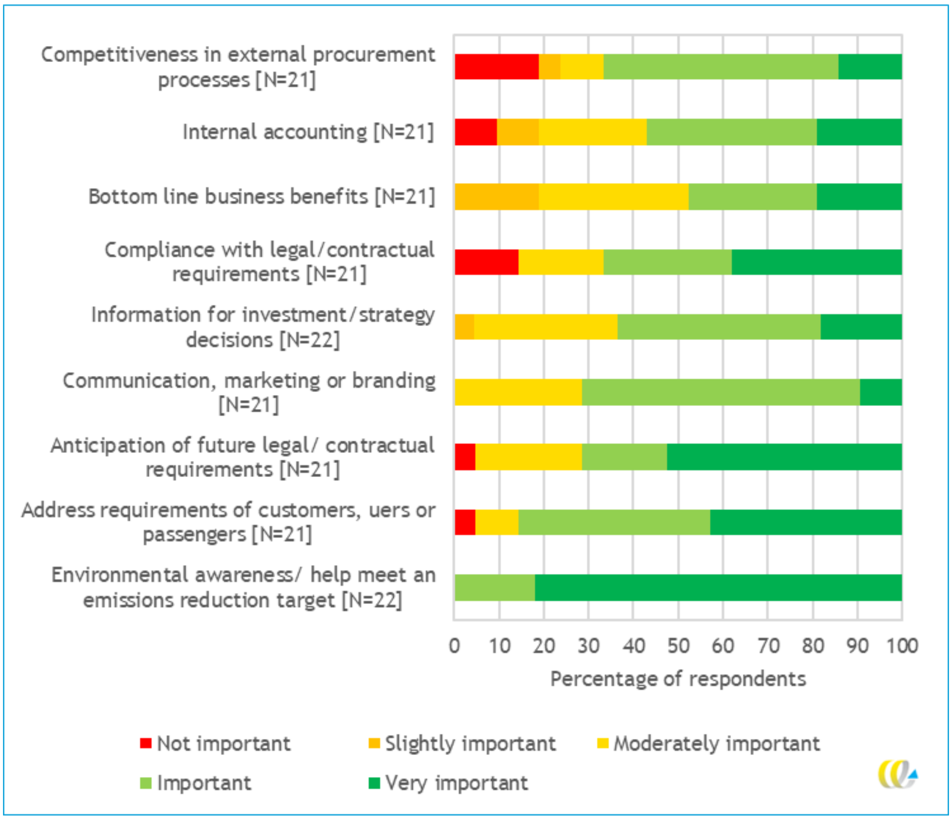
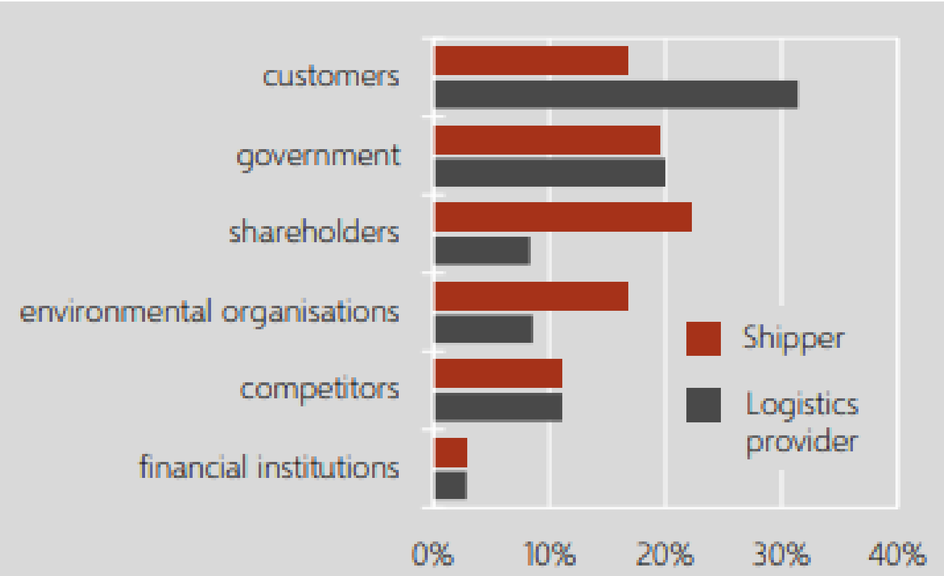



**Figure 8 - Sources of strong external pressure by type of entity (% of respondents that indicate that these potential sources of external pressure are 'strong')**




Source: (McKinnon, A. & Petersen, 2021).

Note: This figure is based on the results of a survey among 92 large EU-based shippers and logistic service providers. About 40% of the respondents were shippers and 60% logistic service providers.

There may also be various *commercial reasons* for applying GHG emissions accounting. As shown by Figure 7, the need to address requirements from customers, users or passengers is according to the respondents to the stakeholder survey an important driver for applying GHG emissions accounting. This driver was also mentioned by Auvinen, Heidi et al., (2014) and Naber et al., (2015). Another commercial reason to apply GHG emissions accounting (also mentioned by the respondents to the survey) is to satisfy contractual requirements in case GHG emissions of transport and logistic activities is part of tendering requirements (Dobers, K. et al., 2019). Three interviewed transport associations and one transport management system supplier mentioned a third commercial reason to account emissions for transport operators, i.e. to optimise one's own operational efficiency. For example, disaggregated insight in GHG emissions can be used to optimise fuel use. Also case studies executed on GHG emissions accounting by DHL Express (see Annex E.2.6), Mandersloot[18] (see Annex E.2.7) and SNCF[19] (see Annex E.3.1) shows that these companies use the results found mainly to improve the (energy) efficiency of their transport operations. The four interviewees referred to above mention that particularly large transport operators are expected to use the results of GHG emissions calculations for the purpose of optimising one's own operational efficiency. Smaller transport operators are often not able to apply sufficiently detailed GHG emission calculations (based on primary data) that allows for operational optimisation. Finally, from the case study on the Clean Cargo Working Group (see Annex E.2.4) a fourth commercial reason to apply GHG emissions accounting can be derived, i.e. to share the costs of taking emission reduction measures with customers. In order to convince customers to pay for lower emission levels, clear evidence on the emission reductions achieved should be available.

Finally, companies may also apply GHG emissions accounting *to comply with (future) governmental policies* (Dobers, K. et al., 2019, Naber et al., 2015). Also 15 out of 22 (68%) of the respondents to the stakeholder survey indicate that anticipating on future policies (or contractual requirements) is a (very) important reason to account for emissions. An extensive discussion of relevant policy developments that may motivate companies to account for their emissions is included in Appendix D.3 and in Annex D of the Annex report.

[18] Mandersloot is an international operating transport service provider located in the Netherlands.

[19] SNCF is a national French rail operator.

# 3 Problem definition

## 3.1 Introduction

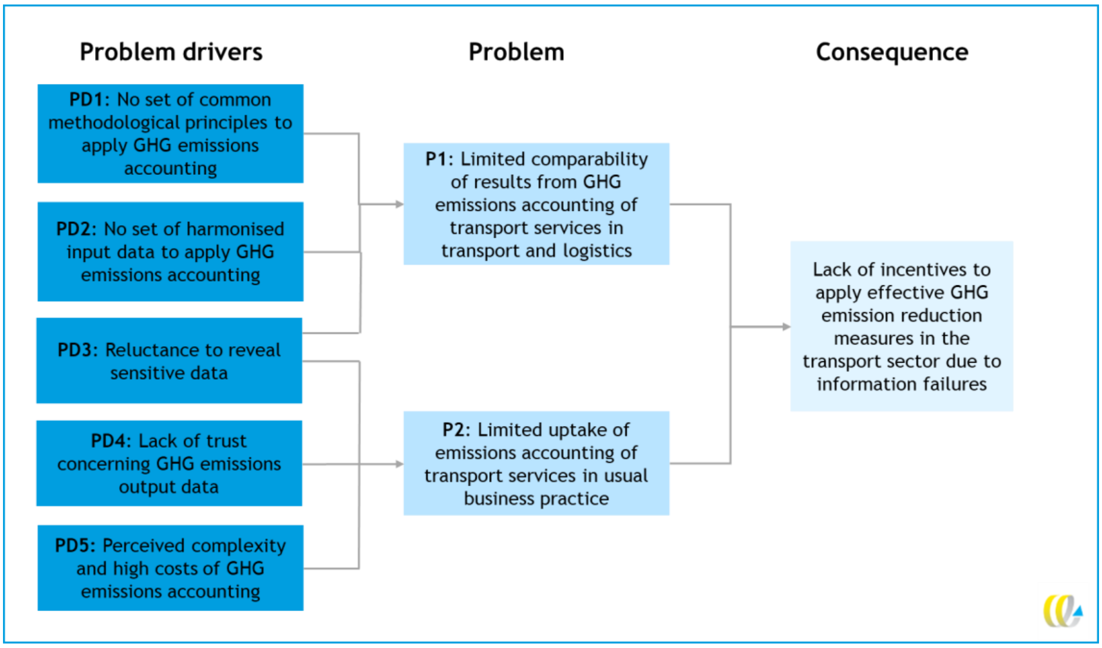
This chapter presents the problems CountEmissions EU is called to address. The problems are presented and discussed in Section 3.2. The underlying problem drivers contributing to the development of the problems are elaborated in Section 3.3. The expected impact of the consequences and problems on different stakeholder groups is provided in Section 3.4. Finally, the expected evolvement of each of the problems and underlying drivers in absence of any intervention is discussed in Section 3.5.

## 3.2 What are the problems?

### 3.2.1 Overview of the problem

The underlying problems, problem drivers and consequences that are relevant for the initiative are presented in Figure 9. More specifically, two problems have been identified:
- Problem 1: Limited comparability of results from GHG emissions accounting of transport services in transport and logistics;
- Problem 2: Limited uptake of emissions accounting of transport services in usual business practice.

**Figure 9 - Problem tree**




The targeted stakeholder survey showed broad support from the stakeholders for the problem defined. A vast majority (24 out of 29, or 83%) of respondents agree either totally or to a large part with the way the problem is stated. Among them, transport associations

(100%), shippers (100%) and transport service users (78%) strongly confirmed the relevance of the defined problem.

Together, both problems hamper companies, customers and passengers from fairly and accurately monitoring and comparing the GHG emission figures for specific trips and journeys. Due to this lack of comparable GHG emissions data, which is driving the information failure, transport users and operators are not fully incentivised to change their behaviours towards more sustainable and green mobility and transport options.

### 3.2.2 Problem 1: Limited comparability of results from GHG emissions accounting in transport and logistics

The existence of a large number of different standards, methodologies and calculation tools (see Section 2.3) as well as numerous emission default values databases and datasets contributes to a high variance in the GHG emissions figures of transport services produced. For example, BVL, (2022) shows that the calculation of GHG emissions of similar transport services by different transport operators using the same datasets and general methodology, may give results that differ up to 45%. As potential explanations for these differences both methodological choices made (e.g. how is dealt with empty kilometres) as well as the specific default input data used were mentioned. A similar finding was found by illustrative calculations carried out in the EU LEARN project, which shows large differences in calculation results based on primary data and default emissions intensity factors (Choumert & Smit, 2019). As a final example of the large variance in GHG emissions figures produced, we refer to an analysis of Sea-Intelligence, (2019), which compared the results provided by the $CO_2$ calculators provided by the fifteen largest container carriers in maritime transport. For the same transport service, difference in $CO_2$ emissions up to 100% are found (see Textbox 2 for more details).

**Textbox 2 - Comparison of $CO_2$ calculators from shipping companies**

Sea-Intelligence, (2019) compared the results of $CO_2$ calculators from the fifteen largest container carriers in maritime transport. Ten out of these fifteen operators do offer an online $CO_2$ calculator. Most, but not all, carriers state that their emission calculations are based on the Clean Cargo Working Group methodology. Furthermore, five of the ten calculators have been verified by an external third party, although it is unclear how this verification has been performed.

The ten $CO_2$ calculators have been used by Sea Intelligence to estimate the $CO_2$ emissions of transport 100 TEU (Twenty Foot Equivalent Container) between Shanghai and five other ports (Rotterdam, Los Angeles/Long Beach, New York, Santos and Melbourne). The results of this exercise differ widely, e.g. emission figures for a specific transport lane (using the same type of vessel) may differ by a factor 2. Differences in assumptions used in the calculations (e.g. whether corrections have been made for the fact that container vessels are not fully loaded) and the input data used do explain these very large range in the estimated $CO_2$ emissions.

The limited comparability of GHG emissions accounting in transport is confirmed by the stakeholders consulted for this study. Particularly the stakeholders joining the workshop acknowledged that large differences are found in the level of GHG emissions calculated for transport services, due to methodological reasons and particularly the large variability in emission intensity factors used.

The limited comparability and accuracy of GHG emissions figures for transport services harms the usability of these figures for the transport users (and operators). Accurate, reliable and comparable GHG emission figures of transport services are seen as a prerequisite to effectively manage emissions and to use these figures for applications like benchmarking the environmental performances of the services provided by different operators (EUI Florence School for Regulation, 2021). These figures should enable transport users and operators to directly compare the environmental performance of the services from different transport operators and/or logistic service providers.

The importance of accuracy, relevance and comparability of the results of GHG emissions accounting is also confirmed by stakeholders. The vast majority (136 out of 169 or 80%) of the general respondents participating in the Open Public Consultation (OPC)[20] and the interviewed stakeholders (with all kinds of backgrounds) confirmed that the lack of reliable and comparable information is an important issue to be addressed by CountEmissions EU. As mentioned by an interviewed consumer and passenger federation, reliable and comparable GHG figures are required to gain acceptance for these figures from consumers and companies, which is needed to build products that would affect their behaviour. Also the results of the targeted survey showed that comparability, relevance and accuracy are considered the main criteria that should be met by GHG figures of transport services according to stakeholders.

### 3.2.3 Problem 2: Limited uptake of emissions accounting in usual business practice

As shown in Section 2.4.1, a significant share of companies in the transport sector does not calculate (and report) GHG emissions related to their operations. And the majority of the companies accounting for their transport emissions do this at the company or vehicle level and not at the level of transport services, which is necessary to influence specific green transport choices by users. For example, a survey under 90 larger logistics providers and shippers show that although about 85% of them were measuring GHG emissions, only a small part (about 30%) calculated disaggregated data to be shared (McKinnon, A. & Petersen, 2021). In aviation and maritime transport, the share of companies calculating emissions is rather high, mainly because accounting is required within the legislative framework for these sectors (i.e. EU MRV for $CO_2$ emissions of maritime transport, CORSIA and EU ETS for aviation). But also for these modes, calculations are particularly made at the vehicle or trip level and not at the level of transport services. These various figures illustrate that emissions accounting at the level of transport services is only applied by a small part of the market. As indicated by several stakeholders interviewed, particularly small and medium-sized companies (the majority of the operators in (freight) transport) are lagging behind in this respect, a view that is confirmed by the analysis presented in Section 2.4.1.

The limited uptake of emissions accounting at the level of transport services was confirmed through the results of the stakeholder consultation. The results of the OPC show, for example, that many respondents are not given enough information when planning a journey or transport goods (45 out of 56 organisations, or 80%; 61 out of 70 individuals, or 87%; and 60 out of 65 online customers, or 92%). Respondents to the targeted survey also estimated the current uptake of emissions accounting as (very) low (26 out of 31, or 84%). The results of the stakeholder consultation also confirm that emissions accounting activities that are performed are often not at the transport service (or trip) level. Only 9 out of 26 (35%) of the respondents to the targeted survey who regularly account for the emissions of transport activities do this at the transport service (or trip) level.

[20] What is more, 103 out of 157 (66%) of the respondents of the OPC indicate that the limited comparability of GHG emissions accounting results is a real concern for their professional or private activities.

On the other hand, the consultation activities also showed that many stakeholders already perform some kind of emissions accounting.

The targeted stakeholder survey showed that although 78% of the respondents (29 out of 37) regularly account for their transport emissions, only 35% do this (in some cases) at the service level.

## 3.3 What are the drivers of the problems?

In this section we discuss the five drivers causing the two problems described in the previous section. Additionally, we present the main interlinkages between these five drivers. Finally, we discuss a relevant contextual factor, i.e. a factor affecting the problems but which is not directly addressed by CountEmissions EU.

### 3.3.1 Problem driver 1: No set of common methodological principles

As discussed in Section 2.3.1, there is a large number of standards and methodologies that transport operators and users can use to account for their emissions. Because of differences in the scope applied and calculation/allocation rules required, these standards/ methodologies lead to a high level of variance in the GHG emission figures produced, harming the comparability (and reliability) of these figures (see Section 3.2.2). The lack of a common methodology was recognised by all types of stakeholders interviewed and the participants of the stakeholder workshop as an important driver of the low level of comparability of GHG emissions figures, particularly in the multi-modal context. Also the results of the OPC clearly showed the relevance of this driver: 90% of the respondents (157 of 174) considered the problem with fragmented emissions accounting in the transport sector to be at least significant. When asked if this problem was affecting their private of professional activities, 69% (113 of 163) replied affirmatively, while 20% (33 of 163) considered this problem to affect them only to a limited extent.

Over the last decade, there have been several attempts to harmonise the methodology framework for GHG emissions accounting in the transport sector. The first one was the introduction in 2012 of the CEN Standard EN 16258, which is still the only standard for GHG emissions accounting in transport. However, as discussed in Section 2.2, this standard has some deficiencies, including much degree of freedom in emission calculation, such that there still may be large variance in the emission figures calculated according to this standard. Therefore, more efforts have been undertaken to further harmonise the methodologies. Particularly the development of the GLEC framework has contributed to harmonisation of the methodologies in the freight transport sector. Although two interviewed operators of freight greening programmes and an interviewed transport association argue that the GLEC framework largely solved the fragmented landscape of methodologies, other stakeholders state that there are still large differences between methodologies that are currently applied (as was also shown in Section 2.3.1). Therefore, there is still a need for further harmonisation.

The current initiatives of a working group of experts from around the world to develop the ISO 14083 Standard (to be published by 2023) should contribute to this further harmonisation. Although the emerging ISO Standard is expecting to partly solve the fragmentation on methodological approaches applied, it will probably not solve all methodological inconsistencies (see Sections 2.3.1 and 3.5.1 for more details).

### 3.3.2 Problem driver 2: No set of harmonised input data for the application of GHG emissions accounting

The lack of harmonised input data is another key driver contributing to the limited comparability of results from GHG emissions accounting in transport. Different types of data may be used to quantify the emissions from transport activities. This data typology is presented in Textbox 3.

**Textbox 3 - Typology of input data**

Three main categories of input data are distinguished:

1. **Primary data** (actual values) refers to data obtained from a direct measurement or a calculation based on direct measurement. It may include measured fuel/energy consumption data as well as transport performance data (e.g. actual distance, number of person/amount of freight transported).
2. **Secondary data: default data** refer to data taken from a published source. The following default values may be distinguished in the context of CountEmissions EU:
   - Energy emission factors, being proxy values used to derive estimates of GHG emissions based on the amount of energy/fuel used. These factors are often expressed in gram per litre/kWh or gram per MJ.
   - Emission intensity factors, being proxy values used to derive estimates of GHG emissions related to fuel combustion based on transport performance data. These factors are often expressed in grammes per vehicle-kilometre, grammes per tonne-kilometre or grammes per passenger-kilometre.
   - Other emission factors applied by few methods that incorporate emissions stemming from the production, maintenance and scrapping of vehicles or infrastructure.
3. **Secondary data: modelled data** refer to data established by use of a model that takes into account primary data, completed with default data to derive estimates of GHG emissions of a transport or hub operation.

The majority of methodologies and standards listed in Section 2.3.1 prioritise the use of primary data reflecting the actual fuel/energy consumed while performing transport operations[21]. To convert actual fuel/energy consumption data into GHG emissions, default energy emission factors are required. There are various sources providing these factors, but as illustrated by Table 9, they differ in the actual values proposed. This variance in energy emission factors leads to some uncertainty in the final GHG emission figures quantified for the transport services.

**Table 9 - Energy emission factors from different sources ($CO_2$ eq/MJ)**

| Well-to-wheel $CO_2$ emission factors ($CO_2$-eq/ MJ) | | Gasoline | Diesel | LPG | CNG |
|---|---|---|---|---|---|
| FQD | WTW | 93.3 | 95.1 | 73.6 | 69.3 |
| CEN EN 16258 | WTW | 89.4 | 90.4 | 75.3 | 68.1 |
| Concept ISO 14083 | WTW | 90.1 | 87.3 | 81.6 | 72.7 |

[21] There is a general agreement among stakeholders interviewed on the added value of using primary data, as using default data will not show the results of innovations and does not (accurately) reflect the differences in GHG emissions performance of companies on the same corridor using the same mode.

Although the use of primary data is preferred by most standards/methodologies, this data is not always available to companies[22]. For example, Stevens et al., (2018) found that one of the main challenges of applying GHG emissions accounting for transport at Heineken is obtaining accurate (primary) data. Dependency on third parties and the limited level of control on the supply chain were important reasons for that. For cases with limited availability of primary data, most methodologies and standards (see Annex A.2) allow the use of default emission intensity factors[23], although this will result in lower accuracy and comparability of GHG emissions figures. To minimise this risk, these data should preferably be taken from trustworthy and high quality databases. However, Stevens et al., (2018) mentioned that it is often challenging for companies to find credible sources of default emissions intensity factors for their GHG emissions calculations, in particular for cross-border logistic activities, a finding that was confirmed by an interviewed transport operator. Emission intensity factors presented by credible sources like DBEIS/DEFRA (UK Government, 2020), HBEFA (INFRAS, 2022) and the French Degree (Legifrance, 2015) may differ up to a factor two for the same vehicle under the same circumstances (Stevens et al., 2018). Although these differences may be explained by a wide range of factors, like differences in climate, environmental specificities, composition of the vehicle fleet, etc., it significantly complicates the search for the most appropriate emission intensity factors by transport operators and users. More in general, emission intensity factors represent just one value that does not correspond to the carbon efficiency of the operation at hand (Ehrler, V.C. et al., 2018). For example, default emission intensity factors are often determined based on fuel use per vehicle-kilometre and average load/occupancy factors, but these average load/occupancy factors do often not reflect transport operation considered. Finally, as mentioned by a transport association, a consumer and passenger federation and a supplier of transport management systems during the interviews, default emission intensity factors will not show the results of emission reduction measures taken.

The contribution of this lack of harmonised input data to the limited comparability of GHG emissions accounting outputs in transport was broadly acknowledged by the participants of the stakeholder workshop and the interviewed stakeholders.[24]

### 3.3.3 Problem driver 3: Reluctance of transport operators to share sensitive data

Because of a fear to share commercially sensitive data, particularly freight transport operators may be reluctant to share primary operational data (CE Delft et al., 2014, Choumert & Smit, 2019). For example, emission reports can reveal the amount of fuel or energy used related to the assignments for customers, as emissions can be reversely converted into the amount of fuel used and hence fuel costs made. This information may negatively affect the negotiation position of transport operators on transport prices, as it provides shippers information on the cost structure of operators (Dobers, K. et al., 2019, Ehrler, V.C. et al., 2018, TNO, 2020b). As mentioned by a transport association and

[22] Or, as mentioned by an interviewed supplier of transport management systems, it may not be beneficial for companies to apply primary data, as using default data results in lower GHG emission figures than applying actual data.

[23] Using modelled data is often allowed as well. However, this option is often (too) expensive and complex for stakeholders (particularly for SMEs) (TNO, 2021).

[24] In the initial problem definition presented to stakeholders in the targeted survey, this problem driver was integrated with PD1. However, based on feedback from stakeholders suggesting that issues associated with input data need a more prominent place in the problem definition, PD2 was added to the problem tree as a separate driver. In this context, the vast majority of the respondents to the targeted survey mentioned that the variance in methodological principles and input data together, is (highly) relevant (77%, 24 of 31).

researcher interviewed, also information on load factors may be considered as commercially sensitive data. Transport operators often offer transport prices based on two runs, assuming an empty return trip. However, by sharing load factor data it may become clear that there is a backhaul, offering the client arguments to bargain for lower prices.

A large share of the stakeholders confirms the existence of this problem driver: 19 out of 31 (61%) respondents to the stakeholder survey indicate that this driver is (highly) relevant[25]. Least support is found among transport service users (four out of nine; 44%) and individual shippers (four out of seven; 42%), probably reflecting their interest in receiving this commercially sensitive data (as it may improve their bargaining position). Although both large and small operators are reported to be unwilling to share commercially sensitive data, three stakeholders interviewed (i.e. a standardisation body, a transport association and a researcher) argue that particularly the small ones are hesitant in this respect, since they have less bargaining power (in price negotiations) and therefore may be more reluctant to share such sensitive data. On the other hand, as mentioned by a supplier of transport management system, large companies are, in general, more concerned on being transparent on their cost structure.

Because of reluctance of operators to share primary data on fuel consumption and/or transport performance data, transport users/organisers have to fall back on default emission intensity factors to complete their GHG emissions calculations at the level of transport services. As a consequence, these calculations less accurately reflect the actual emissions associated to the transport services, harming the comparability of transport services in terms of GHG emissions (P1). This problem driver also limits the uptake of GHG emissions accounting by transport operators (as they do not want to share the results with transport users/organisers) and transport users/organisers (as they do not have access to the best available data, their willingness to account for their transport related emissions may be reduced), contributing to the second problem presented in 3.2.3.

### 3.3.4 Problem driver 4: Lack of trust concerning GHG emissions output data

The usability of GHG emission figures (e.g. for external benchmarking or for sustainable financing) depends heavily on the trust transport users have in their reliability and accuracy. A lack of trust, therefore, limits the demand for these figures (Choumert & Smit, 2019, Kellner, 2016) and hence the uptake of GHG emissions accounting in usual business practice (P2). This problem driver was explicitly acknowledged by three transport associations, a consumer and passenger federation, two public authorities and a researcher during the stakeholder interviews[26].

There are various reasons explaining the lack of trust of transport users in GHG emissions output data. First of all, the lack of a common methodology and a harmonised set of input data (see Sections 3.3.1 and 3.3.2) lowers the trust in GHG emissions figures calculated, as this complicates checking the accuracy and reliability of these figures. The incentive of transport operators to underreport emissions (green washing) is another explanation for this lack of trust, as was acknowledged by stakeholders during the stakeholder workshop.

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[25] This opinion was shared by France in the questionnaire sent out to Member States. They clearly indicated that CountEmissions EU should provide rules addressing the exchange GHG emissions data with an appropriate level of security and privacy.

[26] As this driver was not provided in the targeted survey and OPC, no results supporting this driver from these consultation activities is available. However, the relevance of reliable and accurate GHG emissions data was pointed out by the respondents of the OPC: 145 out of 175 (84%) respondents acknowledge this as (very) important.

By underreporting operators may try to improve their own competitive position on the market (Dobers, K. et al., 2019). Underreporting may be achieved by 'values shopping': if emissions computed using primary data are higher than computations using default emission intensity factors, there is a strong incentive on the part of the reporting entity to use default factors (Davydenko, I. et al., 2019). Transport users' fear that operators will make unconscious errors in their measurements and/or calculations may also contribute to this lack of trust in the reliability of GHG emissions output data. More in general, the dependency of (non-validated) third-party data reduces the trust of transport users concerning the reliability of GHG emissions output data (Davydenko, I et al., 2018). Finally, as mentioned by one of the interviewed transport operators, shippers are sometimes uncertain on whether the GHG emissions figures show emissions savings that can be actually linked to transport services carried out for them. In this case, there is not lack of trust in the accuracy and reliability of the figures, but more in what these figures exactly reflect.

The lack of credible and harmonised verification scheme for the output of GHG emissions accounting is exacerbating many of the reasons mentioned above for the lack of trust of transport users in calculated GHG emission figures. It was mentioned by many stakeholders during the workshop as an important issue contributing to the low uptake of GHG emissions accounting by the market.

### 3.3.5 Problem driver 5: Perceived complexity and high costs of GHG emissions accounting

The uptake of GHG emissions accounting in usual business practice (P2) is hampered by the perceived complexity and high costs of GHG emissions accounting. With respect to the perceived complexity, Transporeon et al., (2022) find that about 40% of the road hauliers are not capable to calculate these emissions at all, and 35% only at the company level (see Section 2.4.1). The results of a stakeholder survey carried out as part of the LEARN project Royo et al., (2018) and of the survey carried out as part of this project, do confirm these findings. For example, in the stakeholder survey conducted within this study 20 out of 31 respondents (64%) indicate that the perceived complexity (and high costs) is a (highly) relevant barrier for applying GHG emissions accounting in transport. This driver is seen as most relevant for small companies, as is evidenced by results from Tolke & McKinnon, (2021) that show small companies are less capable to account for emissions than large companies (see Figure 4 in Section 2.4.1). Smaller companies often experience specific knowledge gaps[27], while for larger companies data collection and data quality/ completeness are the most challenging issues. Only one of the interviewed stakeholders challenged the fact that emissions accounting is more complex for small companies. This supplier of transport management systems claims that emissions accounting becomes easier the less vehicles and transport legs are involved and therefore may be less complex for small companies than for larger ones.

High costs (related to the expected benefits) is also an important barrier for the uptake of GHG emissions accounting (CE Delft et al., 2014, Royo et al., 2018), a finding that is acknowledged by the vast majority of interviewed stakeholders and at the stakeholder workshop. High costs are partly related to the perceived complexity of GHG emissions accounting and the efforts that have to be taken to get familiar with it. But there are

[27] For example, test cases carried out in the LEARN project (Choumert & Smit, 2019) show that a common mistake made by small road carriers was in the computation of transport activity. All small road carriers that took part in the test cases computed transport activity by multiplying the sum of kilometres driven by the sum of weight of all shipments carrier instead of summing up all shipments multiplied by the shipment-specific distances.

also other causes for high costs. First, there are significant costs associated to emissions calculations, which is mainly related to the fact that GHG emission computation methodologies are often not aligned with business practice (Davydenko, I et al., 2018). These calculations require the combination and matching of different data sets, which may be stored in different systems and administrations (or even organisations)[28]. Particularly in case of fragmented or incomplete data, this matching of different data sources may be challenging. There may also be problems with the availability of transport activity data (Ehrler, V.C. et al., 2018), e.g. because the exact mass of a shipment is not recorded or available routing information is not detailed enough (e.g. missing data on the actual route followed by the vehicle).

Secondly, there may be significant costs associated to sharing of GHG emissions figures between transport operators and transport users (e.g. shippers). For example, a large shipper may work with hundreds if not thousands of carriers and have fragmented operations in different countries. Collection of GHG data means dealing with that large number of service providers, collecting in different forms, and computed with different underlying methodologies, assumptions and default data (Connekt, 2021, Nikias et al., 2015, Stevens et al., 2018). Large carriers face a mirror problem, as they may need to report to uncountable number of customers, who may have their own requirements for reporting. In addition, in the passenger transport segment, the collection of emissions data from operators can be hampered due to the fact that contracts with public authorities, or other responsible bodies, are often long term and the requirements to provide data on emissions are not always reflected in these contracts.

Thirdly, verification/assurance of data or accounting results may also lead to costs for transport operators or users. Davydenko, I et al., (2018) find that a majority of the transport operators and users are not willing to bear these costs, even though they acknowledge the importance of verification to get reliable emissions figures.

Finally, as mentioned by one of the interviewed transport associations, costs of GHG emissions accounting may also be considered (too) high by stakeholders as they often outweigh the benefits. This finding was confirmed by one of the interviewed freight transport service users, who stated that transport users will not ask for GHG emissions figures as it will have a significant impact on the transport price, because of the fact that there are no/few observable benefits. The other way around (as mentioned by one of the operators of a freight greening programme), operators are not incentivised to apply GHG emissions accounting as they cannot increase the transport price (to cover the costs of accounting).

### 3.3.6 Interlinkages between the problem drivers

The five problem drivers presented above are closely linked to each other. Particularly the two more technical problem drivers PD1 (i.e. no set of common methodological principles) and PD2 (i.e. no set of harmonised input data) are inherently linked, as the type of input data to be used depend heavily on the choice of the common reference methodology. For instance, a different set of default values would be necessary for using well-to-wheel (WTW) and full life cycle assessment (LCA) methodologies, respectively. Both drivers are, on the other hand, also distinctive, as they both have their own impact on the quality of the output of the calculations. The use of different methodologies and different sets of input

[28] For instance, fuel use data, which is often stored in financial administration (as it is what transport operators buys), needs to be matched with transport activity data, which are stored elsewhere (as it is related to the customer orders) or it may be even the shipper who has a better view on these data (Dobers, K. et al., 2019).

data leads to higher variance of GHG emissions calculation results, but significant inconsistencies may also be observed when using the same methodology and different type of input data. For that reason, both drivers are separately included in the problem tree.

PD3 (i.e. reluctance to share sensitive data) is particularly linked to PD4 (i.e. lack of trust concerning GHG emissions accounting output), as PD3 reinforces PD4: the less primary data is used in the emissions calculation because of the reluctance to share these data, the less reliable the results of the calculation would be available for the final data recipients. PD3 is also linked to PD5 (i.e. perceived complexity and high costs of GHG emissions accounting), as the lower availability of primary data (because of the reluctance to share it) may contribute to higher costs for calculating GHG emissions by transport users.

PD4 is, apart from the interlinkage with PD3, also linked to PD1 and PD2, particularly as the lack of trust in GHG emissions data is driven by the proliferation of GHG calculation methods and the fragmented landscape of default emissions values.

Finally, PD5 is not only linked to PD3, but also to PD1 and PD2, as the complexity and high costs of GHG emissions accounting may be associated with the proliferation of methods and default datasets.

### 3.3.7 Contextual factor: Lack of demand for GHG emission figures from customers and passengers

Next to the five problem drivers discussed above, we also identified a contextual factor. As explained before, this is a factor affecting the problem but which is not directly addressed by the CountEmissions EU initiative. The contextual factor is defined as ‘the lack of demand for GHG emissions figures from consumers and passengers’ (CE Delft et al., 2014, Royo et al., 2018), which contributes to the limited uptake of emissions accounting in usual business practice (P2). Currently, mostly consumer-oriented and publicly traded companies who provide corporate sustainability reports and want to market their green credentials do report their GHG emissions. For many other companies, traditional performance indicators like costs, transit time and reliability are still far more important in effectively meeting consumers’ demand (ITF, 2022, CE Delft, 2018). This was confirmed by the results of the targeted stakeholder survey.

This is also the case for passenger transport, where factors like travel time, reliability, price and comfort have a much larger impact on transport decisions than environmental issues (CE Delft, 2018). This explains the limited demand for GHG emissions figures from passengers and consumers.

Because of this lack in demand for GHG emission figures from customers and passengers, there is in general little incentive to report GHG emissions by the shippers and transport operators, as a positive business case is often missing (Dobers, K. et al., 2019).

## 3.4 Stakeholders affected

The problems, as discussed in Section 3.2 affect different types of stakeholders. A detailed overview of the way the various problems affect stakeholders is given by Table 10.
The stakeholders affected are:

- **Transport service organisers and particularly transport operators.** Transport operators are mainly affected because they lack reliable data to improve the energy efficiency of their operations (and hence lower their energy costs). Furthermore, the

lack of a harmonised framework may complicate the application of GHG emissions accounting for those transport service organisers that want to account for the GHG emissions of their transport services, e.g. for regulatory or business-related purposes. SMEs are considered to be affected most significantly, as they have less knowledge and capacity to apply GHG emissions accounting on themselves.
- **Transport users**, who can take less informed decisions because of the lack of reliable and comparable information on GHG emissions of specific transport services. Furthermore, large shippers (or logistic service providers) who apply GHG emissions accounting of their transport services themselves (addressing regulatory or business-related needs), may be confronted with non-comparable emission figures from their carriers, complicating their overall emissions calculations.
- **Potential users of GHG emissions figures of transport services (e.g. financial institutions, governments)** are affected by the lack of reliable and comparable emission figures, which lowers the probability that these figures can be used effectively.
- **Society as a whole**, as the problems may hamper the uptake of effective and efficient GHG emissions measures, resulting in more adverse impacts of global climate change.

**Table 10 - Stakeholders affected by the various problems**

| Consequence and problems | Stakeholders affected |
|---|---|
| Lack of incentive to apply choices and measures reducing GHG emissions in the transport sector due to information failures | – Society, due to higher levels of GHG emissions resulting in higher climate costs.<br>– Transport service organisers and particularly transport operators, as they lack reliable data to optimise their operations with respect to energy efficiency. As SMEs are currently less often measuring the GHG emissions of their operations, they are more heavily affected.<br>– Transport users (i.e. shippers, (online) customers, passengers) as 1) they cannot choose methods or means based on emissions, and 2) transport prices may be higher as transport operators do not take all cost-effective fuel efficiency measures. |
| Limited comparability of results from GHG emissions accounting in transport and logistics (P1) | – Transport service organisers, as the lack of a common methodology results in higher complexity (and hence costs) of measuring emission figures. Furthermore, the value of $CO_2$ emission figures is lower, as they are not (always) suitable for external benchmarking.<br>– Transport users (i.e. shippers, (online) customers, and passengers) as a comparison of GHG emission figures between operators is complicated. For (large) shippers (and logistic service providers) who apply GHG emissions accounting themselves, the limited comparability of GHG emission figures from carriers providing transport services to them, heavily complicates the overall calculations.<br>– Institutions who want to use GHG emissions figures of transport services for alternative purposes (e.g. cities or financial institutions), as no common (verified) figures are available. |
| Limited uptake of emissions accounting in everyday business practice (P2) | – Transport users (i.e. shippers, (online) customers, passengers), as emission figures per transport service are not available on a wide scale. As a consequence, they are not able to (fully) take the environmental impact into account when making a transport decision.<br>– Transport service organisers, as they do not base their transport decisions on relevant $CO_2$ emissions figures, which may result in inefficient transport operations. |

## 3.5 Expected evolution of the problem

### 3.5.1 Problem 1: Limited comparability of results from GHG emissions accounting in transport and logistics

Despite recent and ongoing harmonisation efforts for a common GHG emissions accounting approach for transport services, the problem of limited comparability of GHG emissions figures is expected to persist to a significant extent.

The introduction of the ISO 14083 Standard on GHG emissions accounting in the transport sector will probably contribute to a further harmonisation of the methodological principles applied. According to many of the stakeholders interviewed, this ISO Standard will probably become the dominant standard in the transport sector. The majority of the current standards, methodologies and calculation tools are intending to align with the upcoming ISO standard[29] (see Table 84 in Annex D.2), which will contribute to further harmonisation. Full harmonisation between the various methodologies and calculation tools is, however, not ensured, particularly because the application of the ISO Standard is voluntary. Additionally, the ISO Standard probably will leave some room on certain aspects of the methodology (e.g. two different approaches for allocating emissions to individual transport services are allowed), which may harm to some extent the comparability of the results of GHG emissions accounting.

According to the stakeholders interviewed, the use of primary data instead of default input data is expected to grow in the future, further improving the accuracy and comparability of GHG emissions figures. This trend is mainly expected to occur at large companies which have the knowledge and resources to collect primary data and perform detailed calculations. Small transport companies often lack these capabilities and therefore their calculations would continue to be mostly based on default emission intensity factors. However, a further harmonisation of databases providing these default emission intensity factors is expected by stakeholders, improving the quality of the input data for GHG emissions accounting (see Annex D.2). Furthermore, it is expected that these databases will contain more disaggregated data (i.e. more detailed emission intensity factors for different vehicles, segments, regions, etc.), which will also contribute to higher levels of accuracy in calculated GHG emission figures. Despite these expected trends in the field of input data, stakeholders expect that the level of harmonisation of input data will be at a significantly lower level than for methodological principles and will stay an important driver for the lack of comparability of the results of GHG emissions accounting.

### 3.5.2 Problem 2: Limited uptake of emissions accounting in usual business practice

Based on the results of the stakeholder consultation and some evidence from the literature, it is expected that the uptake of GHG emissions accounting in the transport and logistics sector will increase to a certain extent (even without the CountEmissions EU initiative), because of (see Annex D for more details):

[29] For some specific sectors, deliberate deviations from the ISO 14083 methodology may probably be expected, in order to better address certain specificities for those sectors. For example, the upcoming Parcel Delivery Environmental Footprint (see Annex A of the Annex report accompanying this report) will probably recommend another approach to allocate emissions to individual parcels than mentioned in ISO in order to better reflect the specific nature of parcel delivery. Such sector-specific deviations from the ISO 14083 methodology may increase the accuracy of the GHG emissions output and hence the comparability of operators/users on specific transport services.

— The implementation of policies that require data on GHG emissions from transport and logistic activities, like the Corporate Sustainability Reporting Directive[30] (see Annex B). These policies will incentivise the demand for GHG emission output and hence the uptake of GHG emissions accounting. Most likely, particularly large companies (i.e. transport users) will be incentivised by these policies to apply GHG emissions accounting.
— The growth in the supply of sustainable products and services, like ESG financing products and sustainable delivery services. These products/services require (high-level) data on GHG emissions of transport services. The increased demand for reliable GHG emissions output may contribute to an increased uptake of GHG emissions accounting by transport operators.
— According to three interviewed stakeholders (i.e. a transport association and two operators of freight greening programmes), the demand from consumers/ passengers for GHG emissions data at the transport service level may increase due to increased environmental consciousness. However, empirical evidence on this trend is to our knowledge limited.
— In some specific transport segments (e.g. chemical industry, fashion, parcel delivery) guidelines or specific standards are developed to facilitate the uptake of GHG emissions accounting by lowering the (perceived) complexity of the accounting. There is no information available on other transport segments that are planning such initiatives.
— Technical developments, like on-board fuel consumption monitoring and data sharing technologies, may further facilitate and simplify the collection of primary data required to account for emissions (see Annex D.4 for more details).

Although it seems likely that the uptake of GHG emissions accounting will increase in the future, the magnitude of this increase is very uncertain and probably low, particularly as most of the drivers of this problem are expected to persist at a significant level without any policy action. The trends discussed above will not lower the reluctance of operators to share commercially sensitive data neither will it fully solve the issue that GHG emissions figures are often not trusted by transport operators (which will particularly require some common verification system). As regards the complexity and costs related to accounting of emissions, technological developments and the development of sector specific standards, guidelines or calculation tools may address this driver to some extent. However, their use will be associated with certain costs, and may only incentivise part of the market to take up emissions accounting. Furthermore, without any common methodological framework, they will not ensure comparable GHG emission figures in the transport sector as a whole.

[30] This proposed directive (EC, 2021c) would amend the existing reporting requirements of the Non-Financial Reporting Directive (EU, 2014a). All large companies (and companies listed on regulated markets) should report on their impact on environmental themes like climate change, pollution and biodiversity. The actual information to be disclosed it not defined yet, but it may be expected that GHG emissions of transport services will be part of the data to be reported.

# 4 EU right to act

The Treaty on the functioning of the European Union (EU, 2012) supports in various ways the EU right to act on the establishment of a level playing for GHG emissions accounting in the transport and logistics sector, and on the facilitation of its uptake. First of all, in accordance with Article 4(2) of the Treaty, shared competence between the EU and the member states in the area of transport. Additionally, Article 91(1) and Article 100(2) of the Treaty confers to European institutions the right to lay down appropriate rules to international transport. As GHG emissions accounting at the transport service level is relevant for a large share of the transport sector (including international transport) and because the EU transport sector has a clear international component[31], a coordinating role of the EU in harmonising GHG emissions accounting in the transport sector is therefore supported. Second, Article 191 and 192(1) of the Treaty provides European institutions the right to act on the mitigation of environmental issues, including climate change.

Although acting in the field of harmonised GHG emissions accounting in transport is under the competence of the EU (as explained above), the Union should only act if this cannot be done (as effectively) by the individual member states. Currently, the number of national (public) initiatives in this field are limited. Only in France a harmonised methodological framework for GHG emissions accounting has been implemented as well as measures to incentivise its uptake (see Annex A and D of the Annex report accompanying this report for more details on both schemes). No intentions for other national initiatives are known and hence EU action on this issue seems to be meaningful.

On the other hand, in case national initiatives are initiated, there is a risk of the creation of a patchwork of national frameworks, which may result in different calculation and/or reporting requirements for transport operators (and users) (CE Delft et al., 2014). As many of these companies operate on an international level, this may lead to a higher administrative burden compared to the situation where an EU framework is implemented (e.g. operators have to use different calculation rules for the different countries where they offer transport services, shippers receive GHG emissions figures in different formats from operators located in different countries). Action at the national level may also lower the effectiveness of the initiative, as GHG emissions figures from transport operations carried out in different countries cannot be benchmarked and may provide different, or even negative incentives to apply specific emission reduction measures[32].

Harmonisation of the framework for GHG emissions accounting at the EU level may also provide economies of scale for providers for technical support tools, like calculation tools and data exchange mechanisms. By removing any barriers to the internal EU market for these agents, they can offer their services at the entire EU market at lower costs.

[31] Maritime transport and aviation are almost fully international, i.e. cover trips between different countries. But also for the other modes, a smaller but still significant share is international. For example, 39% of road freight transport (in terms of tonne kilometres) was international in 2019 (Eurostat, 2022).

[32] For example, because of differences in the methodological frameworks, the expected $CO_2$ reduction potential of a modal shift from road transport to rail transport is much larger in country A than in country B. This may confuse shippers operating in both countries, affecting their willingness to consider a modal shift.

# 5 Objectives

## 5.1 General objective

The general policy objective of the CountEmissions EU initiative is defined as:

*Incentivise behavioural change among businesses and customers to reduce GHG emissions of transport services through the uptake of comparable and reliable GHG emission data.*

By providing individuals and companies more comparable and reliable information on the GHG emissions of specific transport services, they will have the opportunity to make a more systematic comparison of these services. This will empower them to make more sustainable delivery and transport choices or to voluntary offset the environmental impact of their trips/journeys.

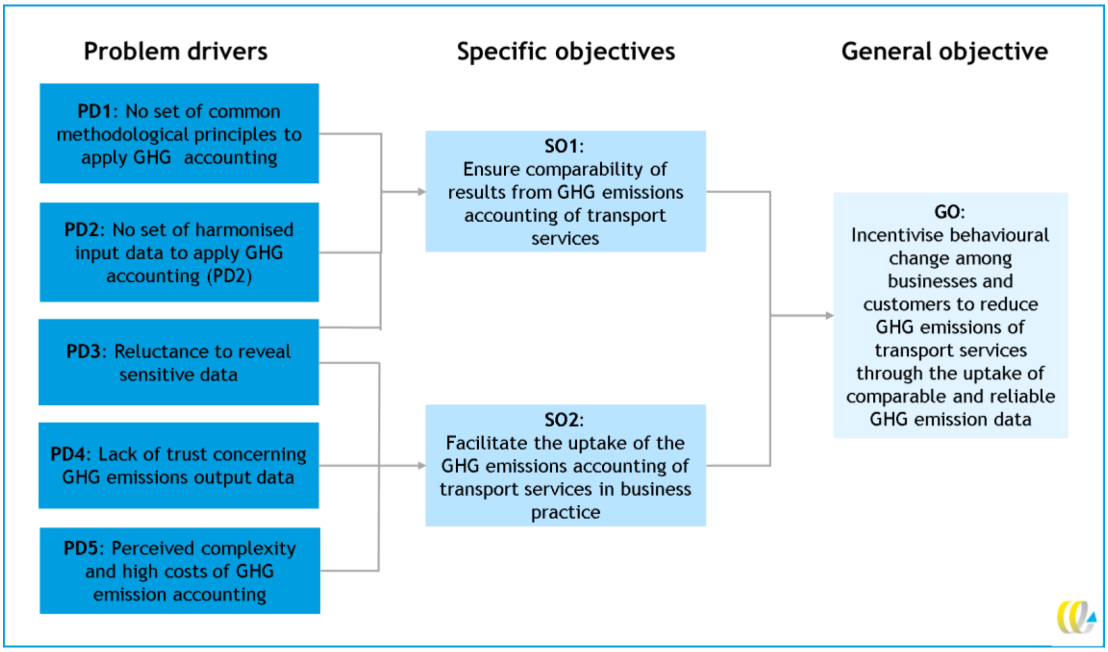
This objective is in line with the Sustainable and Smart Mobility Strategy (EC, 2020d), which presents the aim to put in place the right incentives to drive the transition to zero-emission mobility. Therefore the incentives for transport users to make more sustainable choices must be reinforced. These incentives are mainly economic (i.e. carbon pricing, taxation, and infrastructure charging), but should be complemented by improved information to users. This means that sustainable choices should be more clearly indicated to individuals and companies by providing them the right information on the GHG emissions associated to their transport decision. This approach is fully in line with the general objective of CountEmissions EU.

Among stakeholders, there is a strong support for the general objective of CountEmissions EU: 28 out 31 (90%) of the respondents to the targeted stakeholder survey agreed the European Commission should pursue the objective as stated above.

## 5.2 Specific objectives

To ensure that the specific (and general) objectives reflect the underlying drivers of the problem and that there is a clear logical link between the two, we present the objectives in logical chain diagram linking the objectives to the various problem drivers identified in Chapter 3 (see Figure 10).

**Figure 10 – Logical chain between objectives and problem drivers**




The first specific objective is to ensure the comparability of results from GHG emissions accounting in transport, addressing the current lack of a common reference methodology and harmonised input data as well as the reluctance to share primary data by providing a single EU framework for GHG emissions accounting in transport. The second specific objective on facilitating the uptake of GHG emissions accounting in business practice, aims to provide a harmonised approach for implementing the common reference methodology and stimulating its use in all transport segments and modes, and together with SO1 tackles aspects linked to the reluctance of operators to share emissions data.

The two specific objectives present a certain level of synergy. Ensuring comparable results from GHG emissions accounting at the transport service level may result in a higher demand for such figures from transport users and hence an increased uptake of GHG emissions accounting by transport operators. However, there are other measures besides harmonising the methodological framework to increase the uptake of emissions accounting, like supporting the development of calculation tools. Therefore, SO2 is also largely complementary to SO1, and hence efforts on both specific objectives are required to achieve the general objective.

Among stakeholders, there is broad support for both specific objectives. From the targeted survey it became clear that 86% (25 out of 29) respondents agree on SO1, while 72% (21 out of 29) respondents agree on SO2 as well.

# 6 Options to achieve the objectives

## 6.1 Introduction

In this chapter we present the policy options that will be considered to achieve the objectives as presented in Chapter 5. Therefore, we first discuss the baseline scenario, i.e. the most likely developments without any policy intervention (see Section 6.2). An overview of the relevant policy measures is given in Section 6.3. By combining these policy measures into packages, the policy options to be considered in the remainder of this study are developed (see Section 6.4).

## 6.2 Baseline scenario

### 6.2.1 Methodology and assumptions

The baseline scenario for CountEmissions EU builds on the EU Reference Scenario 2020, but also reflects the 'Fit for 55' initiatives proposed by the EC on 14 July 2021 and the EC proposals part of the REPowerEU package adopted on 18 May 2022. Essentially in the baseline scenario there is a need for transport emissions information (coming from external regulatory requirements and external stakeholder – for example investors – expectations), but no harmonised way of measuring or calculating that information. The extension of the problem has already been discussed in detail in previous sections. Some 'climate aware' businesses will then measure and calculate emissions information, but they will do so in either a way that suits their communication purposes or they may indeed be required by their stakeholders/supply chains to measure and calculate emissions using more than one method. Of all member states only France currently has applicable legislation and we assume that would remain the case, or that 27 individual efforts to develop legislation would not result in a harmonised method for European businesses. Verification of any transport emissions calculations would occur in some form, but would need to be a bespoke private sector service based on the method used.

Coherence with all the initiatives of the 'Greening Freight Package' is ensured by using a common baseline scenario. What this means precisely is that (to our knowledge): population projections and GDP projections are consistent across the assessments for the different files. GDP projections take into account the impact of the COVID crisis, building on the 2021 Ageing Report. International fossil fuel prices have been updated to reflect the high energy price environment, in line with the assumptions used for the assessment underpinning the REPowerEU package.

For the transport sector, the baseline scenario builds on the policy measures included in the EU Reference Scenario 2020 that are available in the EU Reference Scenario publication. What this means is that passenger and freight activity projections and emissions associated with transport activity reflect the 'Fit for 55' initiatives proposed by the EC on 14 July 2021: the RefuelEU Aviation and FuelEU Maritime initiatives, the Alternative Fuel Infrastructure Regulation, the revision of Regulation setting $CO_2$ standards for light duty vehicles, the revision of the ETS Directive and the revision of the Energy Taxation Directive. At national level, the projections take into account the policies of the final National Energy and Climate Plans (NECPs) submitted by member states at the end of 2019/beginning of 2020. In addition, the proposed amendments of the Renewables Energy Directive and of the

Energy Efficiency Directive, part of the REPowerEU package, are also included in the Baseline scenario. Outputs come directly from the PRIMES-TREMOVE Transport Model.

Eurostat business statistics by employment size class between 2015 and 2020 (most recent year available) were used to define levels of business activity in the transport sector. The number of businesses is assumed to stay constant to 2050 and the average of the years 2015–2020 was used. The economic activities for which the data was extracted represent the transport sector (those under NACE code H and its subclassifications), manufacturing (NACE code C), trade (NACE code G), and the tourism industry (Eurostat aggregate under code TI). These were then further differentiated into 'transport service operators'; 'transport hub operators' and 'transport service users'.

Although the update of the EU reference scenario (mix scenario) provides some core indicators used to assess some of the significant impacts (e.g. $CO_2$ reduction), for some impacts a more dedicated baseline scenario is required. We further specify the baseline scenario by developing (and quantifying) basis indicators that can be used to inform benchmarks for all impact categories. The focus is on providing an estimate of 'transport GHG emissions measurement and calculation uptake' in the EU business community; and costs associated with measuring and calculating emissions now (i.e. these are the basis indicators added to the core indicators). Doing so ensures that the baseline facilitates the assessment of the significant impacts and aligns the methodologies and assumptions between the baseline and the assessment of impacts. The bespoke baseline indicator developed as part of the impact assessment is the future uptake of business level and service level transport emissions by three types of businesses: transport service operators, transport hub operators and transport service users. This aggregation (of NACEv2 codes) is explained further in the section on assessment of impacts. For each type of business, large companies and SMEs are considered separately. SMEs are further broken down into micro, small and medium enterprises.

The calculation of uptake of service level transport emissions measurement and calculation amongst businesses was then combined with baseline activity profiles (i.e. the labour costs involved in measuring and calculating transport emissions) to arrive at the baseline administrative and adjustment costs for businesses. It is important to note that in some cases (for example verification) the baseline activity (labour) costs are assumed to be relatively high since only bespoke solutions from existing certification/verification providers will exist (i.e. a variety of different methodologies will exist concurrently).

### 6.2.2 Baseline results

#### Transport activity

In the Baseline scenario, EU transport activity is projected to grow post-2020, following the recovery from the COVID pandemic. Road transport would maintain its dominant role within the EU by 2050. Rail transport activity is projected to grow significantly faster than for road, driven in particular by the completion of the TEN-T core network by 2030 and of the comprehensive network by 2050, supported by the CEF, Cohesion Fund and ERDF funding, but also by measures of the 'Fit for 55' package that increase to some extent the competitiveness of rail relative to road and air transport. Passenger rail activity is projected to go up by 24% by 2030 relative to 2015 (67% for 2015-2050). High speed rail activity, in particular, would grow by 68% by 2030 relative to 2015 (165% by 2050), missing however to deliver on the milestone of the SSMS of doubling its traffic by 2030 and tripling it by 2050. Freight rail traffic would increase by 42% by 2030 relative to 2015 (91% for 2015-

2050) also not delivering on the milestone of the SSMS of increasing the traffic by 50% by 2030 and doubling it by 2050.

The empirical evidence on the causality effect between the GHG emissions accounting, changes in transport activity and the related reduction in the GHG emissions is scarce.

First of all, an interesting reference can be made to the existing US SmartWay program (EPA, 2023) that helps companies advance supply chain sustainability by measuring, benchmarking, and improving freight transportation efficiency. This program provides a comprehensive and well-recognized system for tracking, documenting and sharing information about fuel use and freight emissions across supply chains. This system helps companies identify and select more efficient freight carriers, transport modes, equipment, and reduces freight transportation-related emissions by accelerating the use of advanced fuel-saving technologies. Based on an official reporting from the Unites States Environmental Protection Agency, managing the program, since 2004 SmartWay has helped business partners avoid emitting 152 million metric tons of $CO_2$, 2.7 million short tons of $NO_x$, and 112,000 short tons of PM.

Another example relates to the use of eco-labelling for transport services. Transport operators participating in eco-labelling programs report their emissions to the neutral party managing an initiative. This manager processes the results of individual companies and rewards an ECO-label depending on their performance. A better GHG performance could result in a higher eco-label. ECO-labelling offers the participants a reason to accelerate GHG emission reductions. To give an idea of the GHG emissions reduction potential of eco-labelling of transport services, we looked at the GHG emission reduction achieved by the Dutch Lean & Green program. Companies participating in this program have reduced $CO_2$ emissions by over 700 kton since the start of Lean & Green, or about 0.7% of road transport emissions in the Netherlands.

An additional example points to the permits to enter Low or Zero emissions zones.
The permission to enter a low or zero emission zone in most cases is given based on the total GHG emissions of a transport company. However, CountEmissions EU can be used for allowing specific shipments or passenger services (based on GHG emissions data at transport service level), thus providing more precise tools for access rights to low emission zones. In this respect, the emissions reduction levels depend on the size of the zone and the vehicle categories that need to comply with a regulation, but in essence all city logistics can be affected, thus unlocking a large reduction potential. A study of CE Delft (2016) assessed for instance that $CO_2$ emissions from city logistics in the Netherlands are around 3.6 Mton per year. The impact of the introduction of 30-40 zero emission zones in the largest cities in the Netherlands is estimated to be around 1 Mton of reduced $CO_2$ per year. On an individual city level, a recent study (De Bok et al., 2020) concluded based on a simulation study for Rotterdam that GHG emissions from transport operations can be reduced by 90% within a zero emission zone.[33]

## GHG emissions and air pollutant emissions

Well-to-wheel GHG emissions from transport including international aviation and maritime, are projected to be 26% lower by 2030 compared to 2015, and 89% lower by 2050. $NO_x$ emissions are projected to go down by 56% between 2015 and 2030 (87% by 2050), mainly

[33] To further clarify the links between the harmonization of the GHG emission accounting and the potential decrease in GHG emissions, see Annex F.

driven by the electrification of the road transport and in particular of the light duty vehicles segment. The decline in particulate matter (PM2.5) would be slightly lower by 2030 at 53% relative to 2015 (91% by 2050).

### Number of businesses in the transport sector and other sectors performing transport on own account

The number of enterprises in the transport sector and other sectors performing transport on own account is estimated at 1.8 million in 2020 and is projected to remain stable over time.

### Evolution of number of businesses performing GHG emissions accounting at service level

The evidence collected suggests that while quite a high proportion of enterprises already considers their transport emissions at aggregate (i.e. enterprise) level and their share will continue to increase over time, there are very few who consider emissions at the service level. In addition, the growth in the number of business entities who measure transport emissions at the service level is expected to be low in the baseline but also to differ between large enterprises and SMEs. The shares of large enterprises performing GHG emissions accounting at service level in the total number of large enterprises in the baseline scenario for 2020-2050 are provided in Table 11, while the total number of large enterprises performing GHG emissions accounting at service level is provided in Table 12.

**Table 11 – Shares of large enterprises performing GHG emissions accounting at service level in the baseline scenario**

| Transport/logistic activity | Transport mode | 2020 | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|
| Passenger | Interurban rail | 8.6% | 14.3% | 17.1% | 25.7% | 34.3% |
| | Other transport over land | 0.7% | 0.7% | 0.7% | 0.7% | 0.7% |
| | Maritime | 13.2% | 18.4% | 23.7% | 28.9% | 36.8% |
| | Inland navigation | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | Air | 22.9% | 25.7% | 30.0% | 37.1% | 44.3% |
| Freight | Road | 13.7% | 18.3% | 22.6% | 30.4% | 37.6% |
| | Rail | 8.1% | 13.5% | 18.9% | 27.0% | 35.1% |
| | Inland navigation | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | Maritime | 13.7% | 17.6% | 21.6% | 29.4% | 37.3% |
| | Air and space | 22.2% | 22.2% | 33.3% | 44.4% | 44.4% |
| | Postal activities | 8.6% | 13.7% | 18.2% | 26.4% | 34.1% |
| Hub operators | Warehousing and storage | 2.1% | 3.1% | 4.1% | 5.6% | 7.7% |
| | Support activities for transportation | 1.0% | 2.0% | 3.0% | 4.9% | 6.8% |
| Other | Manufacturing | 6.3% | 11.2% | 15.8% | 24.4% | 32.2% |
| | Wholesale and retail | 6.3% | 11.2% | 15.8% | 24.4% | 32.2% |
| | Tourism | 1.7% | 3.9% | 6.0% | 10.0% | 13.5% |

**Table 12 - Number of large enterprises performing GHG emissions accounting at service level in the baseline scenario**

| Transport/logistic activity | Transport mode | 2020 | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|
| Passenger | Interurban rail | 3 | 5 | 6 | 9 | 12 |
| | Other transport over land | 4 | 4 | 4 | 4 | 4 |
| | Maritime | 5 | 7 | 9 | 11 | 14 |
| | Inland navigation | 0 | 0 | 0 | 0 | 0 |
| | Air | 16 | 18 | 21 | 26 | 31 |
| Freight | Road | 88 | 117 | 145 | 195 | 241 |
| | Rail | 3 | 5 | 7 | 10 | 13 |
| | Inland navigation | 0 | 0 | 0 | 0 | 0 |
| | Maritime | 7 | 9 | 11 | 15 | 19 |
| | Air and space | 2 | 2 | 3 | 4 | 4 |
| | Postal activities | 27 | 43 | 57 | 83 | 107 |
| Hub operators | Warehousing and storage | 4 | 6 | 8 | 11 | 15 |
| | Support activities for transportation | 10 | 21 | 31 | 51 | 70 |
| Other | Manufacturing | 96 | 171 | 242 | 374 | 492 |
| | Wholesale and retail | 44 | 78 | 111 | 172 | 226 |
| | Tourism | 9 | 21 | 32 | 53 | 72 |
| **Total** | | **318** | **507** | **687** | **1,018** | **1,320** |

The shares of SMEs performing GHG emissions accounting at service level in the total number of SMEs in the baseline scenario for 2020-2050 are provided in Table 13 while the total number of SMEs performing GHG emissions accounting at service level is provided in Table 14.

**Table 13 - Shares of SMEs performing GHG emissions accounting at service level in the baseline scenario**

| Transport/logistic activity | Transport mode | 2020 | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|
| Passenger | Interurban rail | 0.0% | 0.0% | 0.0% | 0.0% | 0.7% |
| | Other transport over land | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | Maritime | 3.4% | 4.6% | 5.6% | 7.6% | 9.4% |
| | Inland navigation | 0.2% | 0.4% | 0.5% | 0.8% | 1.1% |
| | Air | 1.1% | 1.3% | 1.5% | 1.9% | 2.2% |
| Freight | Road | 2.8% | 3.7% | 4.5% | 6.1% | 7.5% |
| | Rail | 0.0% | 0.2% | 0.2% | 0.2% | 0.4% |
| | Inland navigation | 0.3% | 0.7% | 1.0% | 1.6% | 2.2% |
| | Maritime | 3.4% | 4.6% | 5.6% | 7.6% | 9.4% |
| | Air and space | 5.6% | 6.6% | 7.6% | 9.3% | 10.9% |
| | Postal activities | 4.4% | 6.8% | 9.0% | 13.2% | 17.0% |
| Hub operators | Warehousing and storage | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% |
| | Support activities for transportation | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% |
| Other | Manufacturing | 0.3% | 0.6% | 0.8% | 1.2% | 1.6% |
| | Wholesale and retail | 0.3% | 0.6% | 0.8% | 1.2% | 1.6% |
| | Tourism | 0.6% | 1.3% | 2.1% | 3.4% | 4.6% |

Table 14 – Number of SMEs performing GHG emissions accounting at service level in the baseline scenario

| Transport/logistic activity | Transport mode | 2020 | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|
| Passenger | Interurban rail | 0 | 0 | 0 | 0 | 1 |
| | Other transport over land | 25 | 25 | 25 | 25 | 25 |
| | Maritime | 197 | 263 | 324 | 438 | 540 |
| | Inland navigation | 9 | 15 | 20 | 31 | 42 |
| Freight | Air | 42 | 50 | 57 | 70 | 82 |
| | Road | 14,938 | 19,857 | 24,518 | 33,118 | 40,840 |
| | Rail | 0 | 1 | 1 | 1 | 2 |
| | Inland navigation | 19 | 37 | 55 | 90 | 123 |
| | Maritime | 132 | 175 | 216 | 292 | 360 |
| | Air and space | 28 | 33 | 38 | 47 | 55 |
| | Postal activities | 3,874 | 5,995 | 8,004 | 11,713 | 15,042 |
| | Warehousing and storage | 3 | 4 | 5 | 8 | 11 |
| Other | Support activities for transportation | 12 | 24 | 36 | 59 | 82 |
| | Manufacturing | 100 | 179 | 253 | 391 | 515 |
| | Wholesale and retail | 1,807 | 3,229 | 4,577 | 7,065 | 9,298 |
| | Tourism | 156 | 366 | 564 | 931 | 1,261 |
| **Total** | | **21,342** | **30,253** | **38,693** | **54,279** | **68,279** |

## Costs for enterprises performing GHG emissions accounting

Table 15 provides a breakdown of the unit costs per transport service for performing GHG emissions accounting, by cost category and type of cost (i.e. one-off and recurrent costs). The unit costs are differentiated between transport service organisers (TSO), transport service users (TSU) and hub operators (HO), and also between SMEs and large companies. Labour costs are derived based on the tariff rates from the Eurostat's structure of earnings survey and labour force survey, considering the category ISCO 2 (professionals)[34]. The number of hours worked and thus the unit costs per transport service are assumed to go down over time, by 15% by 2050 relative to 2020, due to the learning effects.

Table 15 – Unit costs per transport service associated with GHG emissions accounting, by type of activity in 2022 (in €, 2022 prices)

| | TSO (SME) | TSU (SME) | HO (SME) | TSO (Large) | TSU (Large) | HO (Large) |
|---|---|---|---|---|---|---|
| 1. One-off costs for implementing a new GHG emission accounting method | 1,748 | 2,033 | 1,748 | 4,802 | 6,625 | 4,802 |
| 2. Recurrent annual costs with no verification | 1,139 | 570 | 1,139 | 3,190 | 2,734 | 3,190 |
| 3. Recurrent costs for verification of calculation processes (use of certified tool) | 399 | 570 | 399 | 638 | 1,048 | 638 |
| 4. Recurrent costs for the use of calculation tools | 257 | 514 | 514 | 1,799 | 3,597 | 3,597 |

Total costs are calculated by multiplying the number of services for which the enterprises count GHG emissions with the unit values presented in costs per transport service and are reported in Table 16. In the baseline scenario, they are projected to increase from EUR 36.4 million in 2020 to € 61.4 million in 2030 and € 92.7 million in 2050. The largest share of the costs is associated to SMEs.

[34] The tariff rate for ISCO 2 is € 40.9 per hour in 2022 prices (Eurostat, 2023).

**Table 16 – Total costs for SMEs and large enterprises associated with GHG emissions accounting at service level in the baseline (in million €, 2022 prices)**

| | 2020 | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|
| 1.a One-off costs for implementing a new GHG emission accounting method | 3.4 | 3.4 | 3.1 | 2.7 | 2.2 |
| SME | 3.2 | 3.2 | 2.9 | 2.5 | 2.1 |
| Large companies | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 |
| 1.b One-off costs for switching to a new GHG emission accounting method | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SME | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Large companies | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2. Recurrent annual costs with no verification | 24.1 | 33.8 | 41.7 | 54.6 | 64.0 |
| SME | 23.1 | 32.3 | 39.8 | 51.9 | 60.8 |
| Large companies | 0.9 | 1.5 | 2.0 | 2.7 | 3.3 |
| 3. Annual costs for verification activities | 2.0 | 2.9 | 3.6 | 4.9 | 5.7 |
| SME | 1.8 | 2.5 | 3.2 | 4.2 | 4.9 |
| Large companies | 0.2 | 0.3 | 0.5 | 0.7 | 0.8 |
| 4. Annual costs for tools use | 6.9 | 10.2 | 12.9 | 17.4 | 20.7 |
| SME | 6.0 | 8.8 | 11.0 | 14.7 | 17.4 |
| Large companies | 0.9 | 1.4 | 1.9 | 2.7 | 3.4 |
| **Total costs** | **36.4** | **50.3** | **61.4** | **79.6** | **92.7** |
| SME | 34.1 | 46.8 | 56.9 | 73.3 | 85.1 |
| Large companies | 2.2 | 3.5 | 4.6 | 6.3 | 7.6 |

## 6.3 Policy measures

This section presents the list of policy measures intended to address the identified problems and underlying drivers (see Chapter 3). As a result of the iterative process leading to the identification of the policy measures, and to clarify links between the measures and the objectives, the policy measures have been categorised in seven policy areas, which are presented in Table 17[35]. For each of these policy areas, relevant policy measures have been defined. The retained policy measures are shown in Table 17 as well. In de remainder of this section we will discuss how these policy measures are selected and how they are defined.

The policy areas identified reply to both the specific objectives and problem drivers, as is shown by Table 17. Each of the problem drivers are addressed by policy measures from at least one of the policy areas. The link between the policy areas (or actually the policy measures in these areas) and the specific objectives/problem drivers is discussed in more detail in Section 6.3.2.

[35] This intermediate passage was necessary also to clarify a number of interlinkages between the specific objectives, the policy measures and the problem drivers.

**Table 17 – Overview of retained policy measures**

| Policy measure | | Problem driver addressed | Specific objective addressed |
|---|---|---|---|
| **Methodological framework** | | | |
| PM1 | ISO 14083 is set as common reference methodology at the EU level. | PD1 | SO1 |
| PM2 | Product Environmental Footprint Category Rules for GHG emissions in transport, including rules for transport services, is set as common reference methodology at the EU level. | | |
| PM3 | A common reference methodology is set at the EU level, based on ISO 14083 with additional elements and increased accuracy. | | |
| **Input data and sources** | | | |
| PM4 | The use of primary data is recognised and centralised databases for default values are established at EU level (by European Environment Agency). Modelled data are used in conformity with the reference methodology. | PD2/PD3 | SO1 |
| PM5 | The use of primary data is incentivised and centralised databases for default values are established at EU level. Quality assurance of external databases operated by third parties is provided at EU level (by European Environment Agency). Modelled data are used in conformity with the reference methodology. | | |
| **Harmonised emissions output data and transparency** | | | |
| PM6 | Minimum requirements for harmonised GHG output formats and metrics are provided at EU level, together with common rules on the communication and transparency. | PD1/PD3/PD4 | SO1/SO2 |
| **Sectoral implementation support** | | | |
| PM7 | Horizontal guidelines for the harmonised implementation of CountEmissions EU in various sectors and segments of the transport market are provided at the EU level. | PD3/PD4/PD5 | SO1/SO2 |
| **Conformity** | | | |
| PM8 | Mandatory process and data verification for all entities falling under the scope of CountEmissions EU is established at EU level. | PD4 | SO2 |
| PM9 | Mandatory process and data verification for entities above a certain size falling under the scope of CountEmissions EU is established at EU level. | | |
| PM10 | Voluntary process and data verification for all entities are established at EU level. | | |
| **Complementary measures** | | | |
| PM11 | EU provides calculation tools at the EU level. | PD5 | SO2 |
| PM12 | Market provides calculation tools certified by EU recognised bodies. | | |
| **Applicability** | | | |
| PM13 | Mandatory application of CountEmissions EU in the transport sector. | PD5 | SO2 |
| PM14 | Binding opt-in application of CountEmissions EU in the transport sector. | | |
| PM15 | Voluntary opt-in application of CountEmissions EU in the transport sector with a label. | | |

### 6.3.1 Approach for selecting policy measures

The selection of the retained policy measures, as presented by Table 17, was done by using a three-step approach:

1. **Step 1: Identification of longlist of policy measures.** Based on the analysis of the current state of play in the field of GHG emissions accounting (see Annex A), other

relevant EU/international policies (see Annex B), a review of relevant literature, results from the stakeholder consultation (see Annex G) and discussions with the Commission, a longlist of policy measures have been developed for each policy area that reply to the relevant problem drivers and specific objectives.

2. **Step 2: Screening of the policy measures using specific criteria.** In order to identify the most viable policy measures from the longlist, these have been screened on a set of criteria. Because of the heterogeneity of the various policy areas, different criteria have been set for each of the policy areas. The screening analysis was qualitative, based on input received from the stakeholder consultation, evidence from the desk study and discussions with the Commission. A five-scale qualitative ranking for each of the criteria was used to identify the main advantages and disadvantages of all policy measures.
3. **Step 3: Selection of policy measures.** Based on the results of Step 2, the most viable policy measures have been identified for the considered policy area. For each of the policy areas, at least one policy measure has been selected. Both the retained and discarded measures have been discussed with the Commission in order to have a shared agreement on the set of policy measures to be included in the policy options.

### 6.3.2 Retained policy measures

In this section we present in more detail for each of the policy areas the retained policy measures. The full screening analysis used to select these measures can be found in Annex C. In that Annex we also present an overview of the discarded policy measures including the rationale for discarding them (see Annex C.10).

#### Methodological framework

Defining a common reference methodology is key for CountEmissions EU, in order to ensure that emission calculations are made in a harmonised way. A common reference methodology addresses the problem driver ‘no set of common methodological principles to apply GHG emissions accounting’ (PD1), and hence contributes to meeting the specific objective to ensure comparability of results from GHG emissions accounting in transport (SO1).

The development of a harmonised methodological framework for GHG emissions accounting is supported by a vast majority of the stakeholders interviewed[36] and the stakeholders attending the workshop. Particularly representatives of individual transport operators and users claim that such a framework will contribute to an equal level playing field. According to the respondents to the targeted stakeholder survey, comparability, reproducibility (of calculations) and relevance for all stakeholders are the main criteria that should be met by the common reference methodology.

##### *Scope and design of calculation approach of the common reference methodology*

In Annex A.1.1 we have thoroughly analysed the various alternatives to design a common reference methodology, distinguishing between the scope of such a methodology and the

[36] A few stakeholders (i.e. a consumer and passenger federation, a transport association and a freight transport service user), however, claim that the methodological framework should allow a range of methodologies (or sector-specific methodologies/standards) instead of one common methodology, as this will lower the administrative burden for companies and may better facilitate the coverage of specificities of a specific sector.

calculation approach to be applied. The main conclusions with respect to the scope of the methodology are:

- **Geographical scope**[37]: the common reference methodology preferably has a global perspective, particularly as a large share of transport in the EU has an origin or destination outside the EU (Ehrler, V. et al., 2016). Also stakeholders prefer a global scale for the common methodology: 20 out of 28 (71%) respondents of the survey favour a global scale.

- **Type of emissions**: as mentioned in Section 1.2, CountEmissions EU is targeting GHG emissions. An explanation for the exclusion of air pollutant emissions is provided in Textbox 4. From the GHG emissions, the common reference methodology preferably includes the GHG emissions (both $CO_2$ and non-$CO_2$ GHG emissions, like methane and nitrous oxide) of fuel combustion and refrigeration. For the global warming effects of non-$CO_2$ emissions of aviation at high altitudes[38] and black carbon emissions[39] no scientifically sound methodologies are currently available. Therefore, it is recommended not to include these emissions into the scope of the common reference methodology.

**Textbox 4 - Exclusion of air pollutant emissions from CountEmissions EU**

There are a few reasons not to include air pollutant emissions, such as particulate matter (PM) and nitrogen oxides ($NO_x$), in the initial framework of CountEmissions EU:

- The objective of CountEmissions EU, as presented in the Sustainable and Smart Mobility Strategy (EC, 2020d), is to incentivise transport users and operators to lower the GHG impact of their transport decisions by the provision of better information on GHG performance of transport services. The reduction of air pollutant emissions is therefore not a primary objective of the initiative.
- Of the current emission accounting methodologies and standards, the majority consider only GHG emissions. Only the US SmartWay programme (SmartWay, 2023), the PEF (EC, 2021c) and the upcoming Parcel Delivery Environmental Footprint (CEN, forthcoming) do cover, to some extent, air pollutant emissions (see Annex A and D in the Annex report accompanying this study).
- Accounting for air pollutant emissions of transport is more complicated than accounting GHG emissions. First, the level of air pollutant emissions is not directly related to fuel/energy consumption levels (as is the case with GHG emissions) (CE Delft, 2021). For example, by using technologies like catalysts and soot filters, air pollutant emissions may be reduced without reducing fuel use levels. Accounting air pollutant emissions therefore requires more detailed input data (on the specific vehicle considered) than accounting for GHG emissions. Second, as the adverse impacts of air pollutant emissions are local, only accounting for the overall level of air pollutant emissions (per transport service) is not sufficient. Also the location where the air pollutants are emitted should be considered by the accounting activities.

[37] The geographical Scope of the method relates to the extent to which the method can be applied to account for transport emissions in different geographical areas.

[38] $NO_x$, $SO_x$ soot, and water vapour emissions at high altitude may, in conjunction with anthropogenic sources, modify atmospheric composition (gases and aerosols), and hence influence radiative forcing and climate (IPCC, 1999).

[39] Black carbon(i.e. a form of particulate matter emissions consisting of dark carbon particles ), may absorb and scatter sunlight, which can lead to increased temperatures. When deposited on earth, especially in the cryosphere, black carbon causes snow and ice to melt faster, due to reduced reflectivity (SFC, 2017).

- **Activity boundaries**: the common reference methodology preferably covers all well-to-wheel emissions of transport activities, including the emissions from hub activities (e.g. at warehouses)[40]. The emissions from construction and dismantling of energy production infrastructure are preferably covered by the common reference methodology as well[41]. All these emissions are relevant at the level of transport services (as they significantly contribute to total emission levels or as they differ between modes and/or fuel types) and appropriate methods and data are available to include them in emission calculations. Among stakeholders there is broad support for this scope: almost all interviewed stakeholders[42] and 15 out of 28 (54%) respondents to the targeted survey prefer a well-to-wheel scope. Extending the scope to full lifecycle emissions (LCA) of vehicles and infrastructure (i.e. emissions associated to the construction, maintenance and dismantling of vehicles and infrastructure) is complex, as data availability on these emissions is currently poor. Moreover, calculating these emissions at the transport service level require a significant number of assumptions, harming the reliability and comparability of these figures. In addition, the contribution of these emissions to the total emissions of transport services is relatively low and decisions made by individual transport operators and users have only indirect impact on the production processes and construction of transport infrastructure or vehicles. Therefore emissions associated to the construction, maintenance and dismantling of vehicles and infrastructure may not be a primary choise for the scope CountEmissions EU, at least at the initial stage. Most stakeholders interviewed and attending the workshop presented similar views. However, from the OPC and the targeted survey, it became clear that citizens and transport users to some extent do support the coverage of full life-cycle emissions[43]. So it seems that beneficiaries of transport services are in favour of an extended scope of CountEmissions EU, while stakeholders that are more integral part of the transport system are more hesitant, as they have doubts on the feasibility of such an extension.

- **Intended user**: transport operators, organisers and users are all relevant users of the common reference methodology. For that reason, most current methodologies and standards do consider all these entities (see Section 2.3.1).

- **Use perspective**: both ex post and ex ante (based on ex post results with prognoses on routing and vehicle use) emission calculations are preferably covered by the common reference methodology. Both perspectives are supported by a vast majority of the stakeholders: 26 out of 27 (96%) of the respondents to the targeted survey support an ex post perspective and 21 out of 27 (78%) an ex ante approach.

- **Emission perspective**: the common reference methodology preferably considers service average emissions, i.e. the average emissions (e.g. over a year) of a transport service operator for a specific transport service. As these emissions are not affected by influence of weather conditions or traffic circumstances, their robustness and relevance is very high. And the fact that no journey specific data have to be collected (e.g. on traffic conditions), contributes to its applicability. The use of service average emissions

[40] These include the vehicle propulsion emissions, emissions from auxiliary processes and from leakages and spills, but also the emissions from energy provision.

[41] In this way also, amongst others, the emissions related to solar cell and windmill production are included, recognising that GHG emissions from electricity produced by solar cells and wind turbines are not zero.

[42] Only two representatives from the aviation an maritime sector prefer a narrower Scope: tank-to-wheel emissions.

[43] For example, the full lifecycle approach was supported by 75 out of 164, or 46% of the respondents of the OPC , especially among citizens.

may, however, lead to complications for scheduled passenger transport services in some specific cases. See Textbox 5.

**Textbox 5 - The use of service average emissions for scheduled services with low occupancy rates**

Assessing environmental impact based on service average emissions may inadvertently create incentives that skew traveller decisions, particularly for scheduled passenger services with low occupancy, such as certain rural public transport options. These services, due to their lower occupancy rates, have relatively high average emissions per passenger kilometre (g/pkm). This can sometimes surpass the average emissions of on-demand transport options like taxis.

If travellers base their choices on this average emissions data, they might preferentially select on-demand services. But this approach could yield higher overall emissions in the short term. Because scheduled services operate regardless of occupancy, the additional emissions from utilising these services are effectively zero. In contrast, using on-demand services directly contributes to additional emissions.

Over the long term, however, the analysis becomes more complex. Replacing low-occupancy scheduled services with more fuel-efficient options—either on-demand or more efficient scheduled services—could prove more environmentally friendly. Consequently, for transport operators, average emissions data can provide meaningful insights.

Yet, it's vital to remember that this analysis focuses solely on environmental considerations. Many underutilised scheduled transport services primarily exist to meet social objectives, such as ensuring mobility for all residents in rural areas, including those without personal vehicles. Despite these services not always being the most environmentally or economically efficient, their social value often secures their continued operation. In such situations, evaluating marginal emissions instead of average emissions might provide a more balanced perspective from an environmental standpoint.

Clearly, the benefits and drawbacks of applying service average emissions in cases of low-occupancy scheduled services aren't straightforward. Further research is necessary to address these complex scenarios. Moreover, it could be beneficial to incorporate a mechanism within the CountEmissions EU framework that allows for methodological adjustments when applying standard procedures results in inequities between specific transport segments.

As for the calculation and allocation approach, the following conclusions were drawn:

- **Minimum[44] level of granularity of emission calculation and allocation**: the common reference methodology preferably apply calculations at the level of a specific transport operation category (TOC)[45], i.e. a group of operations of a certain transport operator, with similar characteristics (e.g. the final leg from a distribution centre to clients, or the trip between two hubs). At this level, emission calculations can be made transport service specific, allowing high levels of accuracy and comparability. Most current standards and methodologies apply the level of TOC as minimum granularity as well (see Section 2.3.1).

[44] Depending on the minimum level of granularity applied, the results of the calculations can be used to calculate emissions at higher levels of granularity as well. For example, based on the output of calculations at the TOC level, GHG emission figures at the company level can be calculated as well.

[45] This term is used for instance by ISO 14083.

— **Allocation parameter**: as CountEmissions EU aims to deliver output at the service level, GHG emissions data from transport activities should be allocated to specific users. In case there are a number of users in the same transport chain, this requires the use of an allocation parameter (see Textbox 6). For freight transport, allocation based on tonne-kilometre GCD or SFD are considered the most appropriate alternatives. Real tonne-kilometre are less appropriate, as allocation in a delivery round, quite arbitrary, depends on the way the route is driven, and therefore the services at the end of a distribution round may get allocated more GHG emissions (see Annex C.3.2 for a more detailed explanation why tonne-kilometres GCD or SFD are preferred over real tonne kilometers). For (public) passenger transport, it is often easier to monitor real passenger-kilometres as trains and public transport busses drive the same routes every time, which makes the metric also more accurate and reproducible. Therefore, real passenger-kilometres are considered an appropriate allocation parameter for passenger transport, in addition to passenger-kilometre SFD and GCD.

**Textbox 6 - Definition of potential allocation parameters**

In general, three types of allocation parameters can be distinguished:

1. **Real passenger or tonne-kilometre:** the amount of freight (in tonnes) or number of passengers multiplied by the actual distance (in kilometre) over which it is transported.
2. **Tonne-kilometre or passenger-kilometre shortest feasible distance (SFD)**: the amount of freight (in tonnes) or number of passengers multiplied by the shortest feasible distance (on a mode-specific network) between origin and destination.
3. **Tonne-kilometre or passenger-kilometre great circle distance (GCD)**: the amount of freight (in tonnes) or number of passengers multiplied by the shortest distance between origin and destination, measured along the surface of the Earth.

— **Flexibility in calculation approach**: the common reference methodology may provide various alternatives to the user on specific elements of the calculation, such as different types of allocation parameters to apply. In this context, it would be beneficial for the common reference methodology to include guidance on choosing the appropriate alternative. The various alternatives could, for example, be ranked based on certain criteria, effectively providing a recommendation. Alternatively, it could prescribe a specific method or differentiate between alternatives based the user type and their computational capabilities.

### *Retained common reference methodologies*

The findings presented above on the preferred design of (elements of) the common reference methodology have been used as input for the screening of various existing and emerging methodologies, in order to investigate whether these are appropriate as reference methodology within the CountEmissions EU framework. Furthermore, the findings have been used to identify gaps within the current/emerging methodologies, based on which a number of new methodologies have been developed (addressing (some) of the gaps identified in the current/emerging methodologies). The potential methodologies that have been identified in this way, have been thoroughly screened on a set of criteria in order to select the most appropriate ones to be included in the policy options. The detailed results of this analysis can be found in Annex C.3.3 to C.3.5.

Based on the screening analysis described above, the following three methods were retained for further analysis as a potential reference methodology for CountEmissions EU:

1. **ISO 14083 (PM1)**: this methodology contains most of the preferred design alternatives as discussed above:
   - global scale;
   - well-to-wheel GHG emissions of transport activities (including emissions of leakages and spills), hub activities, and construction and dismantling of energy production infrastructure are covered;
   - both ex post and ex ante calculations are allowed, based on service average emissions;
   - the methodology is targeting transport operators, organisers and users;
   - the minimum level of granularity applied for calculation and allocation is TOC and operational level for transport activities;
   - as allocation parameter both tonne-kilometre/passenger-kilometre GCD and SFD are allowed.

   Because of these characteristics, this methodology provides accurate and comparable GHG emission figures. The methodology is also highly acceptable for stakeholders, as was confirmed by the stakeholders attending the workshop.

2. **Product Environmental Footprint Category Rules for transport (PM2)**: this methodology consist of newly developed PEF Category Rules for transport (including rules for transport services like in ISO 14083). The scope of this new methodology will be broader than of ISO 14083, as it also will cover the life-cycle GHG emissions of vehicles and transport infrastructure. This methodology will address the desire of some stakeholders (i.e. particularly citizens and transport users) to cover these emissions as well (see above). However, the calculation of these life-cycle GHG emissions will be more demanding, lowering the applicability of this methodology. The methodology is expected to deliver well-to-wheel GHG emission figures that are as accurate and comparable as ISO 14083, as the methodology on well-to-wheel emissions is considered to be similar as ISO 14083.

3. **Common reference methodology, based on ISO 14083 with additional elements and increased accuracy (PM3)**: this methodology builds on ISO 14083 but provides more guidance on methodological elements where ISO leaves some room to users. These are elements like:
   - *Definition of Transport Operation Category (TOC) per market segment*. Within ISO it is up to the user to define the TOC. Different competitors might apply different boundaries for a TOC, which might lead to incomparable results. This new methodology will therefore define the TOC, adequately differentiated according to respective market segments.
   - *Time aggregation*. ISO 14083 recommends to base the emission calculations on the annual average emissions on each TOC, trip or hub activity, but allows different time periods as well when explained by the user. Instead of leaving it to the users, this new reference methodology will define per transport segment the cases in which the user can deviate from applying the annual average emissions on each TOC, trip or hub activity.
   - *Allocation parameter*: instead of allowing both tonne-kilometre/passenger-kilometre SFD and GCD (as is done by ISO 14083), this methodology will prescribe the use of GCD kilometres as allocation parameter.
   - *Alternatives for mass-based allocation*: for some types of transport (e.g. parcel delivery) other metrics than tonne-kilometre (e.g. $m^3$-km or container-km) are more appropriate to allocate emissions to individual services. ISO 14083 leaves it up to

users whether they would like to use another metric and which one. In this new methodology, a metric will be defined (and prescribed) for each transport segment.

Because of these additional elements, this methodology will result in more accurate and comparable GHG emission figures than ISO 14083 (PM1). However, as the methodology will provide less flexibility to users, it will be less applicable than ISO 14083 (PM1). Also stakeholder acceptance will be lower, as the stakeholder consultation showed (through the various consultation activities) that all types of stakeholders prefer that the CountEmissions EU reference methodology is built on an existing methodology.

### Input data and sources

Harmonising input data is of importance to make emissions calculations comparable and reproducible. By setting requirement on the (type of) input data to be used and harmonising default values the problem driver 'no set of harmonised input data for the application of GHG emissions accounting' (PD2) is addressed. Furthermore, the availability of high-quality and consistent default data may reduce the impact of the reluctance of transport operators to share sensitive data (PD3) on the quality and consistency of GHG emission figures. This, in turn, contributes both to meeting the specific objective to ensure comparability of results from GHG emissions accounting in transport (SO1).

As mentioned in Section 3.3.2, three categories of input data can be distinguished. The definitions of these three categories are repeated in Textbox 7.

**Textbox 7 - Typology of input data**

Three main categories of input data are distinguished:

1. **Primary data** (actual values) refers to data obtained from a direct measurement or a calculation based on direct measurement. It may include measured fuel/energy consumption data as well as transport performance data (e.g. actual distance, number of person/ amount of freight transported).
2. **Default data** refer to (average) data taken from a published source. The following default values may be distinguished in the context of CountEmissions EU:
   - Energy emission factors, being proxy values used to derive estimates of GHG emissions based on the amount of energy/fuel used. These factors are often expressed in gram per litre/kWh or gram per MJ.
   - Emission intensity factors, being proxy values used to derive estimates of (well-to-wheel) GHG emissions of fuel combustion based on transport performance data. These factors are often expressed in gram per vehicle-kilometre, gram per tonne-kilometre or gram per passenger-kilometre.
   - Other emission factors applied by few methods that incorporate emissions stemming from the production, maintenance and scrapping of vehicles, or infrastructure.
3. **Modelled data** refer to data established by use of a model that takes into account primary data and default data of a transport or hub operation.

Default data and modelled data are sometimes categorised together as secondary data.

Most of the current methodologies and standards (see Section 2.3.1 and Annex A) prioritise the use of primary data, an approach that is broadly supported by the stakeholders who attended the workshop and stakeholders interviewed[46]. In this approach, actual fuel

[46] This issue was explicitly raised by a transport association, a transport operator, a supplier of transport management systems, a public authority, a standardisation body and two operators of freight greening programmes.

consumption data and transport performance data is used to calculate the amount of energy used for a specific transport service. As a final step, energy emission factors (e.g. in g/litre or g/MJ) are used to convert the energy use figures into GHG emission figures. A harmonised set of energy emission factors contributes to the accuracy and particularly comparability of these kinds of calculations.

As indicated in Section 3.3.2, it is not always possible for companies to make use of primary data. In those cases, emission intensity factors may be used to estimate the GHG emissions of a certain transport service. For example, emission intensity factors per tonne-kilometre may be combined with actual tonne-kilometre data to estimate the GHG emissions associated to a specific transport service. Harmonised databases with high quality and differentiated emission intensity factors will contribute to the accuracy and comparability of these kind of calculations, as was also emphasised by the stakeholders attending the workshop and some of the stakeholders interviewed[47]. Another option to deal with missing primary data is to model the emission data. In this approach, available primary data is put in a model (containing default data) in order to estimate the emission figures for specific transport services.

Based on a detailed screening analysis of several policy measures to harmonise input data (see Annex C.4), we have retained the following two policy measures:
1. The use of primary data is recognised and centralised databases for default values (containing both emission intensity factors and energy emission factors) are established at EU level (by European Environment Agency). Specific energy emission factors (e.g. for biofuels) can be developed in line with methods recognised by the EU. Modelled data are used in conformity with the reference methodology (PM4).
2. The use of primary data is recognised and centralised databases for default values (containing both emission intensity factors and energy emission factors) are established at EU level . Quality assurance of external databases operated by third parties is provided at EU level (by European Environment Agency). Specific energy emission factors (e.g. for biofuels) can be developed in line with methods recognised by the EU. Modelled data is used in conformity with the reference methodology (PM5).

Both PM4 and PM5 prefer the use of primary data, in line with the approach followed by the majority of the current methodologies/standards and the preferences of stakeholders. This approach leads to highly accurate, comparable and reproducible GHG emission figures. As little assumptions are needed to make the calculations based on primary data, this approach is considered to be very robust as well.

Both PM4 and PM5 also recognise that the use of primary data is not always possible and hence that in some cases the use of emissions intensity factors should be allowed. As mentioned before, harmonisation of these factors may contribute to higher levels of accuracy, comparability and reproducibility of the final GHG emission figures. In PM4, this is achieved by setting up a centralised EU database, created and maintained by the European Environment Agency (EEA). Such a database may support transport operators/users in accounting for their emissions, as it provides a clear overview of the emission intensity factors that can be used. It also optimise the reproducibility of GHG emission calculations (as a consistent set of emission intensity factors is provided). However, a concern with respect to a centralised database is whether it can provide the level of differentiation in the emission intensity factors required to achieve high levels of accuracy and comparability in GHG emission figures calculated. Detailed emission calculations require disaggregated

[47] The issue was explicitly raised by a transport association, a transport operator, a freight transport service user, a public authority and two operators of freight greening programmes.

intensity factors, reflecting differences in emission levels between transport segments and countries/regions. However, such a level of detail is difficult to obtain with one centralised database, as not all the expertise and capabilities of the players in the various transport segments can be included in the emission factors that are developed for the centralised database. It therefore also allows the use of data from external databases, as long as their quality has been assured at the EU level (by the EEA). As these external databases may contain emission intensity factors that better reflect the specificities of transport services in a certain segment, the GHG emissions figures produced may be more accurate and comparable. However, applicability of PM5 may be slightly lower compared to PM4, as it is less clear for stakeholders which energy emissions factors they should apply[48]. Furthermore, because of the multiple emission intensity factors available, reproducibility of emission calculations will be lower compared to the situation with one centralised database (as is the case in PM4).

Finally, in both PM4 and PM5 an EU centralised database will be created (by the EEA) for energy emission factors[49], aligned with other EU policies like the Renewable Energy Directive and FuelEU Maritime. For specific energy carriers, such as biofuels and synthetic fuels, specific energy emission factors can be established, when these are developed in line with rules developed by the EU. This approach allows a high level of harmonisation of energy emission factors (contributing to highly accurate, comparable and reproducible GHG emission figures), but at the same time recognising the differences in technologies and feedstock used to produce specific energy carriers.

### Harmonised emissions output data and transparency

Harmonising output data of GHG emissions accounting[50] has some benefits. It facilitates the sharing of comparable data between entities along the supply chain, which may be particularly beneficial as companies have to request/provide data to a large number of other companies. Harmonising the various formats that are currently used by these different companies may simplify data sharing. Setting requirements for the output data format may also help to address the reluctance of operators to share sensitive operational data. As was explained in Section 3.3.3 , operators are often hesitant to share fuel consumption data as they fear that this will provide shippers information on their cost structure. Defining the output data in such a way that only a minimum of information needs to be shared between parties to calculate the GHG emissions, will make data sharing less sensitive. This could be achieved by only sharing the GHG emissions for the specific service or GHG intensity factors (i.e. g $CO_2$-eq per tonne-kilometre), with clear statement on the applied method (see Textbox 8 for more details). Finally, by providing some guidance on the output to be delivered by GHG emissions accounting, also the inconsistencies in methodologies applied may be reduced.

[48] As mentioned by a interviewed transport operator, individual companies often lack the knowledge to identify and select the most appropriate emission intensity factors for their transport services.

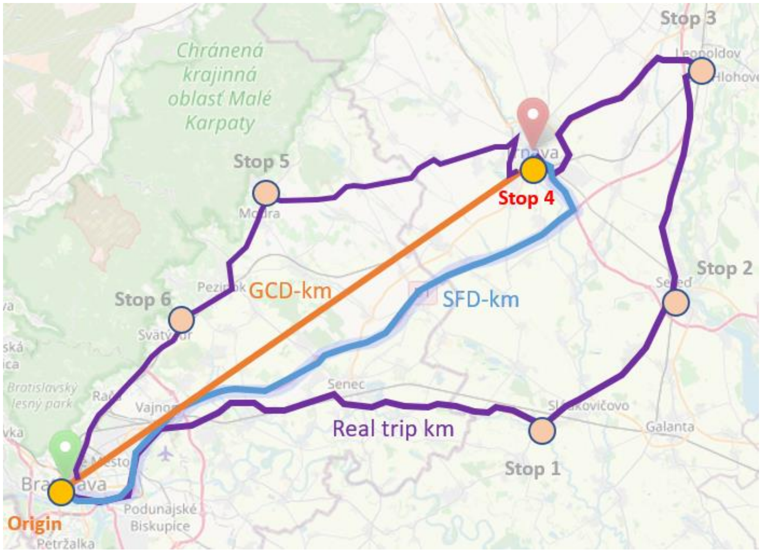
[49] As part of this set of energy emission factors, an harmonised set of global warming potentials (GWPs) will be developed. These are multipliers applied to GHG emissions like methane and nitrous oxide to equate their global warming potential with that of $CO_2$. Harmonising these GWPs is required to ensure harmonised $CO_2$-eq emission factors for various types of energy carriers.

[50] Data on GHG emissions at the level of transport services, shared between transport operators and organisers/users, transport organisers and users, or transport users and consumers.

**Textbox 8 - Minimising the amount of information shared by using GHG intensity factors**

Sharing intensity factors based on tonne-kilometre SFD or GCD[51] (see Figure 11), which are the proposed allocation metrics in the three retained methodologies for CountEmissions EU (see above), do not directly reveal any information on the efficiency of the vehicles used. In case of GHG emission intensity factors per GCD tonne-kilometre (tonnes of freight times the great circle distance between origin and destination, see Figure 11), the intensity factor is calculated by dividing the total GHG emissions of a trip (purple route) by the sum of all the GCD tonne-kilometre of each stop. This intensity factor is then valid for all stops (including Stop 4) and gives, weighted with the GCD tonne-kilometre of Stop 4 (orange route), the total GHG emissions of the delivery at Stop 4. By applying this calculation method, there is no need to share any information on the actual trip kilometres (purple route) or the GHG emission per real tonne-kilometre (giving vehicle utilisation efficiency). The emissions per GCD or SFD tonne-kilometre are the results of network efficiency (how well can transport demand be combined), detouring, vehicle efficiency and the load efficiency. It is therefore hard to draw any conclusion on one of these aspects separately.

**Figure 11 - Illustration of GCD, SFD and real kilometre for a virtual roundtrip in Slovakia with six stops**




Source: OpenStreetMap.

A virtual round trip from Bratislava, with a stop in Trnava highlighted (Stop 4) to illustrate GCD (the great-circle distance, shortest distance from point to point over surface of the earth), SFD (shortest feasible distance over the infrastructure network) and real distance.

In order to ensure that harmonised formats for output data are used at large scale, the following policy measure is included within the CountEmissions EU framework: **the EU provides minimum requirements for harmonised GHG output data formats and metrics (PM6).** These minimum requirements may cover issues like the type of data that should be shared and the way these data should be structured before sharing.

In addition to the minimum requirements with respect to the GHG emissions data, PM6 also covers the establishment of **specific requirements set by the EU for the communication and transparency with respect to any claims based on CountEmissions EU**.

[51] SFD: shortest feasible distance; GCD: great circle distance, see Figure 11.

## Sectoral implementation support

The development of horizontal guidelines harmonising the implementation of CountEmissions EU in various sectors may facilitate the uptake of GHG emissions accounting in the transport and logistics sector. These guidelines may cover issues like:

- data requirements and management;
- emissions calculation guidance and best practice;
- assurance and verification of the emissions data;
- rules for the labelling and certification programmes;
- guidance on data sharing.

The majority of the respondents of the stakeholder survey (23 out of 28, or 82%) emphasise the added value of such guidelines. Only shippers seem less convinced of the need to develop specific guidelines, as three out of four shippers participating in the survey indicate that they do not see a role for such guidelines.

By providing guidance to transport operators and users on accounting their GHG emissions, sectoral guidelines may lower the (perceived) complexity and costs of this activity, decreasing the time and efforts to apply GHG emissions accounting, as they will better understand how to do it. This has been confirmed by five out of six stakeholders with whom this issue was discussed during the interviews[52]. Guidelines therefore address the problem driver ‘Perceived complexity and high costs of GHG emissions accounting’ (PD5) and hence may contribute to the specific objective ‘Facilitate the uptake of GHG emissions accounting in business practice’ (SO2).

Based on the detailed analysis of five policy measures for implementing these sectoral guidelines (see Annex C.6), one policy measure was retained: **horizontal guidelines for the harmonised implementation of CountEmissions EU in various sectors and segments of the transport market are provided at the EU level (PM7)**.

## Conformity

By verifying the results of GHG emissions accounting, the trust of parties along the supply chain can be improved. This requires that both data input and calculation processes are verified. By improving the trust in the results of GHG emissions accounting through verification, the problem driver ‘Lack of trust of transport users on the reliability of GHG emissions output data’ (PD4) is addressed and hence also the objective to facilitate the uptake of GHG emissions accounting for business and customers (SO2).

In general, stakeholders are in favour of some form of verification as this may increase the reliability of the GHG emissions figures and hence may contribute to the uptake of GHG emissions accounting in the transport sector. For example, all respondents to the stakeholder survey indicated that they see the need for a verification scheme as part of the CountEmissions EU framework. This finding was confirmed by the results of the OPC, with 158 out of 178 (89%) respondents suggesting that issue should be tackled by CountEmissions EU. An interviewed transport operator adds that verification of figures is important to proof that their transport services meet sustainability standards set by shippers. On the other hand, there are a few stakeholders who oppose a verification scheme. One of the transport

[52] The only interviewee not supporting the development of sectoral guidelines was a representative from a transport association, who argued that only a general guideline should be sufficient. However, this interviewee also suggested that the common methodology to be applied within CountEmissions EU should not be too complex, which reduced the need for more detailed sectoral guidelines.

associations interviewed sees the costs of verification as a reason not to implement such a scheme. A supplier of transport management systems fears that setting up a verification scheme would delay the implementation of a harmonised framework for GHG emissions accounting and therefore proposes to postpone the development of such a scheme till a later stage.

Based on a detailed screening analysis of several policy measures for verification (see Annex C.7), the following three measures are retained:

1. **Mandatory process and data verification for all entities falling under the scope of CountEmissions EU is established at EU level(PM8)**: verification can be done by third bodies which are bound to non-disclosure. The third bodies can be either public and private entities, which will follow the verification rules provided by the EU.
2. **Mandatory process and data verification for entities above a certain size falling under the scope of CountEmissions EU is established at EU level (PM9)**: verification can be done by third bodies which are bound to non-disclosure. The third bodies can be either public and private entities, which will follow the verification rules provided by the EU. The size threshold is defined in line with the definition of small and medium enterprises (SME), as used by the European Commission (EC, 2003). This definition includes two conditions: 1) number of employees is lower than 250, and 2) annual turnover does not exceed € 50 million, or the annual balance sheet total does not exceed € 43 million.
3. **Voluntary process and data verification for all entities are established at EU level (PM10):** verification can be done by third bodies which are bound to non-disclosure. The third bodies can be either public and private entities, which will follow the verification rules provided by the EU.

In all three policy measures, EU accredited third bodies are in charge of the verification process (instead of public authorities). From the stakeholder consultation it became clear that most stakeholders prefer this governance structure. As mentioned during the stakeholder workshop, third parties can guarantee a high quality verification process while at the same time preserving confidentiality.

From the three policy measures, PM8 is most stringent, ensuring a high level of conformity. It may, however, also lead to a significant administrative burden, particularly for SMEs (CE Delft et al., 2014). The relatively high administrative burden of verification was also a general concern of the stakeholders. In the OPC, an important share of answers (43 out of 178, or 24%) mentioned that specific exemptions to the verification should be possible if it would be proven to be too burdensome and costly. In the stakeholder interviews, a public authority refers to the complaints of transport operators on the costs of verification in the French scheme for GHG emissions accounting in transport. In order to limit the costs of verification[53], PM8, PM9 and PM10 all include the compliance check of the calculation process applied by companies (internal calculations or calculation tools), such that annually can be verified whether the correct process has been applied (and a full annual verification of the calculations is not necessary). Additionally, the use of input data is verified annually by sample checks[54]. In order to further limit the administrative burden of verification, PM9 could be a good alternative, focussing the verification process on the larger companies. This policy measures is, however, less effective in ensuring that accurate and comparable GHG

[53] Another suggestion to limit the administrative costs of verification was mentioned by a representative of a transport association. He suggested to simply conduct some sample checks by a public authority to minimise verification costs.

[54] This approach is in line with suggestions from stakeholders. During the interviews such an approach was mentioned by a transport association, a public authority and two operators of freight greening programmes.

emission figures are calculated by companies, as only the GHG emission figures of larger companies are obliged to be verified. A completely voluntary verification scheme like PM10[55] is an alternative that may be a reasonable low-cost option, especially within a voluntary framework for GHG emissions accounting. Compared to PM9 and particularly PM8, this alternative is less effective in ensuring that accurate and comparable GHG emission figures are calculated and reported.

## Complementary measures

As complementary measure, calculation tools are considered. These are tools that support transport operators and/or users to calculate (and allocate) emissions of their transport services.

As confirmed by 5 out of 6 stakeholders who discussed this issue during their interviews, calculation tools may lower the complexity (e.g. by partly automating the required calculations) and cost (e.g. less time spent on calculations) of applying GHG emissions accounting. Therefore, these tools address PD5 and may contribute to the specific objective on facilitating the use of GHG emissions accounting in business practice (SO2).

The relevance of the provision of calculation tools is emphasised by the results of the stakeholder survey, which show that the vast majority of the respondents is likely to use technical support tools for emissions accounting (18 out of 28, or 64% of the respondents to this question). This finding was confirmed by the outcome of the OPC, which shows that 123 out of 175 (70%) respondents pointed to the need for additional support tools under CountEmissions. Also in the interviews, three transport associations and two providers of green transport programmes explicitly confirm the important role calculation tools measures could play in facilitating the uptake of GHG emissions accounting.

Based on a detailed analysis (see Annex C.8), two policy measures are retained for this policy area:

1. **EU provides emission calculation tools at the EU level (PM11)**. The main advantage of this policy measure is that is ensures consistency with the harmonised reference methodology. This results in high levels of accuracy and reliability. However, stakeholder support for EU centralised calculation tools is expected to be lower than for calculation tools that are provided by the market. The stakeholder survey shows that only 6 of the 27 respondents would prefer the EU to provide these tools. Furthermore, difficulties to cover all sector specificities with such EU centralised tools was mentioned by two interviewed providers of green transport programmes as an disadvantage.
2. **Market provides calculation tools certified by EU recognised bodies (PM12).** The development of calculation tools is left to the market, but the tools should be certified by EU recognised bodies. Because of the certification, the tools are expected to be highly consistent with the harmonised reference methodology, ensuring that they will provide reliable and accurate results. This is probably the main reason the vast majority of the respondents to the survey (23 out of 28, or 82% of the respondents to a question covering this issue) indicate that they prefer the certification of the calculation tools by an independent entity[56]. By setting specific conditions for regular

[55] Within this scheme, verification on request of a third party (on contractual or regulatory reasons) is feasible. However, within the CountEmissions EU framework no obligation to apply verification exist with this policy measure.

[56] Only one freight service user explicitly disagrees with the need for certification. Four stakeholders had no opinion on this issue.

updates of these tools, any required modifications can be implemented relatively quickly. Compared to PM11, there is less certainty that the calculation tools are actually developed. However, the wide range of calculation tools currently provided by the market (see Section 2.3.2) shows that these tools will be offered by the market in case of demand.

## Applicability

The policy area 'applicability' cover policy measures that ensure that the CountEmissions EU initiative is effectively implemented and hence GHG emissions accounting is taken up at a higher level and a more harmonised way than in the baseline scenario.

Three policy measures are considered:
1. **Mandatory application of CountEmissions EU in the transport sector (PM13).** The regulated entity is obliged to account for GHG emissions according to the common methodological framework. For SMEs, the date of application of this mandatory scheme is 2035. Reporting of GHG emissions is voluntary.
2. **Binding opt-in application of CountEmissions EU in the transport sector (PM14)**: accounting for and reporting of GHG emissions is voluntary, but in case an entity calculates and discloses GHG emissions data, the common CountEmissions EU framework fully applies.
3. **Voluntary opt-in application of CountEmissions EU in the transport sector with a label (PM15)**: accounting for and reporting of GHG emissions is voluntary, but in case the transport operator/user decides to account for GHG emissions in line with the CountEmissions EU framework, it is obliged to correctly apply this framework. Companies applying the CountEmissions EU approach are granted a label.

Where the three policy measures differ with respect to the type of instrument applied, they are similar on some other elements (see also Table 18):
- **Regulated entity** (i.e. the entity directly subject to the policy instrument): for freight transport, transport operators, organisers and users[57] are appointed as regulated entity, as this will result in both demand and supply of relevant data for GHG emissions accounting, improving the effectiveness and applicability of the CountEmissions EU framework. For passenger transport, only transport operators and organisers are appointed as regulated entity, as passengers (who are the transport users) are not in the position to apply GHG emissions accounting. Also entities that disclose disaggregated data on GHG emissions related to transport services to any third party for commercial or regulatory purposes are appointed as regulated entities for some aspects related to the transparency and communication of the GHG emissions data.
- **Coverage of transport segments**: all transport segments will be covered by the policy instrument, as exempting some segments (e.g. passenger or freight transport, SMEs) will significantly lower the effectiveness of the CountEmissions EU framework and will harm the level playing field for GHG emissions accounting in the transport sector.
- **Geographical scope of transport activities covered**: the policy instrument targets all transport activities related to operations to or from the EU + all the transport activities within the EU.

A more detailed discussion on these elements can be found in Annex C.9.

[57] Except individual customers of online shops.

**Table 18 - Overview of policy measures on applicability**

| Element | Mandatory accounting | Binding opt-in | Voluntary opt-in |
|---|---|---|---|
| Type of policy instrument | Mandatory accounting | Binding opt-in | Voluntary opt-in |
| Regulated entity | Transport operators, organisers and users (the latter for freight transport only) | | |
| Coverage of transport segments | All transport segments | | |
| Geographical scope of transport activities covered | Transport to/from EU and within EU | | |

PM13, PM14 and PM15 each possess unique strengths and weaknesses. PM15 (voluntary opt-in) offers an easily applicable solution for stakeholders, as it's only employed by operators/users that are capable and willing to conduct GHG emission accounting. However, due to its voluntary nature, PM15 man not be as effective at promoting the adoption GHG emissions accounting. Moreover, enforcing PM15 (as well as PM14, the binding opt-in variant) is complex, given that the government lacks knowledge of which companies are using GHG emission accounting, and therefore, should adopt the common methodological framework.[58] PM14 is more effective than PM15 but slightly less applicable for stakeholders[59]. PM13 (mandatory accounting) is the most effective measure as it requires all companies to account for emissions. However, it also involves the highest administrative costs. Companies, even those with limited knowledge and resources for emission accounting, are obligated to apply it (although in case of SMEs, they are only required to start in 2035).

Support from the stakeholders is mixed with respect to these three policy measures. The stakeholder survey shows particular support for more mandatory schemes: 26 out of 28, or 93% of the respondents prefer a scheme with mandatory elements (i.e. mandatory accounting or binding opt-in). The survey also shows that among SMEs there is more support for optional approaches, or, alternatively, derogations in the mandatory instrument (4 out of 7, or 57%, compared to 9 out of 28, or 32% overall). Also the findings of the stakeholders interviews makes clear that there are proponents of a voluntary scheme. Four transport associations and two associations representing transport users point out that such a scheme would already provide a good incentive to take up GHG emissions accounting. On the other hand, also among the interviewees there are eleven stakeholders (with different backgrounds) who prefer a mandatory scheme, particularly to ensure a full level playing field. From these stakeholders, a freight transport service user, a public authority and a supplier of transport management systems claim that SMEs should be exempted at a first stage, in order to reduce the overall administrative burden of the initiative. Additionally, two operators of freight greening programmes suggest to allow for different levels of detail in calculations or input data used within a mandatory scheme. This would provide companies with limited capabilities in emissions accounting to start with it, while companies that are more advanced in this field are encouraged to apply more sophisticated calculations (e.g. based on high levels of primary data).

[58] As companies are not required to report their emission figures, those failing to correctly implement the CountEmissions EU framework under PM14 or PM15 may only be reported as infringing by supply chain partners or competitors, significantly reducing enforceability.

[59] As all entities accounting emissions have to apply the common methodology in PM14, even the ones for which the application of other methodologies is more convenient or easier.

## 6.4 Policy options

The retained policy measure as presented in the previous section have been ‘packaged’ into six policy options, based on the following three criteria:

1. **Methodological choice**: the extent by which the methodology for GHG emissions accounting can be considered as comprehensive (but leaving little room for companies to make their own decisions which may hamper the applicability/acceptability of the methodology) or as conducive (leaving more flexibility to companies, which may result in less comparable and accurate results).
2. **Level of harmonisation of data and complementary measures**: the extent by which data and complementary measures are harmonised at a central (EU) level or a more decentralised level (e.g. by the market).
3. **Level of applicability**: the extent by which the CountEmissions EU framework will become mandatory or voluntary.

Below, the six policy options are introduced, followed by a brief presentation of the elements that are common for each of the policy options. The five policy options are summarised by Table 1, which provides an overview of the policy measures that are part of each of the policy options.

### Policy Option 1

Policy Option 1 is a stringent one, mandating all transport operators and organisers/users (except passengers) to account for their GHG emissions (PM13) and to let this process (including the input data used) verify by EU accredited third bodies (PM8). In line with the mandatory character of this policy option, the most comprehensive methodological framework is prescribed, i.e. the new reference methodology based on ISO 14083 but with additional elements (PM3). This ensures the highest level of comparability of GHG emissions figures between companies, but at the same time leaves little room for companies to make their own decisions with respect to the accounting of emissions. As in the other policy options, the use of primary data for accounting GHG emissions is stimulated by providing a label to companies doing so. Default emission intensity factors may, however, be used if primary data is not available and can be taken from a centralised EU database (managed by an EU agency) (PM4). Also the provision of harmonised calculation tools is centralised at the EU level (PM11). Finally, PO1 includes the provision of minimum requirements for harmonised GHG output formats and metrics (PM6) as well as horizontal guidelines for the implementation of the common accounting framework across various segments and sectors of the transport market (PM7). Both policy measures are common to all policy options considered in the impact assessment.

### Policy Option 2

The use of the CountEmissions EU framework for GHG emissions accounting is fully voluntary in PO2 (PM15), as is the verification of the process and input data used for the accounting (PM10). In line with the voluntary character of this policy option, the most conducive reference methodology is applied in the CountEmissions framework, i.e. ISO 14083 (PM1), which is expected to be the most accepted methodology by stakeholders (see Section 6.3.2). Supporting tools, like default emissions intensity factors and calculation tools, are harmonised and provided at a central (EU) level (PM11). This offers companies easy access to such tools.

## Policy Option 3

Policy Option 3 aims to strike a balance between further harmonisation of GHG emissions accounting in the transport sector and the added administrative burden for transport operators and users. Accordingly, it gives transport operators/users the discretion to decide whether they wish to account for the emissions of their transport operations. However, if they opt to calculate and share their emissions, they must apply the CountEmissions EU framework (PM14). The application of the most comprehensive methodology—the new reference methodology based on ISO14083, enhanced with additional elements (PM3)—should ensure a high degree of harmonisation of GHG emissions output. Simultaneously, only large companies are required to have their process and input data verified by accredited bodies (PM9), reducing the administrative load for SMEs. While the use of primary data is also preferred in this policy option, utilising default emission intensity factors is permitted. For this purpose, a harmonised EU database has been developed, but the use of intensity factors from external databases, whose quality is assured at the EU level, is also allowed (PM5). This offers companies the chance to use intensity factors that better mirror the characteristics of their transport operations, thereby increasing the accuracy of the GHG emission figures. The provision of emission calculation tools is left to the market, but they should be certified by EU accredited bodies (PM12).

## Policy Option 4

This policy option closely resembles PO3, with the primary difference being the choice of reference methodology in the CountEmissions EU framework. Rather than employing the new reference methodology based on ISO14083 with additional elements (PM3), this policy option opts for the more conducive ISO 14083 methodology (P1) as the reference. This divergence between PO3 and PO4 enables an evaluation of the influence of the chosen reference methodology on the impacts of CountEmissions EU. Moreover, given that ISO 14083 has global applicability, PO4 possesses a worldwide outreach.

## Policy Option 5

This policy option is largely similar to PO3 and PO4, except that the newly developed PEF Category Rules (PEFCR) for transport (PM2) is considered as reference methodology for CountEmissions EU. This methodology addresses the desire of some stakeholders (i.e. particularly citizens and transport users) to cover the life cycle emissions of vehicles and transport infrastructure as well. As the PEFCR will come with a set of default values to be developed by EEA, this policy option does not allow for the use of other external databases. Therefore, in line with PM4 only use can be made of default emission factors from an EU centralised database.

## Policy Option 6

This policy option is largely similar to PO4, with the key difference being that all relevant entities are required to account for their GHG emissions (PM13) as opposed to the binding opt-in variant (PM14) implemented in PO4. This difference between PO4 and PO6 allows for an evaluation of the trade-offs of applying ISO 14083 with a full obligation to account GHG emissions on involved businesses, compared to a less stringent application of the CountEmissions framework (i.e. in the binding opt-in variant).

## Common elements of the policy options

Although the six policy options differ on many elements (as discussed above), they also share some common elements. In all policy options:
- the use of primary data will be prioritised;
- an energy emission factors dataset will be harmonised by the EU, including the possibility to let the quality of alternative emission factors assure at the EU level;
- the EU will provide minimum requirements for the harmonised GHG output formats and metrics as well as common rules on the communication an transparency (PM6);
- the EU will provide horizontal implementation guidelines (PM7);
- transport operators, organisers, users (except passengers) and entities sharing GHG emissions data related to transport services for commercial or regulatory purposes are considered as (potential) regulated entity;
- all transport segments are covered by CountEmissions EU.

**Table 19 - Policy option packaging**

| Policy area | Policy measures | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|---|
| Methodological framework | PM1 | ISO 14083 is set as common reference methodology at the EU level. | | ■ | | ■ | | ■ |
| | PM2 | Product Environmental Footprint Category Rules for GHG emissions of transport, including rules for transport services, is set as common reference methodology at the EU level. | | | | | ■ | |
| | PM3 | A common reference methodology is set at the EU level, based on ISO 14083 with additional elements and increased accuracy. | ■ | | ■ | | | |
| Input data and sources | PM4 | The use of primary data is recognised and centralised databases for default values are established at EU level (by European Environment Agency). Modelled data are used in conformity with the reference methodology. | ■ | ■ | | | ■ | |
| | PM5 | The use of primary data is recognised and centralised databases for default values are established at EU level. Quality assurance of external databases operated by third parties is provided at EU level (by European Environment Agency). Modelled data are used in conformity with the reference methodology. | | | ■ | ■ | | ■ |
| Harmonised output data | PM6 | Minimum requirements for harmonised GHG output formats and metrics are provided at EU level, together with common rules on the communication and transparency. | ■ | ■ | ■ | ■ | ■ | ■ |
| Sectoral implementation support | PM7 | Horizontal guidelines for the harmonised implementation of CountEmissions EU in various sectors and segments of the transport market are provided at the EU level. | ■ | ■ | ■ | ■ | ■ | ■ |
| Conformity | PM8 | Mandatory process and data verification for all entities falling under the scope of CountEmissions EU is established at EU level. | ■ | | | | | |
| | PM9 | Mandatory process and data verification for entities above a certain size falling under the scope of CountEmissions EU is established at EU level. | | | ■ | ■ | ■ | ■ |
| | PM10 | Voluntary process and data verification for all entities are established at EU level. | | ■ | | | | |
| Complementary measures | PM11 | EU provides calculation tools at the EU level. | ■ | ■ | | | | |
| | PM12 | Market provides calculation tools certified by EU-recognised bodies. | | | ■ | ■ | ■ | ■ |
| Applicability | PM13 | Mandatory application of CountEmissions EU in the transport sector. | ■ | | | | | ■ |
| | PM14 | Binding opt-in application of CountEmissions EU in the transport sector. | | | ■ | ■ | ■ | |
| | PM15 | Voluntary opt-in application of CountEmissions EU in the transport sector with a label. | | ■ | | | | |

# 7 Analysis of impacts of policy options

## 7.1 Introduction

It is important to acknowledge that CountEmissions EU is an enabling set of policy measures since it deals with harmonised measurement and calculation of emissions only. While there will clearly be some impacts associated with implementing a harmonised measurement framework for transport services GHG emissions and calculation framework in the EU, it is expected that the existence of a harmonised framework would enable far greater impacts that will be attributed to the sharing of the information produced (reporting). In short: CountEmissions EU is a fundamental enabler (from the transport perspective) for better outcomes in other EU initiatives, for example: in sustainable finance; in corporate sustainability reporting; for labelling; for better emissions information at point of purchase; for green public procurement. Stakeholders from the private sector – in particular around 4 49 000 large companies business – are understandably focussed on their current and future sustainability reporting requirements, for example: related to the Corporate Sustainability Reporting Directive (CSRD) and the European Sustainability Reporting Standards (ESRS). They often have these regulations front of mind. It should therefore be noted that stakeholders find it challenging to separate the concept of a calculation and measurement framework from the reporting or external communication of transport emissions. This results in difficulties in providing direct inputs on the impacts of calculation and measurement of transport emissions in the absence of reporting.

In line with Tool #18 of the Better Regulation Toolbox 2021, we used the following criteria to select relevant impacts:

- Relevance of the impact within the intervention logic. We retained the impacts identified in Step 1 that had a clear link with the policy objectives. These impacts provide valuable information for assessing policy options and determining how well these options align with the initiative’s objectives.
- Absolute magnitude of the expected impacts. We excluded some impacts based on their anticipated scale or magnitude. Specifically, we discarded impacts where the intiative’s effects might be minimal.
- Relative size of the expected impacts for specific stakeholders. However, we did not immediately exclude impacts that might have a small effect. It is critical to identify which stakeholder group is affected. Even if the aggregate impact is expected to be negligible, or if only specific stakeholder groups feel the impact, we must still consider it if it's of significant importance to these groups. This is particularly true when SMEs are impacted. The same principle applies when only certain Member States or industries are affected.
- Importance of impacts for Commission horizontal dimensions. We retained impacts for further analysis if they were not directly related to the policy objectives of the initiative but could be tied to the general (horizontal) policy objectives of the Commission.

The resulting list of significant impacts to be further analysed was then tested with stakeholders and the results are summarised in Annex G. The significant impacts are presented in Table 20

**Table 20 - Description of significant impacts of the policy options**

| Impacts | Description of the impact | Stakeholders affected |
|---|---|---|
| Regulatory costs and benefits | The policy options will result in regulatory impacts: administrative burden; adjustment costs; enforcement costs. For both transport operators (e.g. to apply GHG emissions calculations) and public authorities (e.g. to monitor the initiative). These may consist of one-off investments and recurring costs. Authorities will benefit from a less fragmented and more trustworthy calculation method if it is linked to sustainability reporting requirements. The benefits from the introduction of a harmonized framework are not only accrued by operators, but also transport intermediaries and even the final users. The difficulty in calculating benefits is that most benefits will be related to 'alternative uses' of the information produced (i.e. reporting type applications). Here we are just dealing with a harmonised calculation method, which is a necessary precondition to effectively implementing alternative uses for the information. Consumer costs and benefits are addressed in a separate activity. | Transport service organisers, hubs and users; and public authorities |
| Impact on SMEs | As a result of more harmonised measurement framework, three potential effects can be analysed for SMEs: (i) administrative and adjustment costs (in relation to the specific policy option), (ii) fuel savings or other efficiency benefits related of the reductions originating from the measures implemented, and (iii) additional one-off costs for implementing reduction measures. There is additionally a need to consider within supply chain competition related to procurement or other contractual processes for SMEs. | Transport service organisers |
| Innovation and technological development | There are two clear dimensions that need to be considered as it relates to innovation: 1) there is the potential to disincentivise innovation and technological development if key areas of the harmonised framework are too static/ do not change over long timeframes (e.g. factors related to use of alternative fuels are not updated/ included regularly); 2) the need to reduce costs associated with emissions calculation (through automation) may inspire better digital products and new business models (e.g. technical support tools) in the public and private sectors (Tool #22 Research and Innovation). Automation (through digital innovation) could be particularly important to transfer emissions measurement and calculation experience from large businesses in the transport system (that generally are subject to strict sustainability reporting requirements and have larger R&D budgets) to SMEs that need to reduce costs per employee associated with emissions measurement and calculation. Innovation and technological development stemming from the implementation of harmonised approaches and reporting can impact on data management and thus on data quality (i.e., reliability, accuracy and comparability). Notably, data management refers to procedures, IT applications, interfaces and to the costs for achieving a particular level of data quality. | Transport service organisers (and additionally IT developers) |

| Impacts | Description of the impact | Stakeholders affected |
|---|---|---|
| Direct costs of transport | In general, given a harmonised framework, transport operators and users might behave more efficiently, which results in a reduction of the internal costs of transport (i.e. the costs for transport operators). The main impact will be on operational costs (particularly fuel costs). | Transport service organisers and users |
| Behavioural change towards more sustainable modes for both passenger and goods movement | The application of an EU framework for harmonised measurement of transport and logistics emissions creates preconditions for (direct and indirect) behavioural changes, which may result in a situation for which transport operators and citizens are more aware of the actual and final consequences of their individual decisions for the society as a whole. These behavioural changes result in changes to passenger km and tonne km volumes, which forms the basis for assessment of other impacts. | Transport service organisers and users |
| GHG emission savings | If transport and logistic activities are carried out more efficiently due to more certainty and comparability associated with emissions information, then GHG emissions could be reduced. This will also result in lower external costs of GHG emissions. | Society |
| Other environmental impacts | The (potential) improvement of transport and logistic efficiency and a modal shift to more sustainable modes will have other environmental impacts associated with. The most important one in this respect is the change in a pollutant emissions and associated external costs. | Society |
| Transport accidents | Potential modal shift impacts and changes in transport demand may affect the risk on transport accidents. For example, a shift of transport from road to rail transport will contribute to less transport accidents and hence less casualties. The changes in the number and severity of transport accidents affect the overall transport accident costs. | Society |

Most impacts depend on the ‘uptake’ of emissions measurement and calculation under the various policy options. And that is determined by both the applicability regulatory setting (i.e. what is made voluntary and what is made mandatory if anything, PM13 to PM15) and willingness of transport sector actors to take up transport emissions measurement and calculation. This ‘uptake’ potential both in the baseline and for different policy options was the subject of quantitative analysis, the basis for which is discussed in both Annex D and included in stakeholder input in Annex G. A detailed summary is provided in Section 7.2 .

Potential benefits mainly depend on behavioural changes (mostly in decision making, for example mode choice for both freight and passengers) by transport sector actors. These result in changes to passenger km and tonne km. The most relevant behavioural changes are discussed in more detail in Section 7.3.

Finally, the significant impacts of the various policy options are discussed in Sections 7.4 to 7.6

## 7.2 Levels of uptake of transport emissions measurement and calculation under different policy options

As well as the baseline uptake, uptake by business entities given certain policy options needed to be estimated. Any uptake in addition to the baseline was thought to occur from either the additional incentives provided by regulators (e.g. decrease in investment uncertainty or increase in perceived benefits given harmonised method) or the policy/legal instrument used (e.g. in the case where it is mandatory for businesses to calculate their emissions using a harmonised framework). Any incentives could either be legislative or chances to differentiate in a competitive market using a recognised/harmonised methodology.

In the case where transport emissions measurement and calculation at the service level is mandatory (Policy Option 1 and 6) uptake was assumed to be 100% (for SMEs starting from 2035, as that is the application data for SMEs in PO1), which represents the best-case scenario (i.e. excludes noncompliance). Uptake was assumed to differ also between 'binding opt-in' and 'voluntary' applications, which cover Policy Options 2-5. In the case of a voluntary policy instrument (with no requirement to use the harmonised framework) it was assumed that of the businesses that decided to measure and calculate emissions at the service level, some would choose to use the harmonised framework, while some would continue with other available methods in particular those they were already familiar with. In the binding opt-in cases, it was assumed that any business that chose to measure or calculate emissions at the service level would then do so using the harmonised framework. And further, in the cases where transport emissions measurement and calculation is binding opt-in, the assumption was made that no additional business entities above the baseline in 2050 would be incentivised to take up emissions accounting at the service level. What that means in practice is that the 2050 baseline uptake acts as an upper bound of 'climate aware' business entities, but regulators can incentivise those climate aware entities to engage with emissions measurement and calculation earlier than they would have otherwise. We consider this a conservative assumption since it is entirely possible that (in particular in Option 4 based on the established ISO method) European support of an existing methodology would encourage new businesses to measure and calculate emissions that would not have considered doing so otherwise. It was, however, thought to be unlikely that the existence of a harmonised transport emissions measurement and calculation methodology in itself could incentivise business entities to become 'climate aware'. It was thought that this transition to 'climate aware' status would occur as a result of pressure from investors/clients or other legislative efforts more focused on reporting for example.

The uptake of transport emissions measurement and calculation between 2025 and 2050 given different policy options is shown in Table 21.

**Table 21 - Number of companies applying GHG emissions accounting at the service level in the baseline and the policy options**

| Type of company | Policy option | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| SMEs | Baseline | 30,253 | 38,693 | 46,698 | 54,279 | 61,465 | 68,279 |
| | PO1 | 139,942 | 953,823 | 1,767,702 | 1,767,702 | 1,767,702 | 1,767,702 |
| | PO2 | 44,810 | 68,279 | 68,279 | 68,279 | 68,279 | 69,640 |
| | PO3 | 42,684 | 64,304 | 64,304 | 64,304 | 67,611 | 71,418 |
| | PO4 | 51,256 | 76,917 | 76,917 | 76,917 | 76,917 | 76,917 |
| | PO5 | 41,882 | 62,699 | 62,699 | 62,792 | 66,781 | 70,599 |
| | PO6 | 139,942 | 953,823 | 1,767,702 | 1,767,702 | 1,767,702 | 1,767,702 |

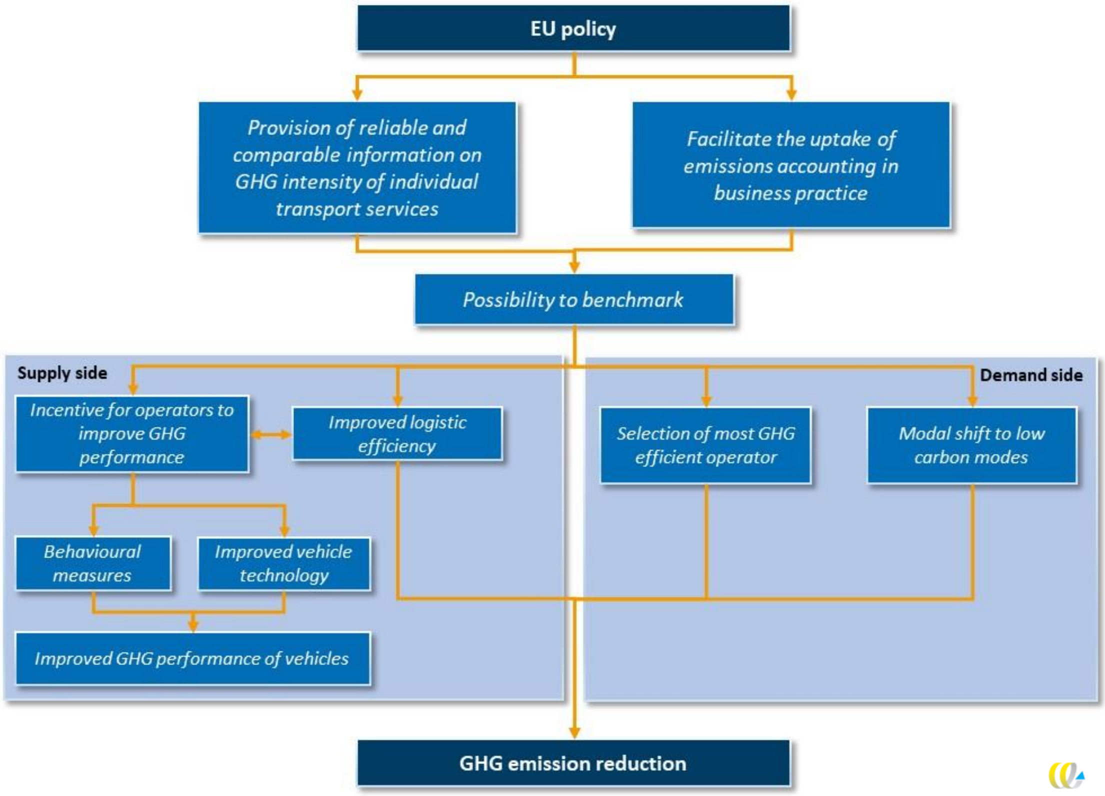
| Type of company | Policy option | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|
| Large companies | Baseline | 507 | 687 | 858 | 1,018 | 1,171 | 1,320 |
| | PO1 | 1,388 | 3,560 | 5,738 | 5,738 | 5,738 | 5,738 |
| | PO2 | 818 | 1,320 | 1,320 | 1,320 | 1,320 | 1,347 |
| | PO3 | 1,099 | 1,821 | 1,821 | 1,821 | 1,821 | 1,821 |
| | PO4 | 1,099 | 1,821 | 1,821 | 1,821 | 1,821 | 1,821 |
| | PO5 | 1,080 | 1,783 | 1,783 | 1,783 | 1,783 | 1,783 |
| | PO6 | 1,388 | 3,560 | 5,738 | 5,738 | 5,738 | 5,738 |
| Total | Baseline | 30,760 | 39,380 | 47,556 | 55,297 | 62,636 | 69,599 |
| | PO1 | 141,330 | 957,383 | 1,773,440 | 1,773,440 | 1,773,440 | 1,773,440 |
| | PO2 | 45,628 | 69,599 | 69,599 | 69,599 | 69,599 | 70,987 |
| | PO3 | 43,783 | 66,125 | 66,125 | 66,125 | 69,432 | 73,239 |
| | PO4 | 52,355 | 78,738 | 78,738 | 78,738 | 78,738 | 78,738 |
| | PO5 | 42,962 | 64,482 | 64,482 | 64,575 | 68,564 | 72,382 |
| | PO6 | 141,330 | 957,383 | 1,773,440 | 1,773,440 | 1,773,440 | 1,773,440 |

## 7.3 Behaviour change with different policy options

Some of the potential benefits associated with harmonised measurement and calculation of transport emissions depend heavily on behaviour change. In particular impacts on modal shift and GHG intensity per tonne-kilometre and passenger-kilometre need to be carefully considered as a basis for determining other effects. This is associated with the comparability/assessment of emissions performance between modes and between alternatives on a single mode of transportation. The ability to compare consistently appeared as the most important criteria to consider among stakeholders consulted through different engagement mechanisms.

The policy options may affect the choices made by stakeholders on both the supply and demand side, as illustrated in Figure 12. On the supply side, the information on GHG emission per transport service (in comparison to similar figures from competitors) may incentivise transport operators to improve their transport efficiency (e.g. by increasing loading rates, further optimising of routing, etc.) and fuel efficiency (e.g. by applying more fuel efficient vehicles/vessels or applying a fuel efficient driving style). There is the potential for CountEmissions EU to increase the use of zero-emission vehicles in line with multiple EU policy objectives. These behavioural changes may results in a lower transport demand (in terms of kilometres) or lower GHG intensity per tonne-kilometre and passenger-kilometre. On the demand side, shippers and passengers are incentivised to choose more sustainable options, either by choosing more sustainable operators within a mode or by shifting to another mode of transport. These behavioural changes may results in modal shift impacts as well as lower GHG intensity per tonne-kilometre and passenger-kilometre.

**Figure 12 - Overview of potential behavioural changes at the supply and demand side of the transport market**




Source: CE Delft et al. (2014).

It is necessary to further define the impact of emissions accounting on the behaviour of individuals and corporations for passenger and freight transport choices related to decarbonisation. We begin with an overview of factors that influence the behaviour of the decision-makers.

## Impact of high quality emissions accounting on corporate emissions

While determining the impact differentiating by passenger or freight transport is a complex task, some research is already available for corporate emissions, which would be more closely associated to freight transport. For corporations, direct economic benefits, competitive advantage, and investor pressure are, to different degrees, the main factors that can cause behavioural change when accurate emissions reporting exists.

## Economic benefits as a driver for emissions reductions

A case study on logistics companies (Herold & Lee, 2017) acknowledged that cost saving initiatives are part of the reasons for these companies choosing to reduce their emissions when quality information is available (although competitive advantages also play a role). A study that looked into companies in the north of China adopting IT in their environmental management (Wang et al., 2015) and concluded that when information is made available, emissions reduction behaviour takes place and is stronger among companies that perceive natural resources as critical for their survival, suggesting a link with economic gain.

A number of companies also monetise their carbon emissions, especially carbon allowances under cap and trade schemes (Ortas et al., 2015), and inherently treat carbon as assets (allowances) or liabilities (realised emissions) (Tang, 2017). However, it is pointed out that while monetising is a relatively common practice, the practice has weaknesses when evaluating emissions performance in that the impact of the emissions is not financial in nature and cannot always be monetised (Tang, 2017).

### Competitive advantage as a motivation

As mentioned previously, obtaining competitive advantage (often in the form of reputational gain) can be a motivator for logistics companies to reduce their emissions when quality information is available (Herold & Lee, 2017). Conversely, it seems that companies that underperform in emissions reduction have a preference for low quality data disclosure to achieve the goal of hiding and legitimising their emissions (Park et al., 2023), while a study performed in Australia (Mia et al., 2021) found that when companies were mandated to disclose emissions there was significant effort from these companies to legitimise their operations with carbon-specific communication. The increase in carbon-related communications was used as a way to prevent disclosure of more accurate data and did not directly lead to emissions reduction, however this does point to the importance companies place on how emissions information can lead to reputational damage and their willingness to prevent it.

### The role of investors in reducing corporate emissions

Emissions disclosures are becoming interesting for investors as there is increased concern for the impact of the activities of companies on the environment, and how that can affect their investment return (Amo & Ganu, 2020). Specifically, institutional investors, and particularly independent, long term, and monitoring investors, are attracted to companies that effectively reduce their emissions (Safiullah et al., 2022).

It also appears that in general investors are expecting higher stock returns from companies that are less effective in managing their emissions, possibly as a part of their carbon risk mitigation strategy (Bolton & Kacperczyk, 2021), supporting the fact that investors place value on carbon management and excerpt pressure on companies for better performance, either for reduced carbon risk or higher financial returns (to compensate the risk).

It is worth noting, however, that investors tend to focus on energy consumption when evaluating the environmental performance of companies (Safiullah et al., 2022), which could mean that emissions further along the supply chain could be ignored.

### Impact of high quality emissions accounting on individual emissions

In a similar way to corporate emissions, individual emissions are more closely associated to passenger transport. In this regard, having emissions information available when making a transport decision can have an impact on the choice, but this impact is limited, depending on framing, and heterogeneous across the population.

## Information as a driver of behavioural change

While research on transport choice behaviour suggest that presenting emissions figures to interested individuals might be more useful to generate awareness than to produce changes in behaviour (Brazil et al., 2017, Silva et al., 2018), there is evidence to suggest that emissions information does improve pro-environmental behaviour among environmentally aware people (Yang et al., 2021) and can indeed influence vehicle purchase choice(Daziano, R. et al., 2021), (Daziano, Ricardo A. et al., 2017) mode choice (Hagedorn & Wessel, 2022), and route choice (Gaker et al., 2011).

## The role of framing

A significant body of research exists addressing not just whether or not the availability of information lead to individuals making better choices from an emissions perspective, but instead how that information is effectively presented to individuals to drive those decisions (Gaker et al., 2011). Essentially it is about information quality. In this regard, presenting emissions as a ratio of the monetary value (Hagedorn & Wessel, 2022), as a percentage of a carbon budget (Núñez Alfaro & Chankov, 2022), or within a prosocial framing (Daziano, Ricardo A. et al., 2017) have received better results that alternatives in some studies, reinforcing the point.

However, other studies have received consistent results across different framings (Gaker et al., 2011). In this case, there is an almost infinite way to frame emissions, and testing them exhaustively is a difficult task. Since the study that receives consistent results does not test the same framings previously discussed, we are inclined to believe that it does not contradict the former statements.

## The distribution of the effect

The effect that accurate emissions information has on individual choice behaviour is not the same across all individuals. First, it appears that women value emissions savings more than men and are more prone to change their behaviour (Gaker et al., 2011). Second, a study found that there is a small minority of people (24%) who drive the behavioural change, with the majority not willing to spend more time or money on reducing emissions when having the information at hand to make the choice (Gaker & Walker, 2013).

## Summary

Table 22 summarises the findings of the literature review on the effect of the disclosure of high quality emissions information, as well as its scope, magnitude, and some of the factors that influence the discussed effect. The summary is presented for both individuals and corporations, which were used as a proxy for passenger transport and freight transport, respectively.

**Table 22 - Summary of the findings of the literature review**

| | Passenger transport/Individuals | Freight transport/Corporations |
|---|---|---|
| Effect of disclosure of quality emissions information | Some reduction of GHG emissions is possible. | Some reduction of GHG emissions is possible. |
| Internal motivations for effect | Environmental awareness. | Economic gain, competitive advantage. |
| Contextual factors influencing the effect | Seemingly dependent on how emissions are presented. | Economic or stakeholder pressure, as well as certain institutional investors, have a positive impact. |
| Scope of effect | Vehicle purchase, mode choice, route choice. | Mostly operational emissions, so possibly only transport companies. |
| Heterogeneity of effect | A minority of people drive the majority of the behavioural change. | – |

The literature suggests that there are, albeit limited, emissions reductions to be expected from disclosing highly accurate emissions information for both individuals (passenger transport) or corporations (freight transport). Individuals and corporations can be internally motivated to reduce emissions in light of available information, but external factors also play a big role, namely individuals are sensitive to framing and corporations are sensitive to external stakeholder and investor pressure.

The effect is also heterogeneously distributed, for instance, a few internally motivated individuals drive most of the impact at the passenger level when given the right information. It is possible that a similar case occurs with corporations based on both their internal and external motivators, but no indication of the distribution of the effects has been found in the research (at least directly linked to accurate emissions disclosure), nor is it easy to draw an estimate from the motivators themselves.

Since stakeholder pressure and reputation are external motivators, it seems plausible that the effect of emissions reduction is bigger if corporations are compelled to make their emissions accounts public, however, the positive effect this could have is still not certain as the link between the increase in carbon-related communications and real emissions reduction has not been fully demonstrated, thus 'greenwashing' remains a relevant issue. In this case, further internalising the emissions cost for companies could be an alternative (which is made an option by high quality accounting), nudging companies and their investors to prefer emissions reductions.

The large effect that framing has on emissions reduction from individuals when high quality emissions information is offered before making a decision (ex ante) suggest that this is a primary policy target to address if policy makers aim to nudge individuals in making better environmentally friendly decisions, but a large part of individuals could remain apathetic, which warrants the greening of all alternatives for real emissions reduction.

## 7.4 Economic impacts

### 7.4.1 Regulatory costs (administrative, adjustment and enforcement costs)

The total costs and cost savings are considered the primary impact associated with CountEmissions EU. As discussed earlier, the initiative is a fundamental enabler of benefits realisation across the broader policy ecosystem. Direct effects are therefore likely to be modest, except in the case of costs. The impact area is closely related to assessment activity on both SMEs and IT costs. We have integrated the three assessment domains, with the SME analysis and IT cost analysis feeding into the standard cost model approach.

## Impacts on national public authorities

### *Adjustment costs for national public authorities.*

All six policy options entail adjustments costs for national statistical offices dealing with transport emissions statistics, driven by the minimum requirements for harmonised GHG output data formats and metrics at EU level (PM6). The workload needed for adapting to the harmonised GHG output data format is estimated at 120 hours per statistical office. The average cost per hour is estimated at € 40.9 in 2022 prices for ISCO 2 category (Professionals) and is assumed to remain constant over time in real prices. Thus, the total one-off adjustment costs at EU level in 2025 are estimated at € 132,504 relative to the baseline (in 2022 prices) for all policy options.

### *Administrative costs for national public authorities*

All six policy options entail administrative costs for accreditation of verifiers by National Accreditation Bodies (NABs), in view of performing data verification. The accreditation of verifiers by NABs is part of PM8 (mandatory process and data verification for all entities falling under the scope of CountEmissions EU at EU level) included in PO1; PM9 (mandatory process and data verification for entities above certain size falling under the scope of CountEmissions EU at EU level) included in PO3, PO4,PO5 and PO6; and PM10 (voluntary process and data verification for all entities at EU level) included in PO2. The workload per NAB for the accreditation of verifiers is estimated at 120 hours in 2025 and is the same for all options. Thus, the total one-off administrative costs at EU level in 2025 are estimated at € 132,504 relative to the baseline (in 2022 prices) for all policy options.

## Impacts on the European Environmental Agency (EEA)

### *Adjustment costs for EEA*

All policy options establish a centralised database for default input values (i.e. emissions intensity factors and energy/fuel emissions factors) at the EU level (PM4 in PO1, PO2 and PO5, and PM5 in PO3, PO4 and PO6). The centralised EU databases will be developed and maintained by the European Environment Agency (EEA). In addition, PM5 (included in PO3, PO4 and PO6) allows for the use of data from databases operated by third parties, following a quality assurance check by the EEA.

For developing the databases (in both PM4 and PM5), 1 full time equivalent (FTEs) is estimated to be needed by EEA in 2025, 2026 and 2027, in addition to € 200,000 in infrastructure costs. The one-off costs associated to the development of the databases are thus estimated at € 693,149. In addition, one FTE and operational costs for maintenance would be required for maintaining and updating the databases from 2026 onwards. The recurrent adjustment costs for EEA are estimated at € 186,000 per year from 2026 onwards relative to the baseline.

As for PM4, the adjustment costs for EEA are fully related to the development and management of the central databases. As explained above, PM4 is included in PO1, PO2 and PO5. The total adjustment costs for EEA due to PM4 relative to the baseline, expressed as present value over 2025-2050, are estimated at € 3.6 million of which € 0.7 million one-off costs.

As for PM5 (included in PO3, PO4 and PO6), the adjustment costs for the EEA consist of the costs of developing and maintaining the central databases and the costs of the quality check of sectorial specific datasets. The former costs are similar to the costs of PM4.
In addition, with respect to the quality assurance of external databases operated by third parties, it is assumed that fifteen hours are needed for performing the quality check per dataset. The quality check is assumed to be performed for the first time in 2026, for 24 datasets (more than one for each sector involved in the quantification). The quality check of each dataset is estimated to occur every two years. Thus, operational costs are estimated to be needed every two years, equivalent to € 35,791 every two years.

The total one-off adjustment costs for the EEA are estimated at € 693,149 in the period 2025-2027, while the recurrent annual costs at € 221,791 in 2030 and in 2050. Expressed as present value over 2025-2050, the total adjustment costs are estimated at € 3.9 million.

## Impacts on the European Commission

### *Adjustment costs for the European Commission*

The definition of PEFCRs for transport of the Product Environmental Footprint methodology (PM2) in PO5 will be done via a research project. The budget to be dedicated to develop the PEFCRs for transport is estimated at € 1.5 million per PEFCR. Based on previous work done in the context of ESPR and the development of an aviation label using PEF category rule, for covering all transport services, 4 PEFCRs are needed (road, maritime and IWW, aviation, rail). However, the work on aviation has already started and part of these costs (50%) are included in the baseline. Thus, the one-off adjustment costs for the European Commission in 2025 for PO5 are estimated at € 5.25 million relative to the baseline (in 2022 prices).

The development of the additional requirements for the methodology based on ISO 14083 but with additional elements and increased accuracy (PM3) in PO1 and PO3 will be also done via a research project. The budget to be dedicated to this work is estimated at € 2.4 million for 2025 (one-off costs) relative to the baseline (in 2022 prices).

Furthermore, PO1 and PO2 will lead to additional costs for the European Commission linked to the development of calculation tools following the common reference methodology (PM11). Based on the cost of THETIS-MRV and experience with existing THETIS-EU modules, such IT-developments are estimated at € 300,000 (one-off costs in 2025).

The total one-off adjustment costs for the European Commission in 2025 are estimated at € 2.7 million in PO1, € 0.3 million in PO2, € 2.4 million in PO3 and € 5.25 million in PO5.

## Impact on businesses and business associations involved in transport services

The analysis of regulatory costs for business has focussed on:
- personnel costs of calculating and reporting GHG emissions (including any transitional/ retraining costs);
- data management and storage systems costs;

- in case they have/develop a technical tool, the fee and costs related to this tool;
- the cost of verification (e.g. third party verifier).

### *Approach*

The EU Standard Cost Model is described in detail in Tools #58 and #59 of the current Better Regulations Toolbox. It is commonly used in Impact Assessments by the Commission where significant administrative costs are a possibility. The model estimates these costs at member state and EU level.

Costs are assessed by multiplying the price and quantity of activities to be performed. In essence, the average cost of the required administrative activity is multiplied by the number of times that administrative activity needs to be performed per time period (normally annually). The net costs are arrived at by then subtracting the administrative costs removed/replaced (given defined baseline activities).

$$Administrative\ or\ adjustment\ cost = \sum P_N.Q_N - \sum P_R.Q_R$$

Where P is the average cost of the administrative activity, Q is the number of times the administrative activity needs to be performed, index N denotes a new obligation and R a removed obligation.

**Activity profiles**
To understand what it might take on average for different types of actor in the transport ecosystem to measure and calculate their transport emissions at the service level, activity profiles have been developed. These activity profiles represent functions and tasks (i.e. the work load and costs) associated with GHG emission counting at service level. The activity profiles reflect:
- the areas of action resulting from the policy measures;
- the categories of costs that are relevant for an impact assessment according to the Commission's Better Regulation Toolbox.

The activity profiles have been developed for the baseline scenario (i.e. no-policy change) and then largely based on the methodology to be implemented: 1) the ISO Standard 14083, 2) the Product Environmental Footprint (PEF) common reference methodology, and 3) a new comprehensive methodology based on ISO Standard 14083 with additional elements. They allow the differentiation of not only implementing these methodologies (in different types of organisations of different sizes), but also specifically tool use and verification activities.

The design of the activity profiles considers also whether a business might migrate from a previous (sectorial) methodology towards the new GHG emissions measurement and calculation methodology or whether it might start this activity from a basis of nothing. The activity profiles are illustrated in Table 23, which provides a breakdown by cost category relevant in impact assessment, type of cost (i.e. one-off and recurring) and detailed description of the costs.

**Table 23 - Design of the activity profiles**

| Area of action | Description of the activities |
|---|---|
| Methodology | – Direct labour cost:<br>• understanding GHG method;<br>• procurement of consultant/calculation service provider/inhouse implementation.<br>– Setting up information gathering (e.g. fuel from OEM, database with trip in the right format).<br>– Decision making by management. |
| Harmonised input data | Annual data collection. |
| Harmonised output data | Implementation of data rules. |
| Conformity | Verification of input and calculation. |
| Complementary measures | Use and understanding of tools (external or internal). |

**Rates (tariffs)**
Personnel's tariff types to monetise the activity profiles have been assumed according to Eurostat's structure of earnings survey and labour force survey data for non-wage labour costs. In particular, the labour costs at EU-27 level have been assumed considering the following two categories of the international standard classification of occupations (ISCO): ISCO 1 (i.e. legislators, senior officials and managers) and ISCO 2 (i.e. professionals)[60].

**Input assumptions**
The main input assumptions are then the time (in person hours) each of these activities would take in different situations: one-time implementation activities for businesses starting accounting; one-time implementation activities for businesses that are already accounting. And then the annual time associated with activities are assumed to be the same for both situations. All of these activities are estimated for both large companies and SMEs (size), and for transport service operators, hub operators and transport service users. Therefore for each of the activities above an average time is estimated for six different cases based on business type/size.

The exception to estimating time per activity is for tool procurement. Tool procurement (whether internal or external) in these different cases was developed as a simple unit cost (for example: on average € 3,500 for large transport service operators) based on previous similar impact assessments and information from stakeholders.

One of the main assumptions is that some activities (for example: tool development and use) would be subject to market forces (i.e. provided as a contract/consultancy service) and therefore businesses would only do the activities in house if they could do it at a lower cost (or higher quality) than what was offered.

[60] The tariff of ISCO 1 is equal to € 47.8 per hour and the tariff of ISCO 2 is equal to € 35.6 per hour.

The input assumptions were tested and reviewed by specific stakeholders including from the academic sector.

**Monetisation**
Once the activities had been estimated in time terms using input from stakeholders, these times were multiplied by the tariffs to arrive at an average labour cost per business size/ type. The average labour costs were split into methodological implementation; verification and tool procurement/use to better reflect the policy measures.

**Use of the monetised activity profiles**
These monetised average costs per business size/type for specific sets of activities were multiplied by the uptake rates applicable to the baseline and different policy options/ measures to give the adjustment costs for businesses.

The key assumptions made during the process were:
- 3% discount rate was used to discount costs to 2022 values;
- proportion of companies who would already be using ISO as a methodological framework in the baseline (as a basis for developing one off costs);
- taking average value for number of businesses from 2015-2020 as starting point reduces issues associated with short term fluctuation;
- taking average values from 2015-2020 as starting point reduces issues associated with pandemic;
- company size by number of employees: 1; 2-9; 10-19; 20-49; 50-249; 250+;
- SMEs with 1-249 employees; large companies with 250+ employees;
- aggregation of NACEv2 codes into TSO, TSU, HO81;
- Eurostat provides only an aggregation for tourism (no breakdown by size).

### *Results*

The outputs of the cost model are summarised by policy option in the tables below.

**Table 24 - Recurrent costs for business in the PO1, PO2 and PO3 relative to the baseline scenario (EU-27), in million € (2022 prices) in 2025, 2030 and 2050**

| | Difference to the baseline | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | | | PO2 | | | PO3 | | |
| | 2025 | 2030 | 2050 | 2025 | 2030 | 2050 | 2025 | 2030 | 2050 |
| **Adjustment costs** | **212.9** | **1,611.3** | **2,611.7** | **22.9** | **44.9** | **1.8** | **25.8** | **48.7** | **8.2** |
| PM1 - ISO 14083 set as common reference methodology | | | | 15.9 | 31.3 | 1.3 | | | |
| PM2 - PEFCR set as common reference methodology | | | | | | | | | |
| PM3 - ISO 14083 with additional elements and increased accuracy set as common reference methodology | 130.2 | 1,003.0 | 1,624.5 | | | | 18.1 | 33.8 | 4.9 |
| PM8 - Mandatory process and data verification for all entities | 41.5 | 296.2 | 481.9 | | | | | | |
| PM9 - Mandatory process and data verification for entities above certain size | | | | | | | 0.3 | 1.1 | -1.3 |
| PM10 - Voluntary process and data verification for all entities | | | | 3.0 | 5.2 | 2.1 | | | |
| PM11 - Emissions calculation tools are provided at EU level | 41.2 | 312.1 | 505.3 | 4.0 | 8.4 | -1.6 | | | |
| PM12 - Emissions calculation tools are provided by the market but they are certified at EU level | | | | | | | 7.5 | 13.7 | 4.5 |
| **Administrative costs** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.02** | **0.03** | **0.03** |
| PM5 - Quality assurance of external databases operated by third parties is provided at the EU level | | | | | | | 0.00 | 0.02 | 0.02 |
| PM12 - Emissions calculation tools are provided by the market but they are certified at EU level | | | | | | | 0.02 | 0.02 | 0.02 |
| **Total net costs** | **212.9** | **1,611.3** | **2,611.7** | **22.9** | **44.9** | **1.8** | **25.9** | **48.7** | **8.2** |

**Table 25 - Recurrent costs for business in the PO4, PO5 and PO6 relative to the baseline scenario (EU-27), in million € (2022 prices) in 2025, 2030 and 2050**

| | Difference to the baseline | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | PO4 | | | PO5 | | | PO6 | | |
| | 2025 | 2030 | 2050 | 2025 | 2030 | 2050 | 2025 | 2030 | 2050 |
| **Adjustment costs** | **30.4** | **54.8** | **8.6** | **56.6** | **93.2** | **37.3** | **144.9** | **1,140.9** | **1,848.2** |
| PM1 - ISO 14083 set as common reference methodology | 23.6 | 41.6 | 9.0 | | | | 107.3 | 835.5 | 1,353.5 |
| PM2 - PEFCR set as common reference methodology | | | | 29.9 | 50.0 | 6.9 | | | |
| PM3 - ISO 14083 with additional elements and increased accuracy set as common reference methodology | | | | | | | | | |
| PM8 - Mandatory process and data verification for all entities | | | | | | | | | |
| PM9 - Mandatory process and data verification for entities above certain size | 0.1 | 0.9 | -1.8 | 7.4 | 11.6 | 8.9 | 5.0 | 47.6 | 77.4 |
| PM10 - Voluntary process and data verification for all entities | | | | | | | | | |
| PM11 - Emissions calculation tools are provided at EU level | | | | | | | | | |
| PM12 - Emissions calculation tools are provided by the market but they are certified at EU level | 6.7 | 12.3 | 1.4 | 19.3 | 31.6 | 21.5 | 32.5 | 257.7 | 417.3 |
| **Administrative costs** | **0.02** | **0.03** | **0.03** | **0.02** | **0.02** | **0.02** | **0.02** | **0.03** | **0.03** |
| PM5 - Quality assurance of external databases operated by third parties is provided at the EU level | 0.00 | 0.02 | 0.02 | | | | 0.00 | 0.02 | 0.02 |
| PM12 - Emissions calculation tools are provided by the market but they are certified at EU level | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| **Total net costs** | **30.4** | **54.8** | **8.7** | **56.6** | **93.3** | **37.4** | **144.9** | **1,140.9** | **1,848.2** |

**Table 26 - One-off costs for business in PO1, PO2 and PO3 relative to the baseline scenario (EU-27), in million € (2022 prices)**

| | Difference to the baseline | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | | | PO2 | | | PO3 | | |
| | 2025 | 2030 | 2050 | 2025 | 2030 | 2050 | 2025 | 2030 | 2050 |
| Adjustment costs | | | | | | | | | |
| PM1 - ISO 14083 set as common reference methodology | | | | 31.8 | 56.4 | 2.9 | | | |
| PM2 - PEFCR set as common reference methodology | | | | | | | | | |
| PM3 - ISO 14083 with additional elements and increased accuracy set as common reference methodology | 295.0 | 2,308.0 | 3,747.8 | | | | 43.6 | 76.3 | 12.0 |
| PM7 - Guidelines for harmonised implementation | 0.06 | | | 0.06 | | | 0.06 | | |
| **Total costs** | **295.1** | **2,308.0** | **3,747.8** | **31.8** | **56.4** | **2.9** | **43.7** | **76.3** | **12.0** |

**Table 27 - One-off costs for business in PO4 and PO5 relative to the baseline scenario (EU-27), in million € (2022 prices)**

| | Difference to the baseline | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | PO4 | | | PO5 | | | PO6 | | |
| | 2025 | 2030 | 2050 | 2025 | 2030 | 2050 | 2025 | 2030 | 2050 |
| Adjustment costs | | | | | | | | | |
| PM1 - ISO 14083 set as common reference methodology | 44.8 | 73.9 | 16.0 | | | | 210.5 | 1,660.2 | 2,698.2 |
| PM2 - PEFCR set as common reference methodology | | | | 63.1 | 94.6 | 14.6 | | | |
| PM3 - ISO 14083 with additional elements and increased accuracy set as common reference methodology | | | | | | | | | |
| PM7 - Guidelines for harmonised implementation | 0.06 | | | 0.06 | | | 0.06 | | |
| **Total costs** | **44.8** | **73.9** | **16.0** | **63.2** | **94.6** | **14.6** | **210.5** | **1,660.2** | **2,698.2** |

The largest impact is from adjustment costs on businesses, however, these costs also represent the highest level of uncertainty based on both the uptake rates and the activity profiles.

### 7.4.2 Impact on SMEs

SMEs play a very significant role in the supply chain of goods and passenger transport. Therefore, the initiative is considered relevant for the SMEs and the SME test has been performed. The share of SMEs in the sectors affected by the quantification of GHG emission from transport services may be as high as 99.7%. Therefore, the consultation activities were designed to identify the affected businesses and to further investigate the extent to which they would be distinctively affected.

Measures on methodology (PM1, PM2 and PM3), and applicability (PM13, PM14 and PM15) would add similar costs (in proportion) for SMEs and larger operators, while measures targeting data (PM4, PM5 and PM6) and verification (PM8, PM9 and PM10) would ease the current burden for SMEs more than larger companies (in particular with regards to the costs currently incurred by businesses to undergo verification). Indeed, depending on the supply chain composition, the problems of data availability are experienced most acutely by SMEs, as such companies tend to rely more on default values because of the costs to collect primary data is too heavy for them (PM4, PM5 and PM6).

Given the particular difficulties faced by SMEs in dealing with the quantification of GHG emissions from transport, the analysis has shown that they would benefit more than larger operators from a single framework, with a choice of certified calculator made available by the market (PM12). PO2 and PO4 are expected to lead to relatively larger benefits for SMEs than for larger operators in the sector, with greater relative benefits expected for PO4 due to the importance of PM1 (the setting of ISO 14083 as the reference methodology), PM6 (the possibility of using EU core database of default values for input data, or recognised sectoral databases), PM9 (the verification of data and processes is not mandatory for SMEs) and PM12 (the market will provide calculation tools that will be certified) for SMEs.

A summary of the assessed impact on SMEs is provided in Table 28.

**Table 28 – Monetised impacts on SMEs, in million € (2022 prices)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| Adjustment costs | 93,825.2 | 1,007.7 | 1,095.0 | 1,369.9 | 1,847.7 | 67,177.5 |
| Administrative costs | 0.0 | 0.0 | 0.3 | 0.3 | 0.3 | 0.3 |
| Avoided fuel used | 9,941.1 | 1,500.5 | 676.4 | 2,289.8 | 593.5 | 593.5 |
| **Net benefits/costs** | **-83,884** | **493** | **-419** | **919** | **-1,254** | **-66,584** |

### 7.4.3 Functioning of the internal market and competition

The measures on methodology (PM1, PM2 and PM3) would impact domestic and international services in all policy options. The choice of a global standard such as the ISO 14083 (PM1) would enhance comparability of GHG emissions from transport services at global level. The measures dealing with verification (PM8, PM9 and PM10), are expected to have an impact on the competition between domestic transport services and international as well. The verification avoids distorting competition, which can happen if some providers of international and domestic services decide to 'cherry pick' the default values over primary data. It also affects companies differently: whereas a larger company would be able to use primary data, SMEs do not have similar opportunities due to their limited collection capacity. PM9 (and to an extent PM10) is expected to have a strong positive impact on levelling the playing field for businesses reliant on EU services. It would contribute to a large extent to tackle the negative effects on competition between operators, encouraging businesses to be more GHG efficient, thereby creating more choice for consumers and users. The US EPA SmartWay program is an example of how such an initiative can foster competition among manufacturers and transport companies. As these entities strive to meet and exceed the environmental standards set by the program, they innovate and improve their offerings to maintain a competitive edge. This competitive atmosphere prompts the development of more fuel efficient vehicles and cleaner transport methods, leading to a broader array of choices for consumers. In essence, this competition can potentially drive down prices and increase the quality of goods and services, directly benefiting consumers. Additionally, it encourages companies to be transparent about their environmental impact, allowing consumers to make informed decisions based on the environmental footprint of different companies. This type of competition can be a powerful tool in pushing the entire industry toward greener, more sustainable practices. See the attached case study on the SmartWay program for more detailed information.

However, the impact is expected to be greatest for PO4, since it will benefit from the combined effects of setting ISO 14083 as the common reference methodology (PM1), the possibility of using recognised sectoral databases in addition to the primary data and the EU core input database (PM5) and the verification excluding SMEs (PM9). Voluntary verification systems, such as the SmartWay program, can create competitive advantages for businesses that choose to participate. By voluntarily committing to higher standards, these businesses can differentiate themselves in the market and attract customers who value environmentally responsible practices. This can drive competition, as other businesses may feel compelled to join the program to maintain their market position.

In policy options where transport emissions calculation is made mandatory, every business in the transportation sector is required to comply with this regulation. In such a scenario, the field is levelled as every competitor has to account for, and likely aim to reduce, their emissions. This standardisation could encourage businesses to compete more intensely in other areas, such as operational efficiency, customer service, and pricing, since they all must meet the same emissions standards. However, this could also potentially disadvantage smaller or less-resourced companies who struggle to meet these regulations, leading to reduced competition and industry consolidation.

On the other hand, a voluntary emissions calculation scheme would give companies the option to participate. Businesses that opt into this program might gain a competitive edge by attracting environmentally-conscious customers and partners. In this scenario, competition could drive innovation in clean technologies and emissions reduction strategies, as companies vie to showcase their commitment to environmental responsibility. However, this might create a split market, where some companies continue with older, more polluting practices because they are cheaper or easier, while others forge ahead with cleaner, greener technologies. This could lead to unequal competition, where companies that choose to ignore their emissions have a cost advantage over those that choose to calculate and reduce theirs.

Thus, the decision between implementing a voluntary or mandatory emissions calculation system should carefully consider the trade-offs involved and the desired outcomes for the competition in the industry as it relates to emissions performance.

In summary, we expect:
1. Level playing field between transport modes may be improved in policy options with large take up, particularly as for maritime transport GHG emissions accounting is (to some extent) already mandatory in the EU, while for other modes this is currently voluntary. The improvement of the level playing field may result in modal shift impacts.
2. Level playing field between countries may be improved in policy options with large take up, particularly as currently only in France GHG emissions accounting is mandatory for transport services.
3. Provision of comparable data on GHG emissions of transport services may provide passengers and shippers who find emissions important to their decision making the option to make better informed comparisons between modes. This may result in a shift towards more sustainable transport modes.

We would expect the impact to be proportional to take up with diminishing returns.

### 7.4.4 Impact on innovation and technological development

Apart from the development and sale of calculation tools, which are expected to be straightforward products by today's standards, the impact on innovation and technological development is expected to be minimal with respect to all policy options. Calculation methods (including any factors used) should be updated regularly to reflect any new technological developments. Doing so will mitigate the potential to disincentivise innovation in low or zero emission products due to factors not accurately representing emissions savings. We expect a 'comply or explain' approach would further mitigate the risk

### 7.4.5 Fuel savings

Fuel savings are thought to occur due to changes in distance travelled through a shift to more sustainable modes for passengers and freight as a result of better emissions information becoming available. The quantification of these effects (in mode terms) is described in more detail in the environmental impacts section below.

The benefits arising from estimated fuel savings are summarised in Table 29.

**Table 29 - Financial benefits of fuel cost savings (PV in million EUR)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| Avoided fuel used (operators and passengers) | 10,362.9 | 1,585.5 | 718.3 | 2,415.9 | 630.5 | 10,362.9 |

## 7.5 Environmental impacts

### 7.5.1 GHG emission savings

The CountEmissions EU initiative contributes to the reduction of GHG emissions in the transport and logistics sector in two ways. First, the implementation of a harmonised framework for GHG emissions accounting may induce some behavioural changes in the transport sector (e.g. modal shift), as was discussed in Section 0, which result in lower GHG emissions. In addition to this direct environmental impact, CountEmissions EU may also indirectly contribute to GHG emissions savings. As mentioned in Section 7.1, the CountEmissions EU initiative is fundamentally an enabling set of policy measures, providing harmonised GHG emission figures for transport services that can be used by other (public and private) initiatives (e.g. in green financing or green public procurement) that contribute to lower GHG emission levels in the EU. Although it is not possible to quantify the GHG emission reductions of these initiatives that can be allocated to CountEmissions EU, we will discuss these indirect GHG emission savings in qualitive terms in this section, particularly as we expect that these will be significant (and probably even larger than the direct GHG emission savings).

#### Direct GHG emission savings

While research on transport choice behaviour suggest that in many cases presenting emissions figures to interested individuals might be more useful to generate awareness than to produce changes in behaviour, there is evidence that emissions information does improve pro-environmental behaviour among environmentally aware people and can indeed influence vehicle purchase choice, mode choice, and route choice(Brazil et al., 2017) (Silva et al., 2018). Shares of passengers and transport service providers making sustainable transport choices are a rapidly emerging research agenda (Lewis et al., 2017) (Daziano, R. et al., 2021) (Daziano, Ricardo A. et al., 2017) (Yang et al., 2021). As is mode choices related to emissions saving and impacting the levels of activity in each mode (McKinnon 2023) (Piecyk & McKinnon 2010). However, feedback from stakeholder consultation and current literature does not provide evidence for a modal shift in excess of 10% related to any harmonisation of GHG emissions methodology (i.e. more trustworthy/ more available emissions data). Applying a conservative approach any potential absolute modal shift has been capped at 10% of total km. Other GHG reduction options (increased transport efficiency, appliance of fuel efficient driving style, use of more fuel-efficient vehicles (within a mode)) are not considered due to a lack of evidence.

The analysis of direct emissions savings is based on two levels of assumptions related to potential behaviour change. For the first level of assumptions, the shares of passengers/ consumers and transport service providers making sustainable transport choices are assumed on the basis of the literature review and stakeholder consultations.
The development in the share of climate aware population[61] over time (2025-2050) is based on literature review (Yang et al., 2021) (Daziano, R. et al., 2021) (Daziano, Ricardo A. et al., 2017) and cross-checked with the feedbacks received during the stakeholder consultations. These assumptions are instrumental to identify the shares of the activity that is impacted by CountEmissions EU.

[61] New Eurobarometer Survey: Protecting the environment and climate is important for over 90% of European citizens (3 March 2020).

On the basis of this information, the assumptions used for the period 2025-2050 are shown in Table 30. No evidence was identified for using differentiated assumptions over the period.

**Table 30 - First level assumption values used for identifying the shares of activity for direct environmental impacts**

| Population | Shares over period 2025-2050 |
|---|---|
| Passengers making sustainable choices among the climate aware populations | 14% |
| Climate aware population over time | 91% |

These values are used as proxy to identify the potential behavioural changes affecting the potential shift towards more sustainable transport modes, but also a potential reduction in activity due to change in travelling habits.

The second level assumptions are those related to the mode choices impacting the shift of activity between modes (McKinnon 2023) (see values Table 31 (passengers transport) and Table 32 (freight transport)). These values show the share of the potential activity subject to shifting from different modes. For example, in Table 31 we expect that – of the activity that is subject to shifting (based on first level assumptions) – bus/coach transport reduces by 5% and that this transport would shift to rail. It should be noted that it is not a proportion of the total activity (which, as can been seen in the results, is much lower and subject to a cap of 10%). These are used as proxies for the modal shift and optimisation of trips.

**Table 31 - Second level assumption matrix for the shares modal shift of passengers transport activity**

| Input mode (-) | Output mode (+) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Buses and coaches | Passenger cars and vans | P2W | Rail | Domestic and International intra-EU (air) | International extra-EU (air) | IWW and domestic maritime | Intra-EU maritime transport |
| **Road transport** | | | | | | | | |
| Buses and coaches | 0% | 0% | 0% | 5% | 0% | 0% | 0% | 0% |
| Passenger cars and vans (taxis) | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 0% |
| P2W | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Rail | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **Air transport** | | | | | | | | |
| Domestic and International intra-EU | 0% | 0% | 0% | 50% | 0% | 0% | 0% | 0% |
| International extra-EU | 0% | 0% | 0% | 40% | 0% | 0% | 0% | 0% |
| Inland waterway and domestic maritime | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Intra-EU maritime transport | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

**Table 32 - Second level assumption matrix for the shares of modal shift of freight transport activity**

| Input mode (-) | Output mode (+) | | | |
|---|---|---|---|---|
| | Road freight transport | Rail | IWW and domestic maritime | International maritime activity |
| Road transport | 0% | 40% | 0% | 0% |
| Rail | 0% | 0% | 0% | 0% |
| Inland waterway and domestic maritime | 0% | 10% | 0% | 0% |
| International maritime activity | 0% | 0% | 0% | 0% |

The proxies above together with the difference between the uptake in the different POs and the uptake in the baseline, showing the changes in the transport activity in 2025, 2030, 2040 and 2050 relative to the baseline (see Table 33). Energy intensity and emission intensity factors from PRIMES-TREMOVE are used to calculate the changes in emissions and fuel used.

**Table 33 - Shares of changes in transport activity due to CountEmissions EU**

| | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| **PO1** | | | | |
| **Total passenger transport activity (Gpkm)** | 0.0% | 0.0% | -0.1% | -0.1% |
| Road transport | 0.0% | 0.0% | 0.0% | 0.0% |
| Buses and coaches | 0.0% | 0.0% | -0.1% | -0.1% |
| Passenger cars and vans | 0.0% | 0.0% | 0.0% | 0.0% |
| P2W | 0.0% | 0.0% | 0.0% | 0.0% |
| Rail | 0.1% | 0.5% | 0.8% | 0.8% |
| Air transport | 0.0% | -0.3% | -0.5% | -0.5% |
| Domestic and International intra-EU | 0.0% | -0.3% | -0.6% | -0.6% |
| International extra-EU | 0.0% | -0.3% | -0.5% | -0.5% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| Intra-EU maritime transport | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total freight transport activity (Gtkm)** | 0.0% | 0.0% | 0.0% | 0.0% |
| Road transport | 0.0% | -0.3% | -0.5% | -0.5% |
| Rail | 0.1% | 0.4% | 0.7% | 0.7% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| International maritime activity | 0.0% | 0.0% | 0.0% | 0.0% |
| **PO2** | | | | |
| **Total passenger transport activity (Gpkm)** | 0.0% | 0.0% | 0.0% | 0.0% |
| Road transport | 0.0% | 0.0% | 0.0% | 0.0% |
| Buses and coaches | 0.0% | 0.0% | 0.0% | 0.0% |
| Passenger cars and vans | 0.0% | 0.0% | 0.0% | 0.0% |
| P2W | 0.0% | 0.0% | 0.0% | 0.0% |
| Rail | 0.1% | 0.2% | 0.1% | 0.0% |
| Air transport | -0.1% | -0.1% | 0.0% | 0.0% |
| Domestic and International intra-EU | -0.1% | -0.1% | -0.1% | 0.0% |
| International extra-EU | 0.0% | -0.1% | 0.0% | 0.0% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| Intra-EU maritime transport | 0.0% | 0.0% | 0.0% | 0.0% |

| | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| **Total freight transport activity (Gtkm)** | 0.0% | 0.0% | 0.0% | 0.0% |
| Road transport | 0.0% | -0.1% | 0.0% | 0.0% |
| Rail | 0.1% | 0.1% | 0.1% | 0.0% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| International maritime activity | 0.0% | 0.0% | 0.0% | 0.0% |
| **PO3** | | | | |
| **Total passenger transport activity (Gpkm)** | 0.0% | 0.0% | 0.0% | 0.0% |
| Road transport | 0.0% | 0.0% | 0.0% | 0.0% |
| Buses and coaches | 0.0% | 0.0% | 0.0% | 0.0% |
| Passenger cars and vans | 0.0% | 0.0% | 0.0% | 0.0% |
| P2W | 0.0% | 0.0% | 0.0% | 0.0% |
| Rail | 0.0% | 0.1% | 0.0% | 0.0% |
| Air transport | 0.0% | -0.1% | 0.0% | 0.0% |
| Domestic and International intra-EU | 0.0% | -0.1% | 0.0% | 0.0% |
| International extra-EU | 0.0% | -0.1% | 0.0% | 0.0% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| Intra-EU maritime transport | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total freight transport activity (Gtkm)** | 0.0% | 0.0% | 0.0% | 0.0% |
| Road transport | 0.0% | -0.1% | 0.0% | 0.0% |
| Rail | 0.0% | 0.1% | 0.0% | 0.0% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| International maritime activity | 0.0% | 0.0% | 0.0% | 0.0% |
| **PO4** | | | | |
| **Total passenger transport activity (Gpkm)** | 0.0% | 0.0% | 0.0% | 0.0% |
| Road transport | 0.0% | 0.0% | 0.0% | 0.0% |
| Buses and coaches | 0.0% | 0.0% | 0.0% | 0.0% |
| Passenger cars and vans | 0.0% | 0.0% | 0.0% | 0.0% |
| P2W | 0.0% | 0.0% | 0.0% | 0.0% |
| Rail | 0.1% | 0.2% | 0.1% | 0.1% |
| Air transport | -0.1% | -0.1% | -0.1% | 0.0% |
| Domestic and International intra-EU | -0.1% | -0.2% | -0.1% | 0.0% |
| International extra-EU | -0.1% | -0.1% | -0.1% | 0.0% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| Intra-EU maritime transport | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total freight transport activity (Gtkm)** | 0.0% | 0.0% | 0.0% | 0.0% |
| Road transport | -0.1% | -0.1% | -0.1% | 0.0% |
| Rail | 0.1% | 0.2% | 0.1% | 0.0% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| International maritime activity | 0.0% | 0.0% | 0.0% | 0.0% |
| **PO5** | | | | |
| **Total passenger transport activity (Gpkm)** | 0.0% | 0.0% | 0.0% | 0.0% |
| Road transport | 0.0% | 0.0% | 0.0% | 0.0% |
| Buses and coaches | 0.0% | 0.0% | 0.0% | 0.0% |
| Passenger cars and vans | 0.0% | 0.0% | 0.0% | 0.0% |
| P2W | 0.0% | 0.0% | 0.0% | 0.0% |
| Rail | 0.0% | 0.1% | 0.0% | 0.0% |
| Air transport | 0.0% | -0.1% | 0.0% | 0.0% |

| | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| Domestic and International intra-EU | 0.0% | -0.1% | 0.0% | 0.0% |
| International extra-EU | 0.0% | -0.1% | 0.0% | 0.0% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| Intra-EU maritime transport | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total freight transport activity (Gtkm)** | 0.0% | 0.0% | 0.0% | 0.0% |
| Road transport | 0.0% | -0.1% | 0.0% | 0.0% |
| Rail | 0.0% | 0.1% | 0.0% | 0.0% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| International maritime activity | 0.0% | 0.0% | 0.0% | 0.0% |
| PO6 | | | | |
| **Total passenger transport activity (Gpkm)** | 0.0% | 0.0% | -0.1% | -0.1% |
| Road transport | 0.0% | 0.0% | 0.0% | 0.0% |
| Buses and coaches | 0.0% | 0.0% | -0.1% | -0.1% |
| Passenger cars and vans | 0.0% | 0.0% | 0.0% | 0.0% |
| P2W | 0.0% | 0.0% | 0.0% | 0.0% |
| Rail | 0.1% | 0.5% | 0.8% | 0.8% |
| Air transport | 0.0% | -0.3% | -0.5% | -0.5% |
| Domestic and International intra-EU | 0.0% | -0.3% | -0.6% | -0.6% |
| International extra-EU | 0.0% | -0.3% | -0.5% | -0.5% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| Intra-EU maritime transport | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total freight transport activity (Gtkm)** | 0.0% | 0.0% | 0.0% | 0.0% |
| Road transport | 0.0% | -0.3% | -0.5% | -0.5% |
| Rail | 0.1% | 0.4% | 0.7% | 0.7% |
| Inland waterway and domestic maritime | 0.0% | 0.0% | 0.0% | 0.0% |
| International maritime activity | 0.0% | 0.0% | 0.0% | 0.0% |

The emissions savings thought to occur as a result of each policy option are shown in Table 34. These savings are monetised using central climate change avoidance costs (€/t$CO_2$) rates from the 2019 Handbook on the External Costs of Transport (CE Delft et al., 2019): short-term (100) and long-term (249). The benefits are discounted at a rate of 3%.
The resulting reduction in external costs are presented in Table 34 as well.

**Table 34 - Reductions in GHG emissions and associated external costs in the various policy options**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| Reduction in GHG emissions (Mton $CO_2$-eq) | 22.1 | 3.7 | 1.7 | 5.6 | 1.5 | 22.1 |
| Reduction in external costs of GHG emissions (PV in million €) | 2,878.9 | 445.4 | 200.0 | 674.1 | 174.9 | 2,878.9 |

## Indirect GHG emission savings

The harmonised GHG emission figures provided by the CountEmissions EU framework may be used to improve (or harmonise) current (private and public) initiatives or to develop new ones. Based on desk study, a review of policy initiatives (see Annex B) and the state of play of GHG emissions accounting (see Annex A), and stakeholder interviews, ten potential alternative applications of the figures provided by the CounEmissions EU framework have been identified, including applications like eco-labelling of transport services, sustainable financing, green public procurement and carbon pricing (see Annex F for more details). In addition, GHG emission figures at the transport level conform the common CountEmissions EU framework may also act as criterion for defining eligibility of certain transport related actions. For example, the parallel revision of the Combined transport Directive may take into account the potential use of the CountEmissions EU framework for that purpose (see Annex B).

From the applications of the figures provided by the CountEmissions EU framework identified, sustainable financing and green public procurement are considered the most promising ones in terms of GHG emission reduction potential, followed by sustainable delivery services (see Annex F.3 for an explanation why these applications are considered the most promising ones). This finding was confirmed by the stakeholder survey, as the respondents to this survey ranked these four applications as the most relevant ones. Although it is difficult to provide estimations of the GHG emission reduction potentials of these applications, as these depend heavily on their actual design and the market where they are implemented, some illustrative figures may provide proof of the significant role they can play in mitigating GHG emissions. For example, IEA, (2017) estimates that green financing can reduce the consumption of fossil fuels by 26%, which can reduce $CO_2$ emissions by about 12%. An econometric study on the impact of green financing on $CO_2$ emissions in China shows that a 1% increase in green finance in Eastern or Central China may result in about 0.6% reduction in $CO_2$ emissions. This significant negative relationship between green financing and $CO_2$ emission levels is confirmed by many other studies, like Saeed Meo & Karim, (2022) and Tran, (2021). Another example is green public procurement of vehicles, which may reduce the $CO_2$ emissions of the fleet by 17% (EC, 2009a).

It is clear that the GHG emission reduction potential of these alternative applications can only be partly allocated to CountEmissions EU. And it may even be the case that these applications will be implemented without CountEmissions EU as well, although in a less effective way (because of a lack of harmonised GHG emissions figures at the transport service level) or in less cost-efficient way (as higher costs have to be made to produce the required GHG emissions figures). But it is also clear that CountEmissions EU has a potential important role in enabling these applications and hence that the indirect GHG emission savings of this initiative are potentially large (and probably larger than the direct emission savings).

Based on an extensive analysis of the most promising alternative applications of the harmonised GHG emission figures produced by the CountEmissions framework, minimum requirements for this framework have been developed which ensure that GHG emission figures are produced within this framework that are suitable to be used for these alternative applications (for more details, see Annex F.4). These minimum requirement are presented in Table 35.

**Table 35 - Minimum requirements of the CountEmissions EU framework to make it useable for the most promising alternative applications**

| Policy areas/elements | Minimum requirements |
|---|---|
| **Methodology** | |
| Geographical scope | Global |
| Type of emissions | All GHG emissions from combustion and refrigeration |
| Activity boundaries | Tank-to-wheel, well-to-tank, hub emissions and emissions from energy infrastructure included |
| Intended user | Operators and users/organisers |

| Policy areas/elements | Minimum requirements |
|---|---|
| **Methodology** | |
| Perspective | Ex ante and ex post |
| Granularity in calculation method | Various levels, but at least individual trips and TOCs |
| Allocation parameters | Emissions per GCD/SFD-kilometres |
| Allocation granularity | Various levels should be supported, but at least at the level of TOC and individual trip level |
| Allocation time aggregation | Annual base |
| **Harmonised input data** | |
| Type of data | Primary data is preferred, but modelled data and default data is allowed in case primary data is not available. |
| **Verification** | |
| Verification approach | Some conditions for verification of data and calculations should be available in order to ensure that the figures are conform a common methodology (to increase comparability of GHG emission figures). Some kind of certification of verifiers will help to improve the credibility of the GHG emission figures. |

The minimum requirements with respect to the methodological elements and input data are met by all policy options. However, particularly PO1 and PO3 may produce more harmonised GHG figures (as by implementing PM3, these POs provide less room for companies to make own choices in calculating GHG emissions), which may increase the usability of the GHG emissions figures for the alternative applications. At the same time, by deviating from the globally accepted ISO 14083 standard, some inconsistencies between emission practices in the international transport network may occur. PO4 and PO6, on the other hand, result in slightly lower consistency in emission figures in the EU context (as by implementing PM1 some more room for companies to make own choices in calculating GHG emissions is offered), but more consistency in the international context. With respect to verification, only PO1 ensures that the GHG emissions figures of all transport services are verified (by implementing PM8). However, in the other five policy options a verification scheme is available and operators of the various alternative applications can request companies to use these schemes to verify their GHG emissions figures. Therefore, all policy options will met the minimum requirements with respect to verification. Based on these arguments, the assessment of the policy options with respect to indirect GHG emissions savings is shown in Table 36.

**Table 36 - Qualitative assessment of the indirect GHG emission savings of the various policy options**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| Indirect GHG emission savings | ++ | 0/+ | ++ | ++ | + | ++ |

### 7.5.2 Air pollution reduction

As well as GHG emissions savings, we expect air pollution reduction through the same mechanisms. These reductions in air pollutants may contribute to a decrease in negative health impacts of these emissions, and less damage to buildings, biodiversity and agriculture. The expected air pollution reductions per policy option (monetised using the 2019 Handbook on the External Costs of Transport) are summarised in Table 37.

**Table 37 - Reductions in costs of air pollutant emissions in the various policy options**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| Reduction in costs of air pollutants (million €$_{2022}$, NPV) | 600.6 | 110.8 | 53.1 | 163.5 | 47.0 | 600.6 |

## 7.6 Social impacts

### 7.6.1 Accident avoidance

Accident avoidance happens only through the travel distance changes that result from mode shift. The expected accident avoidance values per policy option (monetised using the 2019 Handbook on the External Costs of Transport) are summarised in Table 38.

**Table 38 - Reductions in accident costs in the various policy options**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| Reduction in accident costs (million €$_{2022}$, NPV) | 2,760.5 | 424.4 | 192.2 | 645.2 | 168.6 | 2,760.5 |

# 8 Comparison of options

## 8.1 Introduction

Based on the results of the previous chapters, we compare the different policy options. Therefore, we compare the various policy options on the main economic, social and environmental impacts in Section 8.2. Subsequently, we compare the options on the following criteria:

- effectiveness: the extent to which the examined policy options would achieve the identified policy objectives (Section 8.3);
- efficiency: the costs associated with the implementation of the policy options – in total and for specific subgroups (Section 8.4);
- coherence with other EU policy measures and objectives (Section 8.5).

## 8.2 Main economic, social and environmental impacts

The main economic, social and environmental impacts of the various policy options, as assessed in Chapter 7, are presented in Table 39. The major cost element of the policy options consists of adjustment costs for businesses for switching and starting new emissions quantification methodologies. Other significant groups of costs, included in all POs, are adjustment costs related to the use of calculation tools and, with the exception of PO2, the enforcement costs for supporting the verification activities.

Policy Option 1 is a stringent one, mandating all transport operators and organisers/users (except passengers) to account for their GHG emissions (PM13) and to let this process (including the input data used) verify by EU-accredited third bodies (PM8). The costs are then very high with a total cost estimated at € 95 billion relative to the baseline, expressed as present value over 2025-2050. The use of the CountEmissions EU framework for GHG emissions accounting is fully voluntary in PO2 (PM15), as is the verification of the process and input data used for the accounting (PM10). It therefore shows the lowest total costs, estimated at € 1 billion relative to the baseline. PO3, PO4 and PO5 seek a balance between further harmonisation of GHG emissions accounting in the transport sector and the additional administrative burden for transport operators and users. They vary in methodological rigour and associated costs are higher at € 1.4 billion, € 1.5 billion and € 2.3 billion, respectively. PO6 is largely similar to PO4, except that all transport operators and organisers/users (except passengers) are mandated to account for their GHG emissions (PM13) instead of the binding-opt in variant (PM14) that is applied in PO4. Total costs associated with PO6 are expected to be around € 68 billion. The main difference in terms of costs between PO1 and PO2, on the one hand, and PO3, PO4 and PO5, on the other, comes from the extremely high uptake covering the entire population of businesses involved in transport service activities (~1.7 million firms) and performing transport services on their own account. The additional costs in PO5 compared to PO3 (€ 912 million) and PO4 (€ 747 million) are mainly associated with additional complexity for the starting, operations (including verification and using calculation tools) and switching to PEFCR, in addition to research and development investments needed to define specific PEFCR for transport services. The additional costs in PO4 compared to PO3 stem from the expected uptake of the two policy options, while PO3 will have additional adjustment costs for developing the additional features for the new reference methodology based on ISO 14083.

In terms of benefits, all the policy options result in better transparency and improved harmonisation of GHG emissions data from transport services. This is assumed to create incentives towards more efficient and sustainable transport options, resulting in the overall reduction of costs and emissions. These benefits therefore mostly represent the indirect effects of the behavioural change in the transport sector.

As regards total benefits, PO5 stands out with a clearly lower level of total benefits estimated at € 1 billion relative to the baseline, expressed as present value over 2025-2050. The indirect environmental benefits that PO5 would unlock bringing along accelerated greening of mobility, should also be considered, but cannot be accurately quantified. These benefits may translate into increased transparency, credibility, reputation and public image and higher levels of trust in supply-chain partners. PO1 and PO6 introducing the mandatory applicability shows the highest total benefits of € 16.6 billion, while the total benefits of PO4 and PO2 amount to € 3.9 billion and € 2.6 billion, respectively, and PO3 amounts to € 1.2 billion, expressed as present value over 2025-2050. The difference between PO2, on the one hand, and PO3, PO4 and PO5, on the other, is mainly driven by the benefits generated through the mandatory opt in applicability of the three latter options together with the methodology of choice, whereas the voluntary approach envisaged in PO2 is deemed of very limited effectiveness. The total benefits increase in PO4, compared to PO1, PO2 and PO5, is also associated with the possibility to use recognised datasets and certified calculation tools, resulting in the more effective and seamless implementation of the common European framework for GHG accounting for transport services.

Overall, PO2 and PO4 result in net benefits relative to the baseline. PO4 shows the highest net benefits, estimated at € 2.4 billion expressed as present value over 2025-2050, followed by PO2 (€ 1.5 billion). PO3 results in higher net costs of € 218 million, followed by PO5 with € 1.3 billion, PO6 with € 51.3 billion and PO1 with € 78.4 billion of net costs expressed as present value over 2025-2050. PO4 also shows the highest benefit to cost ratio (2.52), followed by PO2 (2.36), PO3 (0.84), PO5 (0.45) PO6 (0.24) and PO1 (0.17).

**Table 39 - Summary of costs and benefits of policy options - net present value for 2025-2050 compared to the baseline (in million €), in 2022 prices**

| Key: impacts expected | | | | | | |
|---|---|---|---|---|---|---|
| – – | – | 0 | + | ++ | | |
| Strongly negative | Weakly negative | No or negligible impact | Weakly positive | Strongly positive | | |
| | Policy Option 1 | Policy Option 2 | Policy Option 3 | Policy Option 4 | Policy Option 5 | Policy Option 6 |
| Economic impacts | | | | | | |
| Adjustment costs (National public authorities (including NABs)) | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 |
| Administrative costs (National public authorities (including NABs)) | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 |
| Adjustment costs (EEA) | -3.6 | -3.6 | -3.9 | -3.9 | -3.6 | -3.9 |
| Adjustment costs (EC) | -2.7 | -0.3 | -2.4 | -0.0 | -5.3 | -0.0 |
| Adjustment costs (businesses) | -95,010.8 | -1,084.6 | -1,374.4 | -1,541.9 | -2,283.7 | -67,927.7 |
| Administrative costs (businesses) | 0.0 | 0.0 | -0.5 | -0.5 | -0.3 | -0.5 |
| Avoided fuel use | 10,362.9 | 1,585.5 | 718.3 | 2,415.9 | 630.5 | 10,362.9 |
| Social impacts | | | | | | |
| Accident prevention | 2,760.5 | 424.4 | 192.2 | 645.2 | 168.6 | 2,760.5 |
| Environmental impacts | | | | | | |
| Climate change avoidance | 2,878.9 | 445.4 | 200.0 | 674.1 | 174.9 | 2,878.9 |
| Reduction in air pollutants | 600.6 | 110.8 | 53.1 | 163.5 | 47.0 | 600.6 |
| Indirect GHG emission savings | ++ | + | ++ | ++ | + | ++ |
| **Overall net benefits** | -78,414.4 | 1,477.3 | -217.9 | 2,352.1 | -1,272.1 | -51,329.4 |
| **Net benefits for SMEs** | -83,884 | 493 | -419 | 919 | -1,254 | -66,584 |

* All negative figures are costs, all positive figures are (net) benefits.

## 8.3 Effectiveness

In our analysis of effectiveness, we examine to which extent the general and specific objectives (SO) of CountEmissions EU, as described in Chapter 5, are met. We do this first for the specific objectives and use the results of that analysis to investigate to what extent the general objective is effectively met.

### 8.3.1 Specific objectives

The indicators we use to analyse to which extent the two specific objectives (SO) of CountEmissions EU are achieved are specified in Table 40.

**Table 40 - Objectives and indicators linked to the effectiveness of the policy options**

| General objective | Specific objectives | Indicator |
| --- | --- | --- |
| Incentivise behavioural change among businesses and customers to reduce GHG emissions of transport services through the uptake of comparable and reliable GHG emission data. | **SO1:** Ensure comparability of results from GHG emissions accounting of transport services. | – Extent by which a common reference methodology (scope, calculation rules, allocation approach) is applied.<br>– Extent to which the type and quality of input data (e.g. primary, modelled, default data) being used in transport GHG emissions calculations leads to accurate and comparable figures. |
| | **SO2:** Facilitate the uptake of the GHG emissions accounting of transport services in business practice. | – Number of transport operators/users taking up GHG emissions accounting. |

#### SO1: Ensure comparability of results from GHG emissions accounting of transport services

As explained in Chapter 5, comparability of results from GHG emissions accounting in transport can only be achieved if both the methodology and input data used are harmonised. Furthermore, it should be ensured that all entities that apply GHG emissions accounting make use of the same methodology and the same type of input data.

As shown by Table 41, the highest level of harmonisation of both the methodology as the input data used is achieved in PO3, PO4 and PO6. As for the common reference methodology, PO3 applies the most comprehensive methodological framework, i.e. the new reference methodology based on ISO 14083 but with additional elements (PM3). As this methodology leaves less room to users to make their own decisions on specific methodological elements, its output is best comparable among companies, modes and services. However, the inclusion of additional elements may lead to some inconsistencies in terms of harmonised accounting of emissions for international operations, as transport emission accounting outside the EU will probably be mainly based on ISO 14083. PO4 and PO6, on the other hand, provide a more conducive methodology (i.e. ISO 14083 – PM1) compared to PO3, as this methodology offers some more flexibility to users at the expense of a slightly lower level of harmonisation. However, as ISO 14083 is probably the methodology most used outside the EU, higher levels of harmonisation of emissions accounting for international transport operations is achieved. With respect to input data, PO3, PO4 and PO6 all include the establishment of a centralised EU emission factor database plus the option to make use of external databases which quality has been assured by the EEA (PM5). The latter element will enlarge the level of differentiation in emission intensity factors available compared to the situation where only an EU centralised database is available (as applied as PM4 in PO1, PO2 and PO5), as better use can be made of the expertise and capabilities of the players in the various transport segments. This higher level of differentiation in default emissions intensity factors results in GHG emissions figures estimated that better reflect the actual emissions, which means higher levels of accuracy and comparability. Finally, both PO3 and PO4 applying the binding opt-in regime (PM14) and PO6 applying the mandatory regime (PM13), it is ensured that both the reference methodology and set of input data as discussed above are applied by all transport operators and users that account for their transport emissions.

PO1 results in a high level of harmonisation at the methodological level (as it also applies the most comprehensive methodology – PM3), but a bit less (compared to PO3, PO4 and PO6) on the input data (as no use can be made from detailed emission intensity factors from recognised sectorial databases – PM4). As accounting for transport emissions is mandatory within PO1 (PM13), it is ensured that all transport operators/users make use of the same reference methodology and set of input data.

PO5 applies a methodological framework (PM2) that is more conducive than the one implemented in PO3/PO4/PO6. At the same time, slightly less harmonisation at the level of input data is achieved by PO5 compared to PO3/PO4/PO6, as the use of external databases is not allowed (according to PM4 that is implemented in PO5).

Finally, PO2 results in the lowest level of comparability of the results of GHG emissions accounting, particularly as this policy option allows the use of other methodologies (than the common reference methodology set by CountEmissions EU) and input data as well (PM15). Harmonisation of GHG emissions accounting at the transport level is therefore not ensured by PO2. However, the development of the EU-wide database with default emission factors (PM4) contributes to more harmonised input data in this policy option as well.

### SO2: Facilitate the uptake of GHG emissions accounting for businesses and customers

The highest level of uptake of GHG emissions accounting conform the CountEmissions EU framework is achieved in PO1 and PO6. As accounting for GHG emissions of transport services is made mandatory for all transport operators and users in these POs, a 100% uptake rate is realised from 2035 onwards (on the shorter term, SMEs are not obliged to account for their transport emissions). The uptake will be further strengthened by measures increasing confidence and trust in the GHG emissions data on the market: the data and process verification system that will become mandatory for all companies (PM8) in PO1 and for all large companies (PM6) in PO6, and the provision of (more harmonised) emission calculation tools on the market, either by the EU (PM11) in PO1 or by market parties (PM12) in PO6.

In the other four POs, the uptake rate of GHG emissions accounting will be significantly lower. From these POs, PO4 is expected to have the highest uptake rates. First, because it applies the binding opt-in scheme, which requires all transport operators/users that account for their transport emissions to do this according to the CountEmissions EU framework. And second, PO4 applies ISO 14083 as the reference methodology, which is highly acceptable to and best applicable for stakeholders, incentivising them to take up

GHG emissions accounting. Particularly in PO5, the more complicated and demanding methodology (i.e. newly developed PEF Category Rules for transport) will probably discourage some transport operators and/or users to account for their emissions. To a lesser extent, this is also the case for PO3. On the other hand, the voluntary character of PO4 limits (to some extent) the number of transport operators/users taking up GHG emissions accounting. However, as PO4 sets ISO 14083, which is largely supported by the market, as common reference methodology, higher uptake rates than in PO3 and PO5 are expected.

Table 41 - Summary of effectiveness of the various policy options

| Key: expected effectiveness | | | | |
|---|---|---|---|---|
| Negatively effective (red) | Not or weakly effective (orange) | Moderately effective (yellow) | Effective (light green) | Highly effective (dark green) |

| | Policy Option 1 | Policy Option 2 | Policy Option 3 | Policy Option 4 | Policy Option 5 | Policy Option 6 |
|---|---|---|---|---|---|---|
| SO1 - Ensure comparability of results from GHG emissions accounting in transport | | | | | | |
| Extent by which a common methodology is applied | As the use of CountEmissions EU is mandatory, the common reference methodology is the only methodology applied, ensuring a high level of harmonisation. The new reference methodology based on ISO 14083 but with additional elements, which is applied in this PO, leaves the least freedom to users to make their own choices, contributing to a high level of comparability of GHG emission figures on the EU transport market. On the other hand, deviating from the globally accepted ISO 14083 standard may lead to some inconsistencies between emissions accounting practices in the international transport network (particularly affecting maritime transport and aviation). | Because of the voluntary nature of this policy option, the common reference methodology is only applied by part of the transport operators and users applying GHG emissions accounting. Therefore, full comparability of GHG emissions of transport services is not ensured. The policy option will, however, contribute to increased comparability. | All transport operators and users applying GHG emissions accounting applies common reference methodology. Therefore, there is just one methodology applied in the market, ensuring comparable GHG emission figures. As PO1, the application of the most stringent methodology contributes to this high level of comparability on the EU transport market. On the other hand, deviating from the globally accepted ISO 14083 standard may lead to some inconsistencies between emissions accounting practices in the international transport network (particularly affecting maritime transport and aviation). | As in PO3, all transport operators and users applying GHG emissions accounting do this by the same methodology. Therefore, only one methodology is used by the market, ensuring comparable GHG emissions figures. As ISO 14083 provides some room to users to make their own choices on certain elements, the level of comparability is a bit lower than in PO3. On the other hand, this methodology is accepted as a worldwide standard, offering the opportunity to align emissions accounting in the international transport networks. | As in PO3 and PO4, all transport operators and users applying GHG emissions accounting do this by the same methodology. Therefore, only one methodology is used by the market, ensuring comparable GHG emissions figures. As the new PEFCRs are not developed yet, it is unclear whether there is less or more room for users to make their own choices on certain methodological elements than with ISO 14083. However, the use of this methodology will likely result in an even larger misalignment with respect to emission accounting in the | As the use of CountEmissions EU is mandatory, the common reference methodology is the only methodology applied, ensuring a high level of harmonisation. As mentioned for PO4, the use of ISO 14083 provides some room to users to make their own choices on certain elements. Therefore, the level of comparability is a bit lower than in PO1. On the other hand, this methodology is accepted as a worldwide standard, offering the opportunity to align emissions accounting in the international transport networks. |

| Key: expected effectiveness | | | | |
|---|---|---|---|---|
| | | | | |
| Negatively effective | Not or weakly effective | Moderately effective | Effective | Highly effective |

| | Policy Option 1 | Policy Option 2 | Policy Option 3 | Policy Option 4 | Policy Option 5 | Policy Option 6 |
|---|---|---|---|---|---|---|
| | | | | | international transport networks. | |
| Extent to which the type and quality of input data being used in transport GHG emissions calculations leads to accurate and comparable GHG emission figures | As the same methodological framework is used by all transport operators/users, everyone has to comply to the same requirements on input data. Furthermore, the existence of a mandatory EU-wide database with default emission intensity factors ensures a high level of comparability of these input values. | As the application of the CountEmissions EU framework is voluntary, part of the transport operators/users will apply other methodologies, which require or allow other types of input data. On the other hand, an EU centralised database of emission intensity factors is developed, which contributes to more comparability of input values. | All transport users/operators applying GHG emissions accounting apply the same methodological framework, implying that everyone has to comply to the same requirements on input data. The existence of a EU-wide database with default emission intensity factors contributes to a high level of comparability of these input values. As there is the possibility to make use of emissions intensity factor from external validated databases as well, higher levels of accuracy and comparability as in PO1 can be ensured, as these external databases will contain more detailed data better covering the specificities of transport services in a certain segment, country or region. | The same evaluation as for PO3 applies on this indicator. | All transport users/ operators applying GHG emissions accounting apply the same methodological framework, implying that everyone has to comply to the same requirements on input data. The existence of an EU-wide database with default emission intensity factors contributes to a high level of comparability of these input values. | The same evaluation as for PO3 applies on this indicator. |
| **SO2 - Facilitate the uptake of GHG emissions accounting for businesses and customers** | | | | | | |
| | | | | | | |

| Key: expected effectiveness | | | | |
|---|---|---|---|---|
| Negatively effective | Not or weakly effective | Moderately effective | Effective | Highly effective |

| | Policy Option 1 | Policy Option 2 | Policy Option 3 | Policy Option 4 | Policy Option 5 | Policy Option 6 |
|---|---|---|---|---|---|---|
| Number of transport operators/users taking up GHG emissions accounting. | 100% uptake rate of GHG emissions accounting (according to the CountEmissions EU framework) by transport operators and users in 2035, as the application of GHG emissions accounting is mandatory. | 4.7% of the transport operators and users apply GHG emissions accounting, of which 80% according to the CountEmissions EU framework. | 3.9% of the transport operators and users apply GHG emissions accounting (according to the CountEmissions EU framework). | 5.3% of the transport operators and users apply GHG emissions accounting (according to the CountEmissions EU framework). | 3.8% of the transport operators and users apply GHG emissions accounting (according to the CountEmissions EU framework). | 100% uptake rate of GHG emissions accounting (according to the CountEmissions EU framework) by transport operators and users in 2035, as the application of GHG emissions accounting is mandatory. |

## 8.3.2 General objective

All policy options will result in additional uptake of comparable and reliable GHG emissions figures of transport services, and hence may contribute to behavioural change among business and customers to reduce the GHG emissions of these services. From the analysis presented in Section 8.3.1, we can, however, conclude that PO1 and PO6 will be the most effective ones. Particularly as these policy options mandate every transport operator and user to account for the emissions of their transport services according to the CountEmissions EU framework. Due to this high uptake of GHG emissions accounting, these POs will result in the highest direct and indirect GHG emissions reductions, as was shown in Section 8.2.

From the three policy options implementing a binding opt-in scheme, PO4 is expected to be the most effective one. As explained above, this option will result in higher uptake rates for GHG emissions accounting than PO3 and particularly PO5. The higher effectiveness of PO4 compared to PO3 and PO5 is also illustrated by the direct GHG emissions reduction effects (see Section 8.2).

Because of its voluntary character, PO2 results in least harmonisation of the output of GHG emissions accounting. Compared to PO4, it also results in lower uptake rates of the harmonised reference methodology, although a higher uptake than in PO3 and PO5 is achieved. Because of that reason, PO4 results in slightly higher GHG emissions reductions than these two policy options.

## 8.4 Efficiency

Efficiency concerns the 'extent to which objectives can be achieved for a given cost (cost-effectiveness)'. The table below presents key efficiency indicators. Overall, PO2 and PO4 result in net benefits relative to the baseline. PO4 shows the highest net benefits, estimated at around € 2.4 billion expressed as present value over 2025-2050, followed by PO2 (€ 1.5 billion). PO3 results in higher net costs of € 218 million, followed by PO5 with € 1.3 billion, PO6 with € 51.3 billion and PO1 with € 78.4 billion of net costs expressed as present value over 2025-2050. PO4 also shows the highest benefit to cost ratio (2.52), followed by PO2 (2.36), PO3 (0.84), PO5 (0.45), PO6 (0.24) and PO1 (0.17).

**Table 42 – Summary of efficiency NPV for 2025-2050 compared to the baseline (in million €), in 2022 prices**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| Total costs | 95,017 | 1,089 | 1,381 | 1,547 | 2,293 | 67,932 |
| Total benefits | 16,602.9 | 2,566.1 | 1,163.6 | 3,899 | 1,021.0 | 16,602.9 |
| Net benefits | -78,414.4 | 1,477.3 | -217.9 | 2,352.1 | -1,272.1 | -51,329.4 |
| Benefits to costs ratio | 0.17 | 2.36 | 0.84 | 2.52 | 0.45 | 0.24 |

## 8.5 Coherence

In comparing the coherence of the policy options, we considered the following aspects:
- **Internal coherence**, analysing how the various components of the policy options operate together to achieve the objectives of CountEmissions EU.
- **External coherence**, analysing to what extent the policy options are in line (or contrast) with other EU policies.

## 8.5.1 Internal coherence

Although all five policy options address the identified problems, they do so in different ways. PO1 proposes the strongest regulatory approach including the mandatory application of the common methodology, mandatory verification rules, as well as EU centralised default data databases and calculation tools. This approach ensures that all the relevant entities account emissions, and that they do so based on the same methodology and data. PO2, to the contrary, envisages a fully voluntary framework, both in terms of the applicability and verification, based on a conducive methodology, but supported with centralised databases and calculation tools. In turn, PO3, PO4 and PO5 offer a semi voluntary approach (binding-in) and lighter verification process, but they differ in terms of the use of centralised or decentralised databases, and the type of an accounting methodology to be followed. PO6 proposes the mandatory application of the framework, but combined with a more conducive methodology, lighter verification process and some flexibility related to the use of input data and calculation of emissions. Specific choices that are made for these options will determine the implementation modalities at different effectiveness and costs. In this context, all options ensure internal coherence.

## 8.5.2 External coherence[62]

In general, the CountEmissions EU initiative is largely complementary to the current EU policy package. It addresses the information failure preventing companies, customers and passengers from monitoring and comparing fairly and accurately various transport service options in terms of their GHG emissions. This market failure is currently not/poorly addressed by other EU policies[63]. However, there are some relevant (potential) interactions between the policy options considered for CountEmissions EU and other EU/global policies. These interactions are discussed below.

### Emissions accounting in maritime transport and aviation

The following EU (and global) policies require transport operators in the maritime and aviation sector to account for their emissions:

- **Maritime transport**: the EU MRV for $CO_2$ of maritime transport[64] (EU, 2015) and the IMO Data Collection System (DCS) for fuel consumption (IMO, 2016) oblige ship operators to monitor and report on the $CO_2$ emissions of maritime vessels[65].
- **Aviation**: as part of CORSIA (ICAO, 2018) and the participation in the EU ETS (EU, 2008), airlines have to monitor and report on the $CO_2$ emissions of (part of) their flights.

[62] The analysis presented in this section is based on a thorough review of individual (current and emerging) policies at the EU and global scale. More detailed results of this review can be found in Annex D of the Annex report accompanying this report.

[63] The Car Labelling Directive (EU, 1999) and tyre labelling regulation (EU, 2020) are examples of policies focussing on information provision to transport users, but they provide only information at the vehicle (or tyre) level and not at the level of transport services (as CountEmissions EU will do). As a consequence, mitigation actions like a shift to more sustainable transport modes or increased transport efficiency, which will be facilitated by CountEmissions EU, are not targeted by these policies.

[64] The data monitored and reported for the EU MRV Directive are intended to be used for other initiatives like the possible inclusion of maritime shipping in the EU ETS (EC, 2021a) and FuelEU Maritime (EC, 2021b) as well.

[65] Actually, the IMO DCS requires ship operators to monitor data on fuel consumption only. Based on these figures $CO_2$ emissions are calculated by the IMO at an aggregate level by using default factors for the $CO_2$ intensity of various fuel types.

There are some significant methodological differences between these initiatives and (some of) the policy options considered for CountEmissions EU:

- **Scope of emissions**: all current initiatives in the maritime and aviation sector only cover $CO_2$ emissions, while the various policy options considered for CountEmissions EU also cover the other GHG emissions ($CO_2$-eq). Therefore, implementation of CountEmissions EU would require additional efforts from ship operators and airlines. However, as the non-$CO_2$ emissions can be calculated based on fuel consumption figures (which are collected for all initiatives) and energy emission factors, this extension of the scope can be made relatively easy.
- **Boundaries for emissions**: all current initiatives in the maritime and aviation sector cover tank-to-wheel emissions. All CountEmissions EU policy options are broader, considering well-to-wheel emissions (PO1-4 and PO6) or even life-cycle emissions (PO5). Extending the scope of GHG emissions accounting in these sectors to well-to-wheel emissions is in essence straightforward, as the well-to-tank emissions can be calculated based on fuel consumptions figures and specific energy emission factors. These energy emission factors are provided in all policy options by a centralised EU database. Extending the scope to full life-cycle emissions, as required by PO5, would require (significantly) more efforts from transport operators. In that case, they have to collect data on emissions related to (port) infrastructure and vessels/airplanes as well.
- **Allocation of emissions to transport service level**: current policies require operators to monitor $CO_2$ emissions at the vehicle level on a per-voyage or annual basis, and hence no allocation of emissions to the level of passengers or cargo (i.e. transport service level) is made. For all CountEmissions EU policy options, an additional step (i.e. allocation of emissions) should therefore be made.

Because of the mandatory nature of PO1 and PO6 (where every operator/user is obliged to account for emissions – PM13), the methodological differences discussed above will require some additional efforts from all operators in the maritime and aviation sector in these POs. Least additional effort are needed in PO2, as applying the CountEmissions EU framework is fully voluntary (PM15) in that policy option. From the other three policy options, particularly PO5 will result in significant additional efforts, as it defines broader boundaries for the emissions to be considered (life-cycle emissions instead of well-to-wheel emissions).

In addition to methodological differences, there are also differences with respect to the type of entities that are regulated by the current policies and the CountEmissions EU policy options. In the maritime sector, EU MRV and IMO DCS only require monitoring and reporting of emissions for ships of 5,000 gross tonnage or above. Also in the aviation sector the smallest emitters are exempted from emissions monitoring for inter-EU flights.
These scopes particularly differ from the scope that is applied in PO1 and PO6, where every operator (and user) will be obliged to account for emissions (PM13). In the other policy options, accounting of emissions at the transport level is voluntary (according to PM14 and PM15) and hence these options are less conflicting with the current policies on this issue.

Finally, there may be some minor issues that require action once a CountEmissions policy option is implemented. For example, EU MRV defines the measurement of cargo carried by roll-on/roll-off ships based on a definition given by the CEN Standard EN 16258.
This definition should be replaced by one in line with the common reference methodology of CountEmissions EU. However, as the CEN Standard EN 16258 will be withdrawn once ISO 14083 is available, this adjustment of the EU MRV regulation has to be done anyway.

Based on the analysis above, we can conclude that, although all POs are not in conflict with current policies in the maritime and aviation sector, it will result in additional efforts required from the operators in these sectors. This will particularly be the case in PO1, PO5 and PO6.

### Default emissions factors

All policy options cover the harmonisation of a data set on energy emissions factors by the EU (by PM4 or PM5). Additionally, other energy emissions factors may be used by companies as these are defined in line with rules recognised by the EU. Alignment of such a centralised dataset with existing EU policies (RED, FQD, FuelEU maritime) is key in order to harmonise the various policy initiatives at the EU level. The possibility to make use of alternative datasets (given these are recognised by the EU), as included in all policy options, facilitates the alignment of CountEmissions EU with global initiatives like CORSIA and IMO DCS.
To conclude, on this topic no risks with respect to external coherence are identified.

Next to a harmonised dataset of energy emissions factors, all policy options also provide an EU centralised database with emission intensity factors. Preferably the factors included in this database will be in line with the 'official' $CO_2$ figures cited in the regulations on $CO_2$ performance standards for new HDVs (EU, 2019b) and LDVs (EU, 2019a) (considering correction factors to account for differences between test-cycle emissions and real-world emissions in specific situations). This would increase the consistency between EU policies and may avoid confusion of stakeholders by applying different sets of emission intensity factor (and hence will increase their acceptance for CountEmissions EU). However, 'official' $CO_2$ figures for HDVs are only available for the newest vehicles and it will take quite some time till these figures are available for the entire fleet. Official $CO_2$ figures are available for a much larger share of the LDV fleet. However, up to 2017 these figures were based on the NEDC test, which deviates much more from real-world emissions than figures based on the currently used WLTP test. Because of these reasons, there may be deviations between the 'official' $CO_2$ figures and the emission intensity factors provided in the EU centralised database. Clear explanations on the reasons for these deviations may be useful in getting acceptance for the default emission intensity factors.

### Corporate Sustainability Reporting Directive

The Corporate Sustainability Reporting Directive (CSRD) (EC, 2021b) provides mandatory EU sustainability reporting standards for all large European companies[66] and all companies listed on regulated markets (except listed micro-enterprises)[67]. The implementation of this Directive will follow a stepped approach: in 2024 all large companies already subject to the current Non-Financial Reporting Directive should report, in 2025 also the other large companies, while listed SMEs only have to start in 2026.

One of the topics on which companies targeted by this Directive should report are their GHG emissions. The first draft standards of the EU Sustainability Reporting Standards[68] includes the requirement to report Scope 1, 2 and 3 $CO_2$-eq emissions. In accounting for these emissions, companies should consider the principles, requirements and guidance provided by the Greenhouse Gas Protocol. These are all in line with the methodological principles applied in the various policy options (see also Section 6.3.2). Based on these draft

[66] Companies for which two of the following three criteria are met: 1) more than 250 employees, 2) more than € 40M turnover, and/or 3) more than € 20M total assets.
[67] This Directive amends the non-financial reporting directive (EU, 2014a), amongst others, by broadening the Scope of companies covered and by providing mandatory reporting standards.
[68] See: ESRS E1 Climate change 2022.

standards, no coherence issues are therefore expected between CSRD and CountEmissions EU.

## Green Claims Initiative

The Green Claims initiative aims to provide a more harmonised approach for providing voluntary environmental information (i.e. Green Claims) and ensuring the reliability and relevance of that information (EC, 2020b). There may be some synergies between this initiative and CountEmissions EU, but as the design of the Green Claims Initiative was still uncertain when conducting the analyses for this study, further analysis of coherence was not possible.[69]

[69] A proposal for the Green Claims Directive has been adopted and published by the Commission after this part of the study was completed. See: Proposal for the Green Claims Directive.

# 9 The preferred policy option

## 9.1 Introduction

Based on the results of the previous chapter, we define in this chapter the preferred policy option (see Section 9.2). This policy option will be further described by presenting its main costs and benefits (see Section 9.3) and discuss its subsidiarity and proportionality (see Section 9.4). Finally, the operational objectives and associated evaluation indicators are presented in Section 9.5.

## 9.2 Definition of the preferred policy option

Based on the analyses carried out in the previous chapters, we conclude that PO4 results in the best balance between effectiveness and costs, and hence is considered the preferred option. As all transport operators and users who account for their emissions all have to apply the ISO 14083 standard, a high level of standardisation of GHG emission figures is ensured. The large support from stakeholders for this standard as common reference methodology for CountEmissions EU also ensures relatively high uptake rates for GHG emissions accounting, contributing to the high effectiveness of this policy option. At the same time, costs for transport operators and users are limited as only companies willing to account for their emissions have to apply the CountEmissions EU framework, from which only the large ones are obliged to let their accounting process verify by third parties. Also the costs for the EU to develop the CountEmissions EU framework are relatively low for this policy option, as no new reference methodology have to be developed for this policy option. Finally, no significant issues with respect to coherence with other EU policies have been identified for PO4.

The other policy options are not considered preferable for the following reasons:

- As the acceptance and applicability of a new reference methodology based on ISO 14083 but with additional elements is expected to be significantly lower as for ISO 14083, the uptake of GHG emissions accounting according to the CountEmissions EU framework is expected to be lower in PO3 than in PO4, resulting in lower effectiveness and efficiency.
- Because of their mandatory character, PO1 and PO6 result in significant total adjustment costs for transport operators and users. Many of the operators and users are probably not (or to a limited extent) intending to make use of the GHG emissions figures calculated[70], such that the costs significantly outweigh the benefits in this option.
- As applying the CountEmissions EU framework is fully voluntary in PO2, the level of harmonisation of GHG emissions accounting in the transport sector may not be equally high as for the other policy options. .
- The inclusion of life-cycle emissions in the scope of the common reference methodology in PO5 leads to significant costs for transport users/operators and the European Commission. As information on these emissions is expected to have little added value with respect to decision making at the transport service level, this policy option is less efficient than PO4 (the preferred option).

[70] As they would not have accounted for the GHG emission figures if they were not mandated to do so by CountEmissions EU in this policy option.

## 9.3 Costs and benefits

The full set of quantified costs and benefits for the preferred policy option are provided in Table 43. Since the preferred policy option is a strong enabler of indirect benefits (associated with innovation or the effectiveness of communications on low carbon transport for example), this is thought to be an incomplete representation.

**Table 43 - Overview of costs and benefits of the preferred policy option (€$_{2022}$, NPV)**

| Item | | Costs/benefits |
|---|---|---|
| **Costs** | | |
| Adjustment costs - | National public authorities (including NABs)) | -0.1 |
| Administrative costs - | National public authorities (including NABs)) | -0.1 |
| Adjustment costs - | EEA | -3.9 |
| Adjustment costs - | European Commission | -0.0 |
| Adjustment costs - | Businesses | -1,542 |
| Administrative costs - | Businesses | -0.5 |
| **Total costs** | | **-1,547** |
| **Benefits** | | |
| Avoided fuel used (operators and passengers) | | 2,415.9 |
| *For operators* | | *2,307.9* |
| *SME* | | *2,289.8* |
| *Large companies* | | *18.1* |
| *For consumers* | | *108.1* |
| Reduction in external costs of GHG emissions | | 674.1 |
| Reduction in external costs of air pollution emissions | | 163.5 |
| *NOx emissions* | | *149.2* |
| *PM emissions* | | *14.2* |
| Reduction in external costs of accidents | | 645.2 |
| *Fatalities* | | *306.8* |
| *Serious injuries* | | *248.0* |
| *Slight injuries* | | *90.5* |
| **Total benefits** | | **3,898.7** |

## 9.4 Subsidiarity and proportionality of the preferred policy option

As highlighted in Chapter 4, there is a clear need for EU action to harmonise and incentivise GHG emissions accounting in the transport and logistics sector. Particularly as initiatives from individual member states are currently lacking (with the exception of France) and not planned for the near future. But even in case national initiatives are initiated, there is a risk of the creation of a patchwork of national frameworks, which may result in different calculation and/or reporting requirements for transport operators and users. As transport is largely international oriented, this may lead to a higher administrative burden compared to the situation where the EU-wide preferred option is implemented. Furthermore,
the preferred option may also support the comparison of GHG emissions figures of transport operations carried out in different countries, contributing to more effective decision making on (sustainable) international transport. Finally, the introduction of the preferred policy option at the EU level may also provide some economies of scale for providers of technical support tools, like calculation tools. Developers that have integrating the common reference methodology into their tools, can offer their services on the entire EU market.

In terms of proportionality, the preferred policy option does not go beyond what is necessary to achieve the objectives. The common reference methodology applied (ISO 14083) do provide a high level of harmonisation, while at the same time it still provides some flexibility to make their own decisions on specific methodological elements. This improves the applicability of this methodology, as contextual factors can be better taken into account in the calculation process. Furthermore, as GHG emissions accounting according to the CountEmissions EU framework only have to be applied by the organisations willing to account for their emissions (i.e. binding opt-in), no additional administrative burden is created for organisations not intending to use GHG emission figures within their business practice at all. And finally, exempting SMEs from mandatory verification lowers the administrative burden for those SMEs that are willing to apply GHG emissions accounting but only have limited financial resources available for it.

## 9.5 Operational objectives and evaluation indicators

The impact and design of CountEmissions EU should be monitored and evaluated in the future. To support this monitoring and evaluation, the general and specific objectives are operationalised, through the operational objectives (see Table 44). For each of the operational objectives possible indicators to measure/assess them have been formulated. In addition, the possible data source per indicator is given.

**Table 44 - Overview of general, specific and operational objectives linked with indicators and sources**

| General objective | Specific objective | Operational objectives | Indicators | Data source |
|---|---|---|---|---|
| Incentivise behavioural change among businesses and customers to reduce GHG emissions of transport services through the uptake of comparable and reliable GHG emission data. | **SO1:** Ensure comparability of results from GHG emissions accounting of transport services. | Set ISO 14083 as common reference methodology for GHG emissions accounting of transport services. | Extent that ISO 14083 is implemented as common reference methodology at a set date. | Survey |
| | | Incentivise the use of primary data. | Number of companies applying primary data for part of their emission calculations. | Survey |
| | | Establish EU harmonised datasets for energy emission factors and emission intensity factors, allowing the use of sectorial/ national databases for emission intensity factors quality checked by the EEA as well. | Extent to which the harmonised data sets deliver the emission factors requested by stakeholders. | Survey |
| | | | Number of sectorial/national databases that have been quality checked by the EEA. | EEA |
| | | Mandate the use of a harmonised data output format. | Share of transport users/operators receiving GHG emissions output data in the harmonised format. | Survey |
| | **SO2:** Facilitate the uptake of the GHG emissions accounting of transport services in business practice. | Provide horizontal guidelines to harmonise GHG emissions accounting across sectors and segments of the transport market. | Number of guidelines downloaded/ requested. | European Commission |
| | | Ensure reliability of the output data by verifying the calculation process and input data used by transport operators/users. | Number of SMEs that choose for verification of their GHG emissions accounting process. | Survey |
| | | Certify calculation tools to ensure that these are conform the CountEmissions EU framework. | Number of calculation tools certified by EU recognised bodies. | EU recognised verification bodies |
| | | Incentivise the uptake of GHG emissions accounting according to the CountEmissions EU framework. | Number of companies applying GHG emissions accounting according to the CountEmissions EU framework. | Survey |

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# A State of play of GHG emissions accounting in transport

## A.1 Introduction

As part of this study we have analysed current standards and methodologies for GHG emissions accounting, relevant technical support tools (i.e. calculation tools and emission databases) and current GHG emissions reporting schemes and green incentive programmes. The results of the analysis of the various individual standards/methodologies, tools and schemes/programmes can be found in the Annex report accompanying this report.
An overview of the various standards/methodologies, tools and schemes/programmes including their main similarities and differences are presented in Chapter 2. In this Annex we present more details on the main elements of the individual standards/methodologies, tools and schemes/programmes.

## A.2 Standards and methodologies

Standards and methodologies provide the rules for the execution of GHG emissions accounting. Whereas standards stand on themselves and can be referred to when the rules of the standard are being followed, methodologies are part of a policy or incentive programme that sets the rules for accounting for that respective initiative. In this Annex we will not strictly distinguish standards and methodologies, as we are mainly interested in the (calculation) rules that are applied by both.

Based on an initial desk study, the results of the exploratory stakeholder interviews and discussions with the Commission, sixteen standards/methodologies have been selected for further analysis. These standards/methodologies are presented in Table 45. Various methodological elements, covering different aspects of the scope and calculation/ allocation rules applied by the methodologies/standards, have been described and discussed in more detail below.

### Geographical coverage

The majority of the standards/methodologies analysed, are used world-wide or in the EU. The CEN standard, the PEF and the Parcel Delivery Environmental Footprint are European standards, whereas the EU MRV and EU ETS aviation are EU legislations with a methodology for carbon accounting. Application is therefore in the EU. The Top Sector Logistics Method is applied in the Lean and green program which originates from the Netherlands, but is also active in the other EU countries now. Article L. 1431-3 of the French transport code is country specific as it concerns French legislation with a $CO_2$-reduction program (Objectif $CO_2$). Smartway is applied in North America.

### Geographical scope

The majority of the standards/methodologies analysed have a global scope, i.e. they can be applied to account for transport emissions anywhere in the world. However, there are a few exceptions. The methodologies directly associated to EU legislation (EU MRV and EU ETS (for aviation)), explicitly have a European scope. Article L1431-3 of the French Transport Code and the US programme SmartWay are both closely linked to national initiatives (in France and the US) and hence have a national scope.

## Type of emissions

All standards/methodologies covering more than one mode (except SmartWay), do cover $CO_2$-eq emissions (i.e. $CO_2$ emissions, but also other GHG gases like methane from fuel combustion and refrigeration). The mode-specific standards/methodologies for maritime transport and aviation, on the other hand, only cover $CO_2$ emissions. Global warming impacts of non-$CO_2$ emissions emitted at high altitudes by aviation are not covered by any of the standards/methodologies, probably because no sophisticated methodology is available to calculate the warming potential of these emissions (see Annex C.3.2 for more details). For the same reason, the global warming impact of black carbon emissions are not covered by any of the standards/methodologies, although ISO 14083 and GLEC do provide information on (accounting for) these emissions.

## Activity boundary

The standards/methodologies differ widely with respect to the coverage of activities for which the emissions are considered. The PEF/OEF framework has the broadest scope in this respect, as it covers emissions of all relevant activities, including life-cycle emissions of vehicle and infrastructure production, maintenance and disposal. These life-cycle emissions are not covered by any of the other standards/methodologies.

There is a clear distinction between the mode-specific standards/methodologies and the standards/methodologies covering all transport modes. The latter all cover both the tank-to-wheel (TTW) emissions, i.e. the emissions from energy use for propulsion, and the well-to-tank emissions, i.e. emissions of operational processes to provide the energy carrier for use in vehicles (or hubs). Emissions from auxiliary processes (vehicle operation related emissions from energy use other than propulsion) are covered by all these standards/ methodologies as well, while emissions from leakages and spills are only considered by ISO 14083. As for the emissions of hub activities, these are covered by most of these standards/methodologies, with the exception of the CEN standard, the SmartWay methodology and Article L1431-3 of the French Transport Code. Finally, ISO 14083 is the only standard/methodology covering the emissions of the production and dismantling of energy production infrastructure (e.g. power stations, windmills, etc.).

The mode-specific standards/methodologies, on the other hand, have a more limited scope with respect to the activities covered. These standards/methodologies only cover the tank-to-wheel emissions, sometimes including the emissions of auxiliary processes and emissions of leakages and spills. Emissions of hub activities or well-to-tank emissions are not covered by any of these standards/methodologies.

## Intended user

Many of the standards/methodologies are intended to be used by both transport operators/organisers and users. From the standards/methodologies that cover all transport modes, only Article L1431-3 of the French Transport Code is an exception, as this methodology is only meant to be used by transport operators and organisers. From the mode-specific methodologies/standards, only ICAO/IATA RP 1678 cover transport users, while all other methodologies only cover transport operators. As many of these methodologies are directly linked to specific legislation (i.e. EU MRV, EU ETS, CORSIA) directly targeting transport operators, the limited scope of these methodologies is logical.

### Granularity of calculation

All standards/methodologies do allow the calculation of emissions at the company level, often for both transport users and operators, but sometimes also for just transport operators. For example, the methodologies linked to EU MRV and IMO DCS do not consider the calculation of company level emissions for transport users, particularly as these policies are both only targeting transport operators. Most of the standards/methodologies covering all transport modes and some of the mode-specific methodologies do also allow calculations at higher levels of granularity, i.e. transport leg level of individual trips. Important exceptions are the Corporate Value Chain methodology and the PEF/OEF framework.

### Data categories allowed for GHG emissions calculation

The standards/methodologies covering all transport modes all prefer the use of primary data, but often allows the use of modelled and/or default input data as well (the only exception is SmartWay, that only allows the use of primary data), sometimes under the condition that it is clearly explained how these data have been retrieved (and sometimes the use of default/modelled data have to be justified as well). The latter is the case for ISO 14083, PEF/OEF, Article L1431-3 of the French Transport Code, GLEC and Top Sector Logistics method.

From the mode-specific standards/methodologies, some only allow the use of primary data (e.g. EU MRV, IMO DCS, CCWG), while others (CORSIA, EU ETS) allow the use of modelled data in case primary data is not available (or costly to collect). In the latter case, the use of a specific model to fill gaps in the primary data is required within this methodologies.

### Allocation parameter

The standards/methodologies differ widely with respect to the allocation parameters that are allowed to be used to allocate emissions to specific transport services. Some standards/methodologies (e.g. CEN Standard 16258) allows a wide range of different allocation parameters. On the other hand, standards/methodologies like the draft ISO 14258 and Top Section Logistics method are much more restrictive, only allowing one or two different allocation parameters. The latter approach contributes to the comparability of the GHG emissions figures calculated in line with the methodology/standard.

As shown by Table 45, some of the standards/methodologies do not define allocation parameters. These are the standards/methodologies that only cover the calculation of emissions at the company level. At this level of granularity, no specific allocation rules (and hence parameters) are required.

**Table 45 - Descriptive analysis of standards and methodologies**

| | Corporate Value Chain (Scope 3) Standard of the GHG Protocol | CEN Standard EN 16258 | ISO 14083 | Product Environmental Footprint (PEF) | Article L.1431-3 of the French Transport Code (Objectif $CO_2$) | *GLEC framework v1.0* | SmartWay methodology | Top Sector Logistics method | Clean Cargo Working Group carbon emissions accounting methodology | Parcel Delivery Environmental Footprint | EU MRV | IMO DCS | ICAO/IATA RP1678 | IATA Recommended practice per-passenger $CO_2$-calculation Methodology | EU ETS aviation | CORSIA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Geographical coverage (area of users)*** | | | | | | | | | | | | | | | | |
| World-wide | ■ | | ■ | | | ■ | | | ■ | | | ■ | ■ | ■ | | ■ |
| EU | | ■ | | ■ | | | | ■ | | ■ | ■ | | | | ■ | |
| National | | | | | ■ | | ■ | ■ | | | | | | | | |
| ***Geographical scope (for calculation)*** | | | | | | | | | | | | | | | | |
| Global | ■ | ■ | ■ | ■ | | ■ | | ■ | ■ | ■ | | ■ | ■ | ■ | | ■ |
| European | | | | | | | | | | | ■ | | | | ■ | |
| National | | | | | ■ | | ■ | | | | | | | | | |
| ***Boundaries*** | | | | | | | | | | | | | | | | |
| ***GHG emissions considered*** | | | | | | | | | | | | | | | | |
| $CO_2$ emissions | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Non-$CO_2$ GHG emissions from fuel and refrigeration | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | | ■ | | | | | | |
| Non-$CO_2$ effects at high altitudes | | | | | | | | | | | | | | | | |
| Black carbon emissions | | | □ | | | □ | | | | | | | | | | |
| ***Activity boundaries*** | | | | | | | | | | | | | | | | |
| Vehicle propulsion related emissions from energy use (TTW) | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Vehicle operation related emissions from energy use other than propulsion | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | | | ■ | ■ |
| Vehicle operation related emissions from leakage and spills | □ | | ■ | ■ | | | | | | | ■ | ■ | | | ■ | ■ |
| Emission related to transport activities at hubs | ■ | | ■ | ■ | | ■ | | ■ | | ■ | | | □ | | | |
| Emission from energy provision (WTT) excluding energy infrastructure construction | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | | ■ | | | | | | |
| Emission from production and dismantling of energy production infrastructure | □ | | ■ | ■ | | | | | | | | | | | | |

| | Corporate Value Chain (Scope 3) Standard of the GHG Protocol | CEN Standard EN 16258 | ISO 14083 | Product Environmental Footprint (PEF) | Article L.1431-3 of the French Transport Code (Objectif $CO_2$) | *GLEC framework v1.0* | SmartWay methodology | Top Sector Logistics method | Clean Cargo Working Group carbon emissions accounting methodology | Parcel Delivery Environmental Footprint | EU MRV | IMO DCS | ICAO/IATA RP1678 | IATA Recommended practice per-passenger $CO_2$-calculation Methodology | EU ETS aviation | CORSIA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All remaining other life-cycle emissions from transport (e.g. vehicle construction and vehicle infrastructure construction) | No | No | No | Yes | No | No | No | No | No | No | No | No | No | No | No | No |
| ***Intended user*** | | | | | | | | | | | | | | | | |
| Transport service operator | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Transport service organiser | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | No | No | Yes | No | No | No |
| Transport service user | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | No | No | No | Yes | No | No | No |
| ***Granularity for calculation*** | | | | | | | | | | | | | | | | |
| Total GHG emissions of transport operator | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| (Total) GHG emissions of transport service user | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| Transport operation category (TOC) | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| Individual trip | No | Yes | Yes | No | Yes | Yes | No | Yes | No | Yes | Yes | No | No | No | No | No |
| ***Data categories allowed for GHG emissions calculation*** | | | | | | | | | | | | | | | | |
| Primary data (based on energy use) | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Modelled data | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | No | No | No | No | No | No | Yes | Yes |
| Default data | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | No | Yes | No | No | Yes | No | No | No |
| ***Allocation parameter*** | | | | | | | | | | | | | | | | |
| Pkm or tkm (real distance) | No | Yes | No | No | Yes | No | Yes | No | No | No | No | No | No | No | No | No |
| Pkm or tkm SFD | No | Yes | Yes | No | No | Yes | No | No | No | No | No | No | No | No | No | No |
| Pkm or tkm GCD | No | Yes | Yes | No | No | Yes | No | Yes | No | No | No | No | Yes | Yes | No | No |
| Number of passengers/freight quantity | No | Yes | No | No | Yes | Yes | Yes | No | No | No | No | No | Yes | Yes | No | No |
| Number of trips | No | Yes | No | No | No | Yes | No | No | No | No | No | No | No | No | No | No |
| Kilometres | No | Yes | No | No | Yes | Yes | Yes | No | No | No | No | No | No | No | No | No |
| Other | No | No | No | No | Yes | No | No | No | Yes | Yes | No | No | No | No | No | No |

= No   = Yes   = Possible   = Unknown

## A.3 Technical support tools

Two types of technical support tools are considered in this section: calculation tools and databases providing emission intensity factors. The most relevant calculation tools and databases have been identified based on an initial desk study, results of the exploratory interviews and discussions with the Commission.

The considered calculation tools and databases are presented in Table 46. Below, we describe these tools in a bit more detail based on some general characteristics.

### Geographical scope

Most of the calculation tools apply a global scope, meaning that emission calculations for transport movements all over the world can be made. There are a few exceptions: EcoPasssenger and the Eurocontrol Small Emitters Tool apply a European scale, while the SNCF tool is intended to apply calculations at the national level. As for the emission intensity factor databases, most have a national scale (i.e. France, UK or the Netherlands). Only the GLEC database provide emissions intensity factors that are meant to be used globally.

### Type of emissions

All calculation tools cover $CO_2$ emissions, while most of them also include the main non-$CO_2$ GHG emissions (like methane, $N_2O$). Exceptions are EcoPassenger and the Small Emitters Tool, which do not cover these non-$CO_2$ GHG emissions (and for Carbon Visibility it is not clear whether these emissions are covered). None of the calculation tools cover black carbon emissions. The climate impact of non-GHG emissions emitted at high altitudes (by aviation) are included in a few calculation tools (i.e. Carbon Care, GHG Protocol Calculation tool, EcoPassenger, and EcoTransIT), although no undisputable methodology to calculate the climate impact of these emissions is available (see Annex A.2).

As for the databases, all of them cover $CO_2$-eq emissions (i.e. $CO_2$ emissions and other GHG emissions). Most of them (except for the DBEIS/DEFRA database) also include the climate impacts of non-GHG emissions emitted at high altitudes. For black carbon, none of the emission databases provide emission intensity factors.

### Activity boundary

All calculation tools include tank-to-wheel emissions from vehicle propulsion and well-to-tank emissions. The only exception is the Small Emitters Tool from EUROCONTROL, which only includes tank-to-wheel emissions (as this tool is initially developed to support airlines in emission calculations for the EU ETS, for which the scope is limited to tank-to-wheel emissions). Emissions from hub activities are included in many tools as well. Emissions from auxiliary processes (e.g. refrigeration), on the other hand, are only included by a minority of the tools, although for quite some tools it is unclear from the available documentation whether these emissions are included or not. Emissions from leakages and spills are only included in a few tools (i.e. BigMile, GHG Protocol tool and the REff Tool). Finally, life-cycle emissions (from vehicle and infrastructure production, maintenance and disposal are not covered by any of the calculation tools.

As for the databases, these do (with a few exceptions) provide emission intensity factors for (almost all) tank-to-wheel and well-to-wheel emissions of vehicle propulsion and hub activities, including the emissions from auxiliary processes and leakages/spills. On the other hand, none of them provides emission intensity factors for life-cycle emissions.

## Intended user

Most of the calculation tools are developed for a broad audience, having transport operators, organisers and users as intended user. An important exception is the Eurocontrol Small Emitters Tool, which is primarily meant to offer support to small aviation companies for ETS calculations. Some of the other tools (e.g. Seaexplorer and the SNCF tool) are mainly intended to be used by transport users and to a lesser extent by transport operators/organisers. The databases with emission intensity factors are intended to be used by all types of users.

## Granularity for calculation

The calculation tools differ with respect to the level of granularity the emission calculations are made. Tools like BigMile and Carbon Care, which are mainly meant to be used by logistic companies, provide the opportunity to calculate emissions at the level of companies individual trips and TOCs. On the other hand, there are also tools available that only calculate emissions at the company level (e.g. REff Tool) or only at the trip/TOC level (e.g. NTMCalc). These differences in granularity are probably closely related to the targeted public of the tool.

## Type of tool

The various calculation tools differ in the functions offered. Most of the tools are mainly offering users the option to calculate emissions based on default emission intensity factors (although they differ with respect to the level of detail). On top of that, some tools (e.g. Carbon Visibility, REff Tool) allow the use of primary data (combined with default values) as well. Finally, some detailed accounting tools can be distinguished which provide more detailed functions, like allocating emissions towards individual shipments. These tools (i.e. BigMile, LogEC, Tracks) offer services for transport companies to execute detailed calculations.

## Alignment with standards/methodologies

Most calculation tools are aligned with one or multiple standards/methodologies, implying that the calculation approach applied (and input data required) by the tool is in line with the requirements set by a specific standards/methodology. Most of the tools are aligned with the EN 16268 Standard and some of them with the GLEC methodology as well. Four calculation tools (i.e. GHG Protocol tool, GreenRouter, the REff Tool and Tracks) are in line with the GHG Protocol (as well). As shown in Annex D for several calculation tools alignment with the upcoming ISO 14083 Standard is already announced.

**Table 46 - Descriptive analysis of technical support tools**

| | Calculation tools | | | | | | | | | | | | | | | Database emission intensity factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BigMile | Carbon Care | Carbon Visibility | EcoPassenger | EcoTransit | EUROCONTROL small emitters tool | GHG Protocol Calculation tool for transport | GreenRouter | LogEC | NTM calc | REff Tool | Seaexplorer | SNCF | TKBlue | Tracks | ADEME database | DBEIS/DEFRA database | GLEC database | STREAM database |
| **Geographical scope (for application)** | | | | | | | | | | | | | | | | | | | |
| Global | | | | | | | | | | | | | | | | | | | |
| European | | | | | | | | | | | | | | | | | | | |
| National | | | | | | | | | | | | | | | | | | | |
| **Boundaries** | | | | | | | | | | | | | | | | | | | |
| ***Type of emissions*** | | | | | | | | | | | | | | | | | | | |
| $CO_2$ emissions | | | | | | | | | | | | | | | | | | | |
| Non-$CO_2$ GHG emissions from fuel and refrigeration | | | | | | | | | | | | | | | | | | | |
| Non-$CO_2$ effects at high altitudes | | | | | | | | | | | | | | | | | | | |
| Black carbon emissions | | | | | | | | | | | | | | | | | | | |
| ***Activity boundaries*** | | | | | | | | | | | | | | | | | | | |
| Vehicle propulsion related emissions from energy use (TTW) | | | | | | | | | | | | | | | | | | | |
| Vehicle operation related emissions from energy use other than propulsion | | | | | | | | | | | | | | | | | | | |
| Vehicle operation related emissions from leakage and spills | | | | | | | | | | | | | | | | | | | |
| Emission related to transport activities at hubs | | | | | | | | | | | | | | | | | | | |
| Emission from energy provision (WTT) excluding energy infrastructure construction | | | | | | | | | | | | | | | | | | | |

| | Calculation tools | | | | | | | | | | | | | | | Database emission intensity factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BigMile | Carbon Care | Carbon Visibility | EcoPassenger | EcoTransit | EUROCONTROL small emitters tool | GHG Protocol Calculation tool for transport | GreenRouter | LogEC | NTM calc | REff Tool | Seaexplorer | SNCF | TKBlue | Tracks | ADEME database | DBEIS/DEFRA database | GLEC database | STREAM database |
| Emission from production and dismantling of energy production infrastructure | | | | [green] | | | | | [yellow] | | | | [yellow] | [yellow] | | [yellow] | [yellow] | | [green] |
| All remaining other life-cycle emissions from transport (e.g. vehicle construction and vehicle infrastructure construction) | | | | | | | | | | | | | | | | | | | |
| **Intended user** | | | | | | | | | | | | | | | | | | | |
| Transport service operator | [green] | [green] | [green] | | | [green] | [green] | [yellow] | [green] | | [green] | | | [green] | [green] | [green] | [green] | [green] | [green] |
| Transport service organiser | [green] | [green] | [green] | [green] | [green] | | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] |
| Transport service user (excl. organiser) | [green] | [green] | [green] | [green] | [green] | | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] |
| **Granularity for calculation** | | | | | | | | | | | | | | | | | | | |
| Total GHG of transport operator | [green] | [green] | [green] | | | [green] | [green] | [green] | [green] | | [green] | | | [green] | [green] | | | | |
| (Total) GHG emission of transport service user | [green] | [green] | [green] | | [green] | | [green] | [green] | [green] | | | [green] | | [green] | [green] | | | | |
| Transport operation category (TOC) | [green] | [green] | [green] | | | | [yellow] | [green] | [green] | [green] | | [green] | | [yellow] | [green] | | | | |
| Individual trip | [green] | [green] | [green] | [green] | [green] | [green] | [yellow] | | [green] | [green] | | [green] | [green] | [yellow] | [green] | | | | |
| Not a calculation tool | | | | | | | | | | | | | | | | [green] | [green] | [green] | [green] |
| **Type of tool** | | | | | | | | | | | | | | | | | | | |
| Calculation with defaults | | [green] | [green] | [green] | [green] | | [green] | [green] | | [green] | [green] | [green] | | [green] | | | | | |
| Conversion of primary fuel data to $CO_2$ (based on set of energy emission factors) | [green] | [green] | [green] | | | | [green] | | [green] | | [green] | [green] | | [green] | [green] | [green] | [green] | [green] | [green] |
| Emission allocation | [green] | | | | | | | | [green] | | | | | [yellow] | [green] | | | | |
| Database of emission intensity factors | [green] | | | [green] | [green] | | [green] | | [green] | | | | [green] | | | [green] | [green] | [green] | [green] |
| Emission modelling | [green] | | [green] | [green] | [green] | [green] | [green] | [green] | [green] | [green] | | | [green] | | | | | | |
| Emission modelling based on collected primary data by the tool | [green] | | [green] | | | [green] | | | | | [green] | [green] | [green] | | | | | | |
| Comparison of carrier performance | | | | | | | | | [green] | | | | | | | | | | |

| | Calculation tools | | | | | | | | | | | | | | | Database emission intensity factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BigMile | Carbon Care | Carbon Visibility | EcoPassenger | EcoTransit | EUROCONTROL small emitters tool | GHG Protocol Calculation tool for transport | GreenRouter | LogEC | NTM calc | REff Tool | Seaexplorer | SNCF | TKBlue | Tracks | ADEME database | DBEIS/DEFRA database | GLEC database | STREAM database |
| **Alignment with standards/methodologies** | | | | | | | | | | | | | | | | | | | |
| EN 16258 | Yes | Yes | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | | Yes | | | | | |
| GLEC | Yes | | Yes | | Yes | | | Yes | | | Yes | | | Yes | Yes | | | | |
| GHG Protocol | | | | | | | Yes | Yes | | | Yes | | | | Yes | | | | |

= No = Yes = Possible = Unknown

## A.4 GHG emissions reporting schemes and green incentive programmes

In this Annex we discuss some relevant GHG emissions reporting schemes and green incentive programmes. The schemes/programmes considered have been identified based on an initial desk study, results of the exploratory interviews and discussions with the Commission. The overview provided below is not intended to be exhaustive, but instead focusses on the main schemes and programmes currently available.

Table 47 provides an overview for GHG emissions reporting schemes and green incentive programmes considered. As shown, all schemes/programmes are targeting freight transport, although there are some differences in the scope of modes considered. For example, GLEC cover all freight transport, while the Clean Cargo Working Group (CCWG) is targeting container shipping.

Below, we discuss these schemes/programmes in a more detail based on some general characteristics.

### Geographical scope

The schemes and programmes differ widely with respect to their geographical scope. Objectif $CO_2$, Lean & Green and SmartWay have developed from national greening incentives and therefore have (particularly) a national focus. The Dutch Lean & Green programme is currently being extended to other European countries as well, such that its initial national scope is broadening to a European scope. CCWG and GLEC have developed by the transport industry which operates globally, and therefore these schemes have a global scope.

### Goal and content of the initiative

All schemes an programmes considered in this section aim to harmonise and incentivise the use of emissions accounting in transport. For that purpose, methodological guidance and reporting requirements are provided by all schemes/programmes. Most of the programmes/ schemes (except CCWG and GLEC) do also offer specific calculation tools, that may support participants in their accounting exercises. Finally, Objectif $CO_2$ and Lean & Green also installed a certification scheme in order to improve the reliability of the GHG emission figures provided by their participants. Certification of output is voluntary within the GLEC framework.

Most of the initiatives (with the exception of GLEC) have broader goals than just accounting of emissions. Objectif $CO_2$, Lean & Green and TK'Blue, for example, also incentive companies to define emission reduction targets and strategies. Additionally, some of the schemes/programmes support (anonymised) benchmarking as well.

### Intended user

All programmes and schemes target all relevant players in their markets, i.e. transport operators/organisers and users.

## Alignment with standards/methodologies

The requirements set for emission accounting within these schemes/programmes are aligned with one or multiple standards/methodologies discussed in Annex A.2. For example, the CCWG initiative applies its own methodology, but this methodology is also aligned with GLEC and the GHG Protocol.

**Table 47 - Descriptive analysis of GHG emissions reporting schemes and green incentive programmes**

| | CCWG | GLEC | French Objectif $CO_2$ | Lean & Green | SmartWay | TK'Blue |
|---|---|---|---|---|---|---|
| **Geographical scope (for application)** | | | | | | |
| Global | ■ | ■ | | | | |
| European | | | | ■ | | ■ |
| National | | | ■ | ■ | ■ | |
| **Goal of initiative** | | | | | | |
| Accounting emissions | ■ | ■ | ■ | ■ | ■ | ■ |
| Defining reduction strategies | | | ■ | ■ | | ■ |
| Benchmarking | ■ | | | ■ | ■ | ■ |
| **Intended user** | | | | | | |
| Transport service operator | ■ | ■ | ■ | ■ | ■ | ■ |
| Transport service organiser | ■ | ■ | ■ | ■ | ■ | ■ |
| Transport service user | ■ | ■ | ■ | ■ | ■ | ■ |
| **Modes covered** | | | | | | |
| Modes covered | Container shipping | All freight | All freight modes and public transport | All freight but focus on continental transport | All freight except maritime | All freight modes except IWT and logistics warehouses |
| **Content** | | | | | | |
| Calculation tool | | | ■ | ■ | ■ | ■ |
| Reporting requirements | ■ | ■ | ■ | ■ | ■ | ■ |
| Verification of input/calculations mandatory | | | ■ | ■ | | |
| **Aligned with standard/methodology** | | | | | | |
| EN 16258 | | ■ | ■ | ■ | | |
| GLEC | ■ | ■ | | ■ | | |
| Article L1431-3 of the French Transport Code | | | ■ | ■ | | ■ |
| GHG Protocol | ■ | ■ | | | | |
| SmartWay | | | | | ■ | |
| CCWG | ■ | ■ | | | | |

| **Verification of output** | | | | | | |
|---|---|---|---|---|---|---|
| No | Yes | | | | Unknown | Yes |
| Voluntary | | Yes | | | Unknown | |
| Verification by third party | | | Yes | Yes | Unknown | |

☐ = No ■ = Yes ■ = Possible ■ = Unknown

# B Other relevant EU/global policies

As part of the desk study, we have analysed the (potential) interactions of the CountEmissions EU initiative and existing (and planned) EU (and relevant other international) policies. An overview of the policies covered by this analysis is given in Table **48**. For each of the individual policies, a factsheet was produced. These factsheets can be found in Annex D of the separate Annex report accompanying this report.

The results of the analysis of other EU and global policies were used for several purposes, including:
- as input for the definition and analysis of the various elements of a common reference methodology (see Annex C);
- as input for the analysis of alternative applications of the GHG emission figures provided by the CountEmissions EU framework (see Annex F);
- as input for the analysis of external coherence of the various policy options (see Section 8.5).

**Table 48 - Overview of assessed policy frameworks**

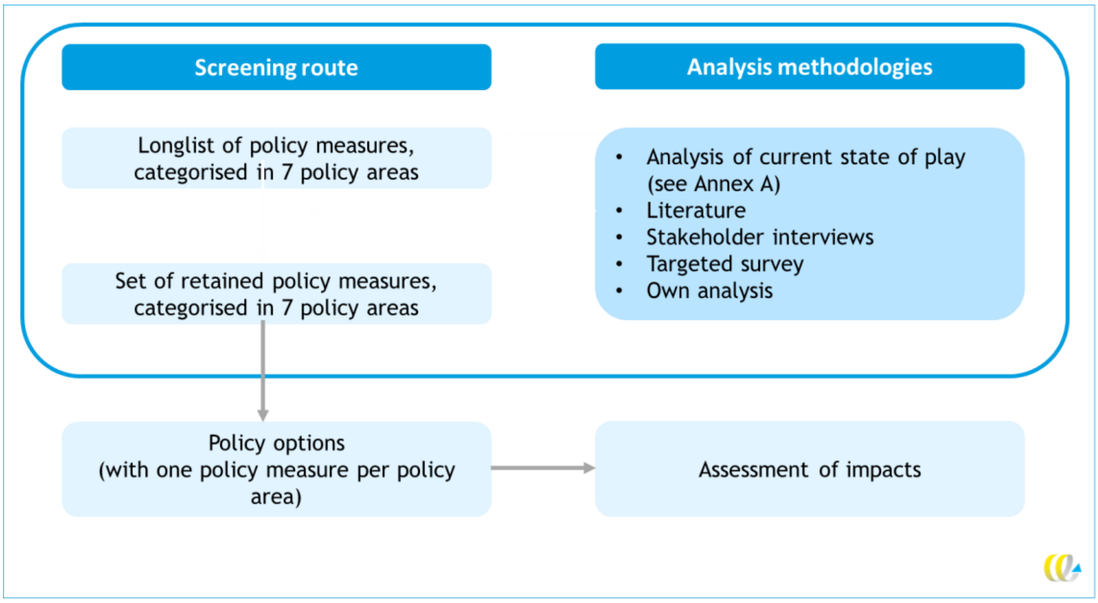
| Transport related EU framework |
| --- |
| – Renewable Energy Directive II and III (Directive 2018/2001 + proposal for RED III);<br>– Fuel Quality Directive (Directive 2009/30);<br>– $CO_2$ emissions performance standards for new light duty vehicles (Regulation (EU) 2019/631);<br>– $CO_2$ emissions performance standards for new heavy duty vehicles (Regulation (EU) 2019/1242);<br>– EU MRV of $CO_2$ emissions from maritime transport (Regulation (EU) 757/2015);<br>– EU ETS (Directive 2003/87/EC), including planned extensions of the scheme;<br>– Clean Vehicles Directive (Directive 2009/33);<br>– Car labelling Directive (Directive 1999/94/EC);<br>– Tyre Labelling Regulation (Regulation 2020/740);<br>– Regulation on electronic freight transport information (Regulation (EU) 2020/1056);<br>– FuelEU Maritime;<br>– Combined Transport Directive (Directive 92/106/EEC), including planned revision;<br>– Passenger rights regulatory framework, including current review. |
| **Transport related global frameworks** |
| – CORSIA - Carbon Offsetting and Reduction Scheme for International Aviation;<br>– IMO Data Collection System for fuel oil consumption of ships. |
| **Other relevant EU frameworks** |
| – Corporate Sustainability Reporting Directive (CSRD);<br>– EU Taxonomy (Regulation (EU) 2020/852;<br>– Product Environmental Footprint (PEF) and Organisation Environmental Footprint (OEF) (Commission Recommendation (EU) 2021/2279); |

# C Selection of policy measures

## C.1 Introduction

This annex describes how we have come to a clear set of policy measures that forms the basis for the policy options considered in this study (see Figure 13). We started the analysis with the identification of a longlist of policy measures, based on the analysis of the current state of play (Annex A), literature and stakeholder interviews. The policy measures on this longlist are screened using several criteria, which were chosen based on information from the aforementioned sources and in addition the targeted stakeholder survey and own analysis. Based on the screening analysis we have selected a set of policy measures that are input for the definition of policy options.

**Figure 13 - Representation of screening process towards clear set of policy measures in the proceedings of the impact assessment process**




As mentioned in Section 0, we have grouped the policy measures along seven policy areas (see Table 49 for details). For each area the screening analysis is performed separately, starting with a longlist of policy measures and resulting in a selection of one or a few alternative policy measures that are retained for the further assessment.

**Table 49 - Policy areas and definition**

| Policy areas | Subject of policy measures in policy area |
|---|---|
| Methodological framework | Definition of a common reference methodology for calculating and allocating of emissions of transport. |
| Input data and sources | Definition of input data to be used for accounting. |
| Harmonised output data | Definition of harmonised format of emissions output data, to be shared between transport service operators, organisers, and users. |

| Policy areas | Subject of policy measures in policy area |
|---|---|
| Sectoral implementation support | The support of a harmonised implementation of CountEmissions EU in various transport segments. |
| Conformity | Procedures to verify the results of GHG emission accounting. |
| Complementary measures | The requirements on calculation tools (to make GHG emissions better applicable). |
| Applicability | The application of the CountEmissions EU framework and the instrument type used for that. |

In Section C.2 we further describe in more detail the approach for the screening analysis of the policy measures. In Sections C.3-C.9 we describe the analysis per policy area. Finally, an overview of the discarded policy measures, including the rationale for discarding, is presented in Section C.10.

## C.2 Approach for screening analysis and selection of policy measures

In order to define a clear set of policy measures, we have applied a three step approach (see Figure 14) which is in line with Tool #16 of the Better Regulation Guidelines:

- **Step 1: Identification of longlist of policy measures**
  For each policy area, a longlist of policy measures that reply to the relevant problem drivers and specific objectives has been developed. The development of this list has been based on the analysis of the current state of play (see Annex A), other relevant EU/international policies (see Annex B), a review of relevant literature, results from the stakeholder consultation (see Annex G) and discussions with the Commission.
- **Step 2: Screening of the policy measures using specific criteria**
  All policy measures on the longlist have been screened on a set of criteria. Because of the heterogeneity of the various policy areas, different criteria have been set for each policy area. The screening analysis is qualitative, based on inputs received from the stakeholder consultation, evidence from the literature and discussions with the Commission. A five-scale qualitative ranking for each of the criteria was used to identify the viability of the various policy measures.
- **Step 3: Selection of policy measures**
  Based on the results of Step 2, the most viable policy measures have been selected for the considered policy area. For each of the policy areas, at least one policy measure has been selected, but often more than one viable policy measure was identified. Both the retained and discarded measures have been discussed with the Commission in order to have a shared agreement on the final set of retained policy measures.

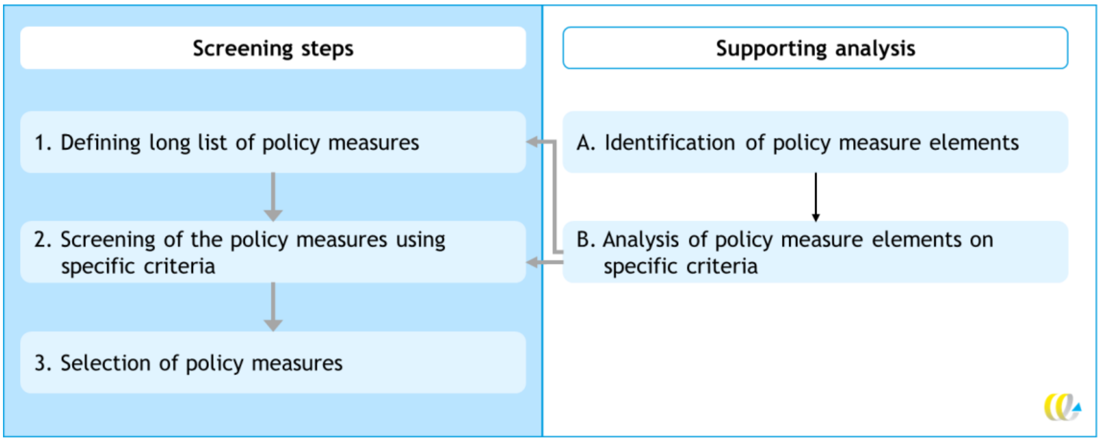
As is also shown by Figure 14, for three policy areas (i.e. methodological framework, input data and sources and applicability), a supporting analysis have been carried out. The policy measures in these three areas consist of different elements, which can be designed in various ways. For example, the methodology for emissions accounting cover elements like the type of emissions included, the type of calculation approach applied, the level of time aggregation, etc. For all these elements different design alternatives exist (e.g. for the type of emissions included total $CO_2$ emissions, all GHG emissions or all GHG emissions + black carbon can be chosen). Because of these large number of elements and design alternatives per element, numerous different policy measures are (theoretically) possible for these policy areas. In order to limit the number of policy measures to be covered in the screening analysis, we therefore performed a supporting analysis, screening the various elements and their design alternatives.

This supporting analysis consisted of two steps:

1. **Supporting Step A: identification of policy measure elements**
   For the three relevant policy areas, a longlist of relevant policy measure elements and alternatives to design those elements was defined. Inputs from the analysis of the current state of play (see Annex A), other relevant EU/international policies (see Annex B), relevant literature, the stakeholder consultation (see Annex G) and discussions with the Commission were used to define this list.
4. **Supporting Step B: analysis of policy measure elements on specific criteria**
   For each of the policy elements, the design alternatives were analysed based on specific criteria. This analysis was qualitative, scoring the alternatives on a five-point scale. As input for this analyses we made use of the results of the stakeholder consultation, evidence from the review of existing standards/methodologies for GHG emissions accounting, input from the literature and discussions with the Commission. Based on the results, the most viable design alternative(s) for each policy measure element was defined.

The results of the supporting analysis were used to define the longlist of policy measures (Step 1), by defining/choosing policy measures that apply for (the majority of) the elements the most viable design alternative(s). For example, as the supporting analysis shows that the GHG emissions accounting methodology should cover all GHG emissions, a methodology only covering $CO_2$ emissions was discarded for the longlist. Furthermore, some results of supporting Step B were also used as input for the screening analysis of the policy measures (Step 2).

**Figure 14 - Screening steps for the selection of policy measures**




## C.3 Methodological framework

The definition of the methodology is key for the CountEmissions EU initiative, to ensure that emission calculations are providing harmonised results. The common reference methodology needs to make clear choices on the scope of the emission calculation, should give the calculation rules, and make clear what calculation options are allowed.

As the methodology consists of various elements, we first conduct two supporting steps:
1. Identifying the various methodological elements and the alternatives to design them.
2. Assess the design alternatives for each of the elements on specific criteria.

The results of this supporting analysis is used in the screening analysis, which is presented in Sections C.3.3 to C.3.5.

### C.3.1 Supporting Step A: Identification of methodological elements

In the exploratory interviews and from the analysis of current standards and methodologies (see Annex A), we have identified various methodological elements of importance for the calculation framework. We have clustered the methodological elements in two themes:
1. The scope of emission calculation.
2. The method of emission calculation.

For each theme an overview of the identified elements and design alternatives is presented in Table 50. The definition of calculation input data and output data are also part of the methodology, but are discussed as part of separate policy areas (see Sections C.4 and C.5) as they can also be defined independently of the methodology (given that the methodology allows for it).

**Table 50 - Overview of calculation methodology elements and relevant design alternatives for these elements**

| **Element** | **Design alternatives** | | | |
|---|---|---|---|---|
| | **Scope of emission calculation** | | | |
| ***Geographical scope*** | ***Global*** | ***European*** | | |
| Type of emissions included | $CO_2$ emisisons | Non-$CO_2$ GHG emissions originating from combustion of fuel | Non-$CO_2$ GHG emissions originating from refrigeration | |
| | Global warming effect of emission of non-$CO_2$ products (e.g. water vapour, contrails, $NO_x$) at high altitudes | Global warming effect of black carbon emissions | | |
| Activity boundaries of the methodology | Vehicle propulsion emissions related from energy use (TTW) | Emissions from auxiliary processes (other than propulsion) during vehicle operation (TTW) (e.g. cooling of freight) | Vehicle operation emissions related to leakage and spills | Emissions from hub activities |
| | Emission from energy provision (WTT), excluding energy infrastructure construction | Emission from construction and dismantling of energy production infrastructure | Life-cycle GHG emission of vehicle construction and maintenance | Life-cycle GHG emission of vehicle infrastructure construction and maintenance |
| Intended users | Transport service operator | Transport service organiser | Transport service user (excl. organiser) | |
| Use perspective | Ex post | Ex ante short-term | Ex ante calculations for long-term scenarios | |
| Emission perspective | Service average GHG emissions | Time/situation specific average GHG emissions | Marginal GHG emissions | |
| | **The method of emission calculation and allocation to transport services** | | | |
| Required granularity of calculation | Total GHG of transport operator | Total GHG emission of transport service user (freight) or organiser | Transport service type | Transport operation category (average over period) |
| | Single vehicle | Individual trip | Total GHG emissions of hub operator | Per activity at hub |
| Allocation parameter for allocation to transport services | Tonne-kilometre | Passenger-kilometre | Tonne-kilometre SFD | |
| | Passenger-kilometre SFD | Tonne-kilometre GCD | Passenger-kilometre GCD | |
| Allocation granularity for allocation to transport services | On company level (e.g. average for transport company) | Transport operation category (e.g. average between hubs) | Trip level – journey specific | |

| Element | Design alternatives | | | |
|---|---|---|---|---|
| Flexibility in calculation method | The user can choose the calculation option from a predefined list | The required calculation option depends on the stakeholder group applying the calculations | The calculation options are ranked from most preferable to least preferable calculation option | The calculation option with best accuracy, comparability is prescribed for all users |

## C.3.2 Supporting Step B: Analysis of methodological elements

We have analysed the different design alternatives for each of the methodological elements listed above on the criteria presented in Textbox 9. The criteria have been identified based on literature and on discussions with the Commission.

**Textbox 9 - Definition of screening criteria**

- **Relevance**: the extent to which the element is relevant for the GHG emissions within the influence sphere of the reporting entity and/or serves the decision-making of the reporting entity to reduce GHG emissions both internal and external to the company.
- **Applicability by stakeholders**: the complexity the reporting entity encounters when to applying the element in the reporting.
- **Acceptability by stakeholders**: the extent to which stakeholder are willing to apply the element in the reporting, taking into account the efforts needed and the value they get out of it.
- **Accuracy**: the extent to which the reported emissions are free of errors and faithfully represent the actual emissions.
- **Comparability**: the extent to which the element allows for meaningful comparisons of GHG emissions over time and between reporting entities (in the same market).
- **Reproducibility**: the extent to which different organisations using the same methodology and data would arrive at the same GHG emission estimates.
- **Robustness**: the frequency with which the element has to be updated over time and the amount of effort that requires.

We have scored the design alternatives for each of the methodological elements on a 1-5 scale corresponding to a colour scale from green to red. The interpretation of this scale is presented in Table 42.

**Table 51 - Interpretation of screening analysis scale**

| | Relevance | Applicability by stakeholders | Acceptability by stakeholders | Accuracy | Comparability | Reproducibility | Robustness |
|---|---|---|---|---|---|---|---|
| 1 | High GHG impact in transport, and important to make right choices in transport sector. | Easy to apply, already current practice. | Common practice. | Available methods are trustworthy; little debate. | 1. No discussions on method and/or 2. right granularity to compare. | Methods do not leave open interpretation. | Method of calculation is not really changing (only minor updates). |
| 2 | Medium GHG impact in transport, but important to make right choices in transport sector. | A more differentiated approach is needed, guidance/tooling is available. | Applied already by many. | Estimates need to be made, but are representative for many cases. | 1. Different methods are available, but results are quite similar and/or 2. granularity allows good comparison. | Little interpretations within the method are possible. | Every year a few values need to be updated. |
| 3 | Medium GHG impact in transport, medium importance to make right choices in transport sector. | Differentiated approach is needed, guidance and tooling is available but less common. | Relatively unknown, more efforts are needed. | Estimates need to be made, that are reasonably representative for many cases. | 1. Different methods are available, and results can be somewhat different and/or 2. granularity allows for rough comparison. | Quite some interpretations in the methods need to be made. | Every year updates; quite some work is needed. |
| 4 | Medium/low GHG impact in transport, low importance to make right choices in transport sector. | Hard to find the right information or tooling. | Difficult to apply, little guidance is available. | Estimates need to be made, that are often not representative. | 1. Different methods are available, and results can be very different and/or 2. granularity does not allow reasonable comparison. | A lot of interpretations in the methods need to be made. | Lot of work to update every year. |
| 5 | Medium/low GHG impact in transport, little importance to make right choices in transport sector. | Method and tooling is not (well) developed. | Very hard to apply. | Estimates need to be made, that are very uncertain. | 1. Methods are not well established and/or 2. granularity does not allow any comparison. | No common way to do calculations. | No good method available. |

Below, we first present the results of the analysis per category starting with the **scope of emission calculations** and followed by **emission calculation methodology and allocation to transport services**. The presentation of the results of the analysis is followed by a argumentation on the scores given to each design alternative and finally by a selection of the design alternatives that are considered for the association methodological element.

## Scope of emission calculations

Table 52 gives an overview of the design alternatives of the different scoping elements and the results of the analysis of these design alternatives. The analysis is based on the results of the analysis of the state of play (see Annex A), the stakeholder consultation (see Annex G) and literature.

**Table 52 - Analysis of design alternatives related to the scope of emission calculations**

| | Relevance | Applicability | Acceptability | Accuracy | Comparability | Reproducibili | Robustness |
|---|---|---|---|---|---|---|---|
| **Geographical scope** | | | | | | | |
| Global | 1 | 3 | 1 | | | | |
| European | 2 | 2 | 1 | | | | |
| **Type of emissions** | | | | | | | |
| $CO_2$ emissions | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Non-$CO_2$ GHG emissions from fuel combustion | 2 | 2 | 2 | 2 | 3 | 2 | 2 |
| Non-$CO_2$ GHG emissions from refrigeration | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| Global warming effect of non-$CO_2$ emissions (e.g. water vapour, contrails, $NO_x$) of aviation at high altitudes | 2 | 4 | 4 | 5 | 5 | 4 | 4 |
| Black carbon emissions | 2 | 4 | 5 | 5 | 5 | 3 | 3 |
| **Activity boundaries** | | | | | | | |
| Vehicle propulsion emissions (TTW) | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Emissions from auxiliary processes (other than propulsion) during vehicle operation (TTW) (e.g. cooling of freight) | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| Emissions from leakage and spills (during vehicle operation) | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| Emissions from hub activities | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| Emissions from energy provision (WTT), excluding energy infrastructure construction | 1 | 1 | 1 | 2 | 3 | 2 | 3 |
| Emissions from construction and dismantling of energy production infrastructure | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| Life-cycle GHG emissions of vehicle construction, maintenance and disposal | 3 | 4 | 3 | 4 | 4 | 4 | 4 |
| Life-cycle GHG emissions of vehicle infrastructure construction, maintenance and disposal | 4 | 5 | 4 | 5 | 5 | 5 | 5 |
| **Intended user** | | | | | | | |
| Transport service operator | 1 | 1 | 1 | | | | |
| Transport service organiser | 1 | 2 | 2 | | | | |
| Transport service user (excluding organiser) | 1 | 3 | 3 | | | | |
| **Use perspective** | | | | | | | |
| Ex post | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| Ex ante short-term | 1 | 1 | 1 | 3 | 3 | 3 | 1 |
| Ex ante calculations for long-term scenarios | 3 | 3 | 1 | 4 | 3 | 3 | 3 |

| | Relevance | Applicability | Acceptability | Accuracy | Comparability | Reproducibili | Robustness |
|---|---|---|---|---|---|---|---|
| **Emission perspective** | | | | | | | |
| Transport service average GHG emissions | 1 | 1 | 1 | 1 | 2 | 1 | 2 |
| Time/situation specific transport service GHG emissions | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| Marginal GHG emissions | 1 | 4 | 3 | 3 | 3 | 3 | 5 |

## Geographical scope

The geographical scope of the method relates to the extent to which the method can be applied to account for transport emissions in different geographical areas and can take account of different modes of transport, types of fuels and vehicles. A European scope and global scope are considered. Based on the analysis only the global scope is selected for the policy measures (see Table 53). The rationale for this is discussed below the table.

**Table 53 - Selected and discarded design alternatives for policy measure element 'geographical scope'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| Global scale | EU scale |

Given the objective of CountEmissions EU to reduce GHG emissions in the European transport sector, it is clearly very relevant to have at least transport in the EU-27 in scope. However, for the EU-27, 40% of international trade is with countries outside the EU-27[71] and 56% of the passengers in aviation is on flights to or from countries outside the EU-27[72]. Considering this, and the objectives of CountEmissions EU to allow for comparison between different transport services (including international ones) and to facilitate behavioural change, a strong case can be made for a global scope (Ehrler, V. et al., 2016). For a fair comparison between the transport emissions of products coming from different regions in the world, the calculation of complete transport chains including transport outside Europe should be possible. In this way transport service users can make their choices on complete information. This would make the exercise much more complex, partly because different emission factors would have to be used for different countries and regions. However, in many existing methodologies (like GLEC, the ISO 14083 draft) and tools, the scope is already global (see Annex A), making it possible to perform emission accounting for a full transport chain with origins or destinations both inside and outside the EU.
Also stakeholders prefer a global scale for the common methodology: 20 out of 28 (71%) respondents of the survey favour a global scale.

[71] Eurostat: 'Intra-EU-27 (from 2020) trade, by Member State, total product', and 'Extra-EU-27 (from 2020) trade, by member state, total product'; year 2019.

[72] Eurostat: 'International intra-EU air passenger transport by reporting country and EU partner country', and 'International extra-EU air passenger transport by reporting country and partner world regions and countries'; March 2022.

## Type of emissions

The CountEmissions EU initiative is targeted at the reduction of GHG emissions of transport (see Section A). Important greenhouse gases emitted by transport are carbon dioxide ($CO_2$), methane ($CH_4$), nitrous ($N_2O$) and (e.g. from air conditioning) chlorofluorocarbons (CFCs) with a global impact on the climate. Greenhouse gases can be emitted both during vehicle operation, but also during the production of the energy carrier. Besides the GHG emissions, global warming is also caused by water and air polluting emissions from aviation at high altitude, leading to clouds and aerosols. The global warming effect from emissions at high altitude is more regional (IPCC, 1990). Finally, black carbon emissions, mainly caused by diesel and fuel oil combustions, have a local global warming effect due to absorption and scattering of sunlight.

The selected and discarded design alternatives for type of emissions are presented in Table 54. The results of the stakeholder interviews support this selection of design alternatives. From the stakeholders who did discuss this issue, twelve preferred to consider $CO_2$-eq emissions within the scope of CountEmissions EU (which is in line with the emissions selected), while only two stakeholders from the maritime and aviation sector prefer to limit the scope to $CO_2$ emissions only (in line with the scope applied in the schemes currently used in those sectors, i.e. EU MRV and CORSIA). Both stakeholders do, however, mention that an extension to non-$CO_2$ GHG emissions could be considered in the future.

**Table 54 - Selected and discarded design alternatives for policy measure element 'Type of emissions'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| – $CO_2$ emissions;<br>– non-$CO_2$ GHG emissions from fuel combustion;<br>– non-$CO_2$ GHG emissions from refrigeration. | – global warming effect of non-$CO_2$ emissions (e.g. water vapour, contrails, $NO_x$) of aviation at high altitudes;<br>– black carbon emissions. |

The analysis for the different design alternatives is discussed in more detail below.

### *$CO_2$ emisisons (selected design alternative)*

For CountEmissions EU it is clear that coverage of $CO_2$ emissions is fundamental, as they are by far the main type of GHG emitted by transport (e.g. circa 98% in GHG emissions of gasoline and diesel combustion, see IFEU, INFRAS & IVA, (2019)). $CO_2$ emission calculations are generally applied and can be accurately calculated from fuel consumption, and energy emission factors ($CO_2$ per amount of fuel) as the $CO_2$ emissions are linearly related to the amount of fuel. $CO_2$ emission calculations are therefore in general well comparable and reproducible. Because of the limited data needed to make calculations, the method is very robust.

### *Non-$CO_2$ GHG emissions from fuel combustion (selected design alternative)*

Other greenhouse gases such as methane ($CH_4$) and nitrous oxide ($N_2O$) do not have a very large contribution in the total GHG emissions of transport in general (e.g. circa 2% in GHG emissions of gasoline and diesel combustion, see (IFEU, INFRAS & IVE, 2019)), but can have an important impact on the GHG emissions of the use of specific fuels, such as CNG and LNG, which can cause significant methane emissions. For a fair comparison between fuels, it is therefore relevant to include other greenhouse gases, specifically methane and nitrous oxide emissions, as well. The precise calculation of methane and nitrous oxide emissions is harder than for $CO_2$ emissions, as the emissions do not only depend on fuel consumption but also on engine technology. However, accurate default factors are available for fuel-technology combinations in databases such as the emission factor database of the EMEP/EEA guidebook. The global warming potential values[73] are regularly updated with new insights by the IPCC, which might lead to differences between methods when they are not regularly updated, giving a bit lower score on robustness than for $CO_2$ emissions.

### *Non-$CO_2$ GHG-emissions from refrigeration (selected design alternative)*

Cooling systems in refrigerated transport and air conditioning often make use of refrigerants such as hydrofluorocarbons (HFCs) which are fluorinated greenhouse gases with a very high global warming potential (GWP). The use of these gases is regulated by the F-gas Regulation (EU, 2014b) and the MAC Directive (EC, 2006), the latter prohibiting the use of F-gases with a global warming potential higher than 150 in new cars and vans.

Although the use of F-gases is reduced, they are still being used and small losses can have a high GHG impact. The monitoring of refrigerants losses from air conditioning and cooling systems (or the amount of refilling required) is therefore very relevant and has also been included in the calculation method of the ISO 14083 draft (ISO, 2022). Including the climate impact of refrigerants in GHG calculations is less common though, as are default factors for calculations when the refrigerant or the exact losses are unknown. Given the high difference in global warming potential of different refrigerants (with GWP values below 150 to above 10,000 (GHG Protocol, 2016)) default factors have a high degree of uncertainty. Finally, new refrigerants with lower GWP are being developed, demanding regular updates of the emission factors, giving a medium (3) score on robustness.

### *Global warming effect of non-$CO_2$ emissions of aviation at high altitudes (discarded design alternative)*

Besides the $CO_2$ emissions and other GHG emission from fuel burning, aviation contributes to global warming with non-$CO_2$ climate impacts from $NO_x$, $SO_x$ and soot, and water vapour emissions at high altitude (EASA et al., 2020). In conjunction with anthropogenic sources, these emissions modify atmospheric composition (gases and aerosols), and hence influence radiative forcing and climate (IPCC, 1999). The non-$CO_2$ climate impact of a flight depends on the quantity and type of emissions, but also on where (altitude, geographical location), and under which conditions (time and local weather conditions) the flight takes place. The effect is expressed by the radiative forcing metric, which expresses the difference between incoming solar radiation and outgoing terrestrial radiation. This metric describes climate impact effects at a certain moment and cannot be expressed easily in $CO_2$ equivalents, which takes into account the global warming potential (GWP) of emissions measured over a time period of 100 years (IPCC, 2007) (Anthes et al., 2020).

The climate impact of these non-$CO_2$ climate impacts is at least as important in total as those of $CO_2$ from aviation (EASA et al., 2020), and therefore very relevant. Of the GHG emissions accounting methodologies and standards assessed (see Annex A), only the GHG Protocol (WRI & WBCSD, 2013) mentions the option to apply a multiplier to cover the effect of non-$CO_2$ climate impacts, but notes that there is very significant scientific uncertainty around the magnitude of the effect (factor 1-8.5 according to Jungbluth, (2019)). The GLEC framework specially mentions these emissions are not included in the framework, but leaves the option open to include it in future updates. The draft of ISO 14083 does not

[73] Global warming potential factors are indices allowing comparisons of the amount of energy that the emissions of 1 tonne of a gas will absorb over a given time period, usually a 100-year averaging time, compared with the emissions of 1 tonne of $CO_2$. These factors are needed to express emissions in $CO_2$ equivalents.

include the effect in the methodology (ISO, 2022). In tools, like EcoTransIT (Anthes et al., 2020), the inclusion of the effect is more common and often offered as an option by applying a multiplier on $CO_2$ emissions. At the moment, only average multipliers are used in tools to quantify the effect, but no accurate and broadly accepted method(s) to define the climate impact of these emissions for specific flights is available yet. Therefore, no good comparison of the global warming impact of these emissions at the flight level can be made. As the current approaches are not harmonised (Jungbluth, 2019), results are also not reproducible. Because of the low scores on the various criteria, we have discarded the global warming effect of emission of non-$CO_2$ products at high altitudes' as a design alternative for the policy measures on the methodology. However, the climate impact of this effect is still being researched and, because of the high relevance, it might be considered to include it in the methodology at a later stage when better methods are available.

### *Black carbon emissions (discarded design alternative)*

Black carbon is a form of particulate matter emissions and consists of dark carbon particles (mostly elemental carbon), produced from the incomplete combustion of fuels.
When airborne, black carbon absorbs and scatter sunlight, which can lead to increased temperatures. When deposited on earth, especially in the cryosphere, black carbon causes snow and ice to melt faster, due to reduced reflectivity (SFC, 2017).

After carbon dioxide, black carbon has the second biggest impact on climate forcing in the atmosphere overall (SFC, 2017). It is therefore a very relevant type of emission. A coalition with amongst others Smart Freight Centre, ICCT and SmartWay, has developed a method to account for black carbon emissions (SFC, 2017), and to measure it alongside GHG emissions. The method, however, does not express the impact of black carbon in global warming terms, which would be very difficult given the dependency on location and weather.
The GLEC framework gives guidance on the reporting of black carbon alongside GHG emissions. In the draft of ISO 14083 (ISO, 2022) black carbon is not included in the methodology, however, an informative annex on black carbon is included. Although very relevant there is no methodology yet to include the effect of black carbon in GHG accounting in an accurate way. The accounting of black carbon itself is quite complex and requires extensive datasets with emission factors differentiating between fuels, engine types, and by preference also use characteristics. The databases should be regularly reviewed to keep them up-to-date (SFC, 2017). Because of the low scores on the various criteria, we have discarded 'Black carbon emission', as a design alternative for the policy measures on the methodology. Because of the high relevance, inclusion might be considered at a later stage if the methodology to express the global warming impact of black carbon is improved.

## Activity boundary

The activity boundary sets the scope for the type of activities and events for which the emissions are to be included in the methodological framework. Activities identified are:
- **Vehicle propulsion emissions**: it concerns the engines exhaust emissions, also called the tank-to-wheel (TTW) emissions.
- **Emissions from auxiliary processes** (vehicle operation related emissions from energy use other than propulsion): it concerns the emissions from auxiliary processes on vehicles, such as cooling and refrigeration, the operation of on board cranes for transhipment, and vehicle interior heating.
- **Emissions from leakage and spills**: these vehicle operation related emissions stem from the loss of refrigerants from the cooling system, fuel evaporation or boil-off (e.g. LNG).

- **Emissions from hub activities**: the emissions from activities at locations where passengers and/or goods switch from one vehicle or mode of transportation to another (hubs). Hub activities are, for example, transhipments operations in ports, terminal operations at airports and sorting centres for distribution.
- **Emissions from energy provision (well-to-tank), excluding energy infrastructure construction**: the emissions of energy provision includes all the GHG emissions of operational processes to provide the energy carrier for use in vehicles or at hubs. It includes processes such as extracting, producing, processing, storing, and transporting of energy carriers.
- **Emissions from construction and dismantling of energy production infrastructure**: the emissions of construction and dismantling of energy infrastructure are often not included in the well-to-tank emissions as they are not directly related to fuel use. The draft ISO 14083 Standard (ISO, 2022) proposes to include it, thereby also including the emissions of solar cell and windmill production. As the contribution of energy production infrastructure on the total emissions of renewable energy sources is relatively high, a fairer comparison can be made between renewable and fossil energy use.
- **Life-cycle GHG emissions of vehicle construction, maintenance and disposal**: it concerns the emissions associated to materials used to construct vehicles, the actual construction activities, transport of vehicles, maintenance activities and disposal activities.
- **Life-cycle emissions of vehicle infrastructure construction, maintenance and disposal**: these are the emissions from the materials used, construction and maintenance activities, demolition of infrastructure, etc.

Table 55 shows the selected and discarded design alternatives. The analysis of each individual design alternative is discussed below the table.

**Table 55 - Selected and discarded design alternatives for policy measure element 'Activity boundary'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| – vehicle propulsion emissions;<br>– emissions from auxiliary processes;<br>– emissions from leakage and spills;<br>– emissions from hub activities;<br>– emissions from energy provision (well-to-tank), excluding energy infrastructure construction;<br>– emissions from construction and dismantling of energy production infrastructure. | – life-cycle GHG emissions of vehicle construction, maintenance and disposal;<br>– life-cycle emissions of vehicle infrastructure construction, maintenance and disposal. |

## *Vehicle propulsion emissions (selected design alternative)*

The basis for GHG accounting of transport services are the vehicle propulsion emissions, which should be fundamental to the methodology. The calculation of propulsion emissions is supported by all current methods/standards (see Annex A). Accuracy, comparability, reproducibility and robustness can in principle be high, particularly when calculations are based on fuel consumption figures. All stakeholders participating in the survey and interviews supported the coverage of these emissions by the harmonised framework.

## *Emissions from auxiliary processes (selected design alternative)*

Not all transport includes auxiliary processes, but for specific transports, such as cooled transport or the heating system in passenger busses, the impact can be in the order of

10-30% of the total GHG emissions of fuel combustion (Ricardo Energy & Environment, 2021, OV Magazine, 2018). Sometimes auxiliary processes are driven by the main engine and sometimes by auxiliary engines or generators. It is therefore also relevant to cover the auxiliary processes for a fair comparison between these two options.

The coverage of auxiliary processes is currently already included by most existing GHG methodologies and standards, such as by EN 16258, GLEC, and the French Transport Code (see Annex A). The calculation method of auxiliary processes is similar to that of vehicle propulsion emissions and only requires extra information on the fuel consumption of the auxiliary engine or generator. The applicability, acceptability and other criteria therefore have the same score as for the design alternative 'Vehicle propulsion emissions'.

### *Emissions from leakage and spills (selected design alternative)*

Emissions from leakage and spills include the emissions from refrigerants and boil-off of LNG. As explained for GHG emissions from refrigeration, small quantities can already have a large GHG effect due to the high GWP values of these substances. The emissions of leakage and spills can therefore be very relevant (Saharidis & Konstantzos, 2018). However, calculations of the climate impact of these emissions is less common than for $CO_2$, as is the provision of default factors for calculations. None of the existing methods/ standards, except the concept ISO 14083 standard, clearly includes these emissions in their methodology (see Annex A). Including it in the calculation requires monitoring of refrigerant refilling or the application of default emissions for certain engine technologies.
The applicability and acceptability therefore have an average score of 3. Accuracy, comparability, reproducibility and robustness also score average, as the methodology for the different kind of spills and leakages is not as well established in methodologies, tools and default factors as it is for propulsion emissions.

### *Emissions from hub activities (selected design alternative)*

To allow a good comparison between emissions of different transport chains, it is very relevant to include the GHG emissions from activities at hubs. For example, to compare the transport by inland waterways followed by truck transport as compared to direct truck transport, it is only comparable when also hub activities are included in the comparison. The $CO_2$ emissions of the transhipment need to be included to determine which option is more $CO_2$ efficient, as these emissions can be significant (e.g. McKinnon and Piecyk find that emissions from hub activities may sum up to 5-7% of the total emissions of a road shipment in the chemical sector (McKinnon, A.C. & Piecyk, 2010)).

The emissions of hub activities can be calculated directly from the energy consumption of those activities, with a method comparable to that used for vehicle propulsion emissions. For hub operators, that have access to the energy consumption figures, emission calculation is therefore not much more complex than for vehicle propulsion related emissions. However, default emission intensity factors are not as common as for vehicle operation. Recently a guideline and tool have been developed for these emissions (i.e. Fraunhofer IML (Dobers, Kerstin et al., 2019) which is also referred to by the concept ISO 14083 standard), but the development of default emission intensity factors within that project is still under development. Therefore, applicability of these calculations is scored slightly lower than for vehicle propulsion emissions (2). With a similar method as for vehicle propulsion related emissions, accuracy, comparability, and robustness score well. From the stakeholder interviews, it became clear that the coverage of emissions from hub activities is well supported. Three transport associations, tree more research oriented organisations and one transport operator explicitly supported the inclusion of these emissions. Only one transport association discards this alternative, as it is feared that it will complicate the calculations.

### *Emissions from energy provision (excluding energy infrastructure construction) (selected design alternative)*

As GHG emissions have a global impact, the emissions of energy provision (well-to-tank emissions) are very relevant to be included in emissions accounting to assure a fair comparison between different fuels and energy carriers. This becomes very clear when comparing electricity and gasoline as an energy source. Without including the emissions from energy provision, the emissions for electricity would amount zero, not taking into account the GHG emissions emitted during the production of electricity. But also for some of the fossil fuels, the share of well-to-tank emissions in the well-to-wheel emissions is very significant. For example, for the use of LNG in maritime transport this share may be up to 40% (ICCT, 2021a).

Most of the current more general (not mode specific) GHG methodologies do include the emissions of energy provision and well-to-tank fuel emission factors are commonly used (see Annex A). There are, however, differences in energy emission factors of fuels, which are not related to physical differences of the fuel, but to calculation methods or updates (see also Table 9 in Section 3.3.2). JRC, for example, has published energy emission factors for diesel and gasoline based on two different approaches, a marginal and an average approach (JRC, 2020b). Both approaches are applied in methodologies and tools.
The comparability between methods and robustness (energy emission factors are unregularly updated) is therefore currently not optimal. There is a strong support from stakeholders for the inclusion of the emissions from energy provision. The vast majority (93%; 26 out of 28 respondents) of the stakeholders who filled in the survey prefers the inclusion of these emissions. At the stakeholder interviews, only two representatives from the maritime sector were opposing the inclusion of well-to-tank emissions.

### *Emissions from construction and dismantling of energy production infrastructure (selected design alternative)*

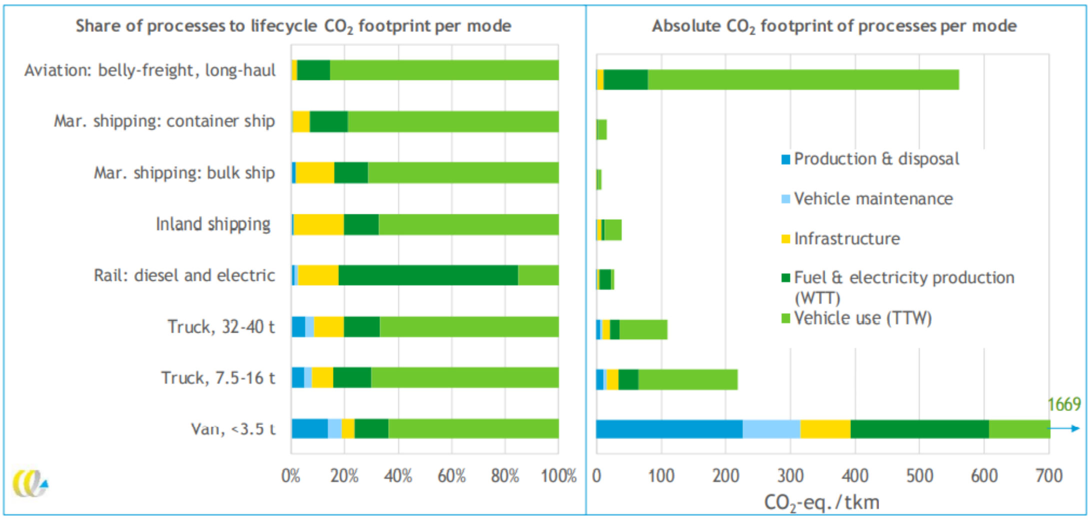
Whereas emissions from energy provision is included in many methods/standards, they normally do not (explicitly) include the emissions of construction and dismantling of energy production infrastructure. The draft ISO 14083 Standard (ISO, 2022) does, however, recommend the inclusion of these emissions. In this way also, amongst others, the emissions related to solar cell and windmill production are included, recognising that GHG emissions from the application of solar cells and wind turbines is not zero.

The contribution of the emissions of construction and dismantling of energy production infrastructure in the well-to-tank figures of fossil fuels is limited (2-3%). For renewable and nuclear energy, however, the contribution to the total emission is very relevant (CE Delft, 2020). The GHG emissions of specific infrastructure is not easily available, as it is often not known what the specific source for energy used is (e.g. is electricity used for a specific service coming from a coal-fired or gas-fired power station?). Therefore, these emissions should often be based on average life-cycle analysis studies or databases and will probably be defined as averages of, for example, the electricity mix. However, as the differences between these emissions for various types of energy carriers (e.g. electricity, petrol, LNG) are significant, these simplifications do not harm the usefulness of these emission calculations. For stakeholders, the applicability and acceptability will be good as long as the emissions are included in the available (default) energy emission factors of energy carriers.

### *Life-cycle emissions of vehicle construction, maintenance and disposal (discarded design alternative)*

Emissions from construction, maintenance and disposal can be as high as 20% of the total life-cycle emissions for cars and vans, and are much lower for larger vehicles such as truck, ships and planes (CE Delft, 2021). The difference in construction, maintenance and disposal emissions between similar vehicles is only a fraction of this 20% and these emission are not expected to play a decisive factor in the comparison of transport services with similar vehicles of the same mode. Between modes, the difference in construction, maintenance and disposal emission is larger, but also not expected to play a decisive factor in the comparison as the impact of vehicle use is dominant for the differences in total emissions (see Figure 15). The inclusion of vehicle construction, maintenance and disposal therefore has limited relevance.

**Figure 15 - Share of processes in life-cycle GHG emissions for key vehicle categories**




Source: (CE Delft, 2021).

Complicating factor for the inclusion of this category of emissions is that data for vehicle construction emissions or energy use are not easily available from vehicle manufacturers. Moreover, translation of the total construction and maintenance emissions of a vehicle to values per kilometre, strongly depends on the use and lifetime of the vehicle, which is not known on forehand and therefore less accurate. Comparability and reproducibility are therefore also very limited. For good comparison the figures should also be regularly updated as production processes are continuously changed and improved, giving a low score on robustness. None of the current transport GHG methodologies/standards studied, includes vehicle construction maintenance and disposal emissions (see Annex A). Among stakeholders, opinions on the inclusion of life-cycle emissions differ widely. From the OPC and targeted survey it became clear that citizens and transport service users do (to some extent) support the coverage of full life-cycle emissions, while both consultation tools also shows that transport operators (and associations representing them and operators of freight greening programmes are more hesitant[74]). On this issue there seems to be a clear

[74] In the targeted survey, five of the nine transport service users indicated that they prefer full life-cycle emissions, while only two out of eight transport operators/associations share this preference.

distinction between beneficiaries of transport services and stakeholders that are more integral part of the transport system, suggesting also a division between what is desired by society and what is considered feasible by the sector. The latter conclusion is supported by evidence from the stakeholder interviews. For example, two transport associations and one transport operator explicitly mention that coverage of full life-cycle emissions is (currently) too complex. Three more research oriented stakeholders, a transport operator and a transport association do, however, suggest that an extension to life-cycle emissions could be considered at a later stage. None of the interviewed stakeholders were in favour of including life-cycle emissions in the CountEmissions EU framework at this stage, an opinion that was shared by the participants to the stakeholder workshop.

Based on the various arguments discussed above, we have discarded 'life-cycle emissions of vehicle construction, maintenance and disposal', as a design alternative for the policy measures on the methodology. Besides inclusion of all life-cycle emission of the vehicle, it might be considered in the future to only include elements of the life cycle that make the difference between transport options, such as the powertrain (see Textbox 10).

**Textbox 10 - Life-cycle emissions of powertrain**

In line with the inclusion of the emissions of construction and dismantling of energy production infrastructure, it might be considered to only include the emissions of the powertrain[75] production, which for battery electric vehicles would include the $CO_2$ emission of the production of batteries. Many discussions on the environmental impact of battery electric vehicles is related to the impact of the battery production (Powell, 2020) and this could be covered by including these emissions in the scope. The rational to include it would be that the difference in $CO_2$ emissions between vehicles with and without batteries is relatively large, as is shown, for example by (CE Delft, 2021), which shows that batteries can have up to 10% share in the life-cycle emissions of electric cars, whereas they are zero for vehicles with only internal combustion engines (ICE), having no batteries. None of the current transport GHG methodologies/standards, however, includes these emissions in the scope of the calculation framework. We therefore did not include this as a design alternative, but is might be considered at a later stage when more information becomes available.

## *Life-cycle emissions of infrastructure construction, maintenance and disposal (discarded design alternative)*

Infrastructure emissions have a share of up to 20% in GHG life-cycle emissions on average (see Figure 15). However, the difference in infrastructure emissions of existing infrastructure is not expected to play a decisive factor in the comparison between modes or within modes, as the impact of vehicle use is dominant for the differences between modes (see Figure 15). Both transport service operator and users have little influence on the GHG emission of infrastructure construction, i.e. only in a limited way by the modal choice. The inclusion of infrastructure emissions is therefore not very relevant for transport service users to make choices when considering GHG emissions. The most important decision moment concerning GHG emissions of transport infrastructure is at the moment when new investments in infrastructure are made. These decisions do not rely directly on the individual transport decisions made by transport users. For investors, however, it is good to realise that it can take many years to get a net 'carbon payback' from new infrastructure facilitating modal shift (UIC, 2016).

The infrastructure emissions for a specific trip are hard to determine accurately as it depends on many factors such as the specific infrastructure being used (with specific

[75] The complete system including engine, transmission and energy storage that powers the vehicle.

infrastructure properties including bridges, tunnels, type of road, etc.), traffic intensity and lifetime of the infrastructure. Emission intensity factors with this accuracy are hardly available, which makes a reliable comparison impossible. None of the current transport GHG methodologies/standards include infrastructure construction maintenance and disposal emissions (see Annex A). As for stakeholder acceptance, similar arguments as discussed above for life-cycle emissions of vehicle production, maintenance and disposal are valid, although it may be expected that stakeholder acceptance for inclusion of life-cycle emissions of infrastructure are lower, as these emissions are less relevant for most of them (as they cannot or only very indirectly affect these emissions).

Because of the low scores on the various criteria, we have discarded 'life-cycle emissions of infrastructure construction, maintenance and disposal', as a design alternative for the policy measures on the methodology.

## Intended user

From the analysis of current methodologies and standards (see Annex A) we have identified two main groups of users of a methodological framework for GHG accounting:
1. **Transport service operators/organisers**: the entities that carry out the transport of passengers or freight as a service or act as intermediary between transport service users and transport service operators (e.g. freight forwarders)
2. **Transport service user**: the entity that uses (and pays) the transport service. It can be a passenger, a firm arranging/buying business travels, or a shipper (freight transport).

Most of the current general (including all modes) methodologies and standards are intended for both types of users
(see Annex A). Article L1431-3 of the French Transport Code is an exception, focussing on transport operators and organisers to report the emission of their service to users.
Most methodologies/standards expect transport service operators to calculate emissions based on primary data (e.g. fuel use and transport performance) whereas they allow transport users to use default factors and 'modelled' emission values.

As shown in Table 56, both design alternatives are selected to be considered for the policy measures on the harmonised policy measures. The rationale for this this is discussed below the table.

**Table 56 - Selected and discarded design alternatives for policy measure element 'Intended user'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| – transport service operator/organiser;<br>–<br>– transport service user. | |

### *Transport service operators/organisers (selected design alternative)*

It is very relevant to include transport service operators as they have access to primary energy data of the vehicles and so are able to calculate GHG emission of transport very accurately. When operators share data with their users, the users can also calculate their emission accurately based on primary data of the operator.

At the same time, including transport organisers is relevant as well.

In case of passenger transport, transport organisers (like travel agencies) can be the point of contact with passengers , and therefore also need to be able to calculate emissions to inform the final customers on the emissions of their transport choice.

In freight transport, freight forwarders are often the contact point between a shipper and a transport operator. The freight forwarder can organise complete transport chains from origin to destination of the goods. Also in this case, it is very relevant that transport organisers have a solid methodology to report the emissions to shippers, such that the latter can make decisions based on GHG emissions of transport options. When transport organisers cannot get information from their transport operators, default emission intensity factors or models are needed to make GHG calculation. This makes the methods more complex than for transport user operators who can (more) often use primary data.

### *Transport service users (selected design alternative)*

Passenger transport service users can be individual passengers (end users of the service), individual customers that make use of shipping services, or organisations and businesses buying transport for their employees. Individual passengers and customers are not intended users of CountEmissions' methodology, but are rather the beneficiaries of the initiative; the entities that can make the choice between different transport options based on the GHG emissions reported by the transport service operators or organisers. For organisations and businesses the same applies, although they might want to make use of the methodology to report on the GHG emissions of business travel when this information is not supplied by the transport service operator/organiser.

Freight transport service users are shippers, who sell their products to customers.
The intention of CountEmisisons EU is to make the GHG emission of the transport part of the product choice of these customers. It is therefore important and relevant that the methodology includes methods for shippers to calculate their emissions in a consistent way. When transport service users cannot get information from their transport operators or organisers , default emission intensity factors or models are needed to make GHG emissions calculations. This, again, makes the methods more complex than for transport operators/organisers.

## Use perspective

Emission calculation can be made afterwards (ex post) and on forehand (ex ante). Ex post calculations can be used for reporting of GHG footprint emissions of transport activities to third parties and to monitor GHG emissions reduction over the years. In addition, ex post calculations can be used to predict ex ante GHG emissions of transport activities.
For ex ante calculations we distinguish between on ex ante calculations for short term decision making (e.g. comparing train and aviation for a certain trip) and ex ante calculation for strategical decision making on the longer term. The latter relates to investments in infrastructure or modal shift policies and needs predictions on how transport emissions will develop in the future.

The selected and discarded design alternatives for this policy measure element are presented in Table 57. The rationale for this selection is discussed below the table.

**Table 57 - Selected and discarded design alternatives for policy measure element 'Use perspective'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| – ex post;<br>– ex ante for short-term decision making. | – ex ante for long-term strategies. |

### *Ex post (selected design alternative)*

All existing methodologies and standards take ex post calculations into account, based on realised transport performance data. As ex post calculations are based on real practice, this use perspective is in potential most accurate and comparable and therefore also very relevant. Having the realised transport data, no estimations need to be made, making the calculation highly reproducible. Also among stakeholders, there is strong support for ex post calculations. Only one (a public authority) out of 27 stakeholders participating in the targeted survey indicated that there is no need to cover ex post calculations by the harmonised methodological framework.

### *Ex ante short-term (selected design alternative)*

One of the objectives of CountEmissions EU is to inform transport users about the GHG emissions of different transport alternatives. To inform transport service users before they take their choices, ex ante information on the transport service is needed. This information can be based on ex post information matching the service as close as possible.
It is therefore very relevant that the methodology allows for ex ante calculation for short-term decision making. As mentioned above, these calculations are preferably based on ex post result with prognoses on routing and vehicle use. As these ex post results are often not a perfect predictor of ex ante emissions, accuracy and reliability of these figures are lower than for ex post calculations (but still of a sufficient level in case detailed ex post data is used as predictor). Most existing methods/standards allow for both kind of calculations (ex post and ex ante for short term decision making) (see Annex A), suggesting that stakeholder applicability should not be a major problem. Finally, there is strong support from stakeholders for this kind of emissions calculations: 21 out of 27 respondents to the stakeholder survey see the need for ex ante calculations.

### *Ex ante calculations for long-term scenarios (discarded design alternative)*

Ex ante calculations for long term scenarios are not expected to be part of the use case of CountEmissions EU. They do not add to the objective of an increased uptake of GHG emission accounting. Future scenarios require estimation for future emission intensity factors and vehicle use. A GHG emissions accounting methodology can be used for the calculation principles and scope, but does not help to make the right future projections.

## Emission perspective

For the emission perspective we distinguish three design alternatives:
- **Service average GHG emissions** give information on the average performance (in terms of emissions) of a transport service operator for a specific transport service. It allows a comparison between different transport operators for a particular transport service.
- **Time/situation specific average GHG emissions** take into account differences in emission levels of a transport service over the day, e.g. due to variance in occupation rates (higher in peak hours) or traffic situation (e.g. peak hour). This time differentiation can be used to express the difference in the performance (in terms of emissions) of the service over the day. In peak hours, for example, the occupation of a train is higher than during off-peak hours, leading to lower emission per passenger-kilometre than on average. On the other hand, a taxi will probably have higher GHG emission per passenger-kilometre in peak hours, because of higher GHG emission per kilometre during time spent in traffic jams.
- **Marginal GHG emissions***:* whereas average (day average or specific time average) emissions consider the efficiency of the transport service or system, marginal GHG

emissions consider the impacts of changing utilisation of the service. Marginal GHG emissions are defined as the extra GHG emissions as a result of an extra passenger or extra cargo (Bigazzi, 2020). In rail passenger transport, an extra passenger will, on average, hardly add to the total GHG emission (Rietveld, 2001), whereas an extra customer for a taxi will likely have the same impact as an average taxi passenger. The marginal perspective can be applied to both service average GHG emissions and time-specific average GHG emissions. When applied to time specific average GHG emissions, off-peak emissions of public transport will in general be lower than during peak hours, as during peak hours extra passengers in public transport might lead to extra vehicle operations (as existing vehicles do not have capacity to transport additional passengers), which is unlikely during off-peak hours. The marginal perspective is particularly relevant for ex ante GHG emission calculations, as it informs transport service users on the impact of other transport decisions, such as switching modes or changing departure times (Bigazzi, 2020).

As shown by Table 58, from the three design alternatives only service average GHG emissions is selected to be considered in the policy measures. This is discussed in more detail below the table.

**Table 58 - Selected and discarded design alternatives for policy measure element 'Emission perspective'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| – service average GHG emissions. | – time/situation specific average GHG emissions;<br>– marginal GHG emissions. |

### *Service average GHG emissions (selected design alternative)*

Service average emissions are very relevant and give transport service users the possibility to compare different transport service operators on their performance of the service on average. When long-term (e.g. annual) averages are used, influences of weather conditions or traffic circumstances have no effect on the calculated emissions. The relevance of transport service average GHG emissions is therefore high. The calculation of averages does not need journey specific information and applicability, acceptability, and also accuracy therefore score high. When calculated at service level (especially when using precise ex post emissions data, based on primary information), e.g. a flight from Paris to Madrid or a parcel from Berlin to Warsaw, the average performance of operators can be fairly compared (depending on the method of course, see next section).

### *Time/situation specific average GHG emissions (discarded design alternative)*

Time specific or situation specific average GHG emissions reflect the GHG emissions of a service under specific circumstances. For ex post calculations it can be useful for transport operators to understand the difference in GHG efficiency between peak hours and off-peak hours or the effect of weather circumstances (e.g. temperature effects on the efficiency of electric vehicles). They can use the information to optimise operations and improve the overall performance.

Whereas time/situation specific information can be very relevant for self-assessment of a transport operator, the information is expected to be little relevant or even misleading for transport service users. For example, whereas the GHG emissions per passenger-kilometre of public transport are low during peak hours (due to high occupancy rates), it is not favourable for the system and the overall GHG emissions to attract more passengers during peak hours (it may even increase the total level of GHG emissions in case more vehicles have to be scheduled in peak hours to transport these additional travellers). We therefore give an average score on the relevance of time/situation specific average GHG emissions. Applicability is scored average too, as more detailed information is needed than for service average GHG emissions. Acceptability will score average because of the extra efforts that are needed and the limited relevance to share the information with transport service users. Also on accuracy, comparability, reproducibility and robustness time/situation specific average GHG emission score lower than service average GHG emissions, because of the higher complexity and additional choices that need to be made, which can lead to difference between users (e.g. the definition of peak hours or allocation of fuel to different traffic situations).

### *Marginal GHG emissions (discarded design alternative)*

Marginal emissions are relevant to inform transport service users on the effect of their choices for a certain transport mode or a certain transport service operator. The marginal emissions, however, very much depend on the specific situation and vary by context. For public transport, the difference between the average emissions and the marginal emissions will, for example, depend on the population density of the area where the transport services is provided and the density of the transport network. The calculation of such marginal emission requires elasticity factors, giving the relation between vehicle use and passenger demand. Calculations are therefore rather complex, which negatively affects applicability and acceptability. The method to calculate marginal emissions is not broadly established and is still subject to scientific research (Bigazzi, 2020). Therefore accuracy, comparability, and reproducibility are given an average score. To have correct values, the elasticity values need be monitored constantly, resulting in a low score on robustness as well.

## Emission calculation methodology and allocation to transport services

Table 59 gives an overview of the analysis of the different design alternatives for the policy elements related to the calculation methodology. This analysis is based on inputs from the analysis of the state of play (see Annex A), the stakeholder consultation (see Annex G), literature (including Davydenko, I. et al., (2014); Ehrler, V. et al., (2016); Kellner, (2016); Kellner, (2022); TNO, (2020b), TNO, (2021)) and own reasoning.

**Table 59 - Screening analysis of calculation methodology and allocation to transport services**

| | Relevance | Applicability by stakeholders | Acceptability by stakeholders | Accuracy | Comparability | Reproducibility | Robustness |
|---|---|---|---|---|---|---|---|
| **Minimum level of granularity of emission calculation** | | | | | | | |
| Total GHG emissions of transport operator and/or hub operator | 2 | 1 | 3 | 1 | 5 | | |
| Total GHG emissions of transport service user (freight) or organiser | 2 | 2 | 3 | 3 | 5 | | |
| Transport service type | 1 | 1 | 1 | 2 | 4 | | |
| Transport operation category (TOC) | 1 | 2 | 3 | 2 | 1 | | |
| Single vehicle | 2 | 2 | 2 | 1 | 4 | | |
| Individual trip | 2 | 3 | 3 | 3 | 2 | | |

| | Relevance | Applicability by stakeholders | Acceptability by stakeholders | Accuracy | Comparability | Reproducibility | Robustness |
|---|---|---|---|---|---|---|---|
| Per activity at hub | 1 | 3 | 3 | 2 | 2 | | |
| **Allocation parameter for allocation to transport services** | | | | | | | |
| Real tonne-kilometre | 3 | 2 | 2 | | 3 | 3 | 3 |
| Real passenger-kilometre | 3 | 2 | 2 | | 3 | 2 | 3 |
| Tonne-kilometre SFD | 2 | 1 | 2 | | 2 | 2 | 2 |
| Passenger-kilometre-SFD | 2 | 1 | 3 | | 2 | 2 | 2 |
| Tonne-kilometre GCD | 1 | 1 | 2 | | 1 | 1 | 1 |
| Passenger-kilometre-GCD | 1 | 1 | 3 | | 1 | 1 | 1 |
| **Allocation granularity for allocation to transport services** | | | | | | | |
| On company level (e.g. average for transport company) | 4 | 1 | 1 | 5 | 5 | | |
| Transport operation category (e.g. average between hubs) | 1 | 2 | 2 | 2 | 2 | | |
| Trip level – journey specific | 2 | 3 | 3 | 1 | 3 | | |
| **Flexibility in calculation approach** | | | | | | | |
| The user can choose the calculation approach from a predefined list. | | 1 | 1 | 4 | 4 | 3 | |
| The required calculation approach depends on the stakeholder group applying the calculations. | | 2 | 2 | 3 | 3 | 2 | |
| The calculation approaches are ranked from most preferable to least preferable calculation method and labelled. | | 1 | 1 | 3 | 3 | 2 | |
| The calculation approach with best accuracy, reproducibility and comparability are prescribed for all users. | | 3 | 3 | 1 | 1 | 1 | |

## *Minimum level of granularity of emission calculation*

GHG emissions accounting can be performed with different granularity. To make data comparable, it is important to reach a certain level of granularity in the calculated GHG emissions. Levels of granularity that have been identified from the review of the current methodologies and standards (see Annex A) are:

- total GHG emissions of transport operator and/or hub operator;
- total GHG emissions of transport service user or organiser;
- GHG emissions per activity at hubs;
- transport service type: a transport service is provided to a transport service user and comprises the transport of passengers/cargo from A to B. A transport service might include multiple modes and hub operations. A transport service type can be rail transport, container transport, delivery of packages, etc.;
- transport operation category (TOC)[76]: a transport operation category is a group of operations of a certain transport operator, with similar characteristics (e.g. the final leg from a distribution centre to clients, or the trip between two hubs);
- single vehicle;
- individual trip.

Based on the analysis of these design alternatives on specific criteria, two alternatives are selected (see Table 60). Notice that the design alternatives refer to *minimum* levels of

[76] The Transport Operation Category (TOC) is often called the leg level as well.

granularity and that calculations at higher aggregation levels can be made based on the data defined at the minimum granularity levels. For example, based on data at the level of TOC, also calculations at the single vehicle level, individual trip level or company level can be made.

**Table 60 - Selected and discarded design alternatives for policy measure element 'Minimum level of granularity of emission calculation'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| – Transport Operation Category;<br>– GHG emissions per hub activity. | – total GHG emissions of transport operator and/or hub operator;<br>– total GHG emissions of transport service user or organiser;<br>– transport service type;<br>– single vehicle;<br>– individual trip. |

**Total emission of transport operator, hub operator and transport service user or organiser (discarded design alternative)**
The total emissions of a transport service operator and hub operator can be calculated relatively easily and accurately from their energy consumption. For total emissions from transport organisers or users this is also the case, but more efforts are required and calculations will be less accurate on average as these calculations need reliable and accurate information from the transport service operator or, if not available, modelled and default values are needed. Although total emissions at company level are relevant to be monitored, the comparability with others is useless, as the transport activities of companies are different. Also most stakeholders do not see the need for defining a methodology for calculating emissions at the company level. In the stakeholder survey, only 5 out of 28 (18%) respondents suggest that company level should be the minimum level of granularity. Based on these arguments, this design alternative is discarded.

**Transport service type (discarded design alternative)**
When company data are differentiated per type of service, data are well comparable with other services or in time. At this level, data also give useful information on the environmental efficiency of a specific service. Energy consumption figures or default emission intensity data and modelled data are available equally as for company level, making this alternative well applicable for stakeholders. This level of granularity is also most supported by stakeholders. In the stakeholder survey, 16 out of 28 (57%) of the respondents mention service type as the preferred level of granularity. However, at service type level (e.g. container transport), emissions cannot be specified for a particular service user and comparability between different service operators or organisers is therefore poor. To make GHG emissions more specific, more detail is needed on the legs of the specific service.

**Transport Operation Category (selected design alternative)**
Breaking down the GHG emissions to Transport Operation Category, means that a company should monitor the fuel consumption of transport between two hubs, a hub and the final destination or the origin and hub. Some variance in the definition of a TOC is possible. For example, the TOC between hub and final destination can be defined similar for each destination or some kind of differentiation is made between different types of destinations (e.g. destinations in the inner city, the suburbs and outside the city). The level of TOC is applied as minimum granularity by most of the general methods/standards (covering all

modes, see Annex A) and is also used, in combination with data on the transport performance on the TOC, as the basis of allocation in these methodologies/standards (see next item). It is therefore very relevant and will end up with very accurate emission figures. This level of granularity does require more efforts for calculation, as more differentiation in the data is needed, but allows for good comparability between data, as emission calculation of services can be made service user-specific. In general, significant support from stakeholders for this alternative is available, although operators' systems are currently not always capable to provide the data at the level yet, as was indicated by one of the interviewed transport operators.

**Single vehicle level (discarded design alternative)**
Emissions at single vehicle level are relevant for monitoring GHG efficiency and can be used to feed the data on other levels. Fuel consumption can be monitored via refuelling data or board computer data, which is relatively easy and accurate. This level is therefore also relevant, but does not directly allow for comparison between competing transport services. For that reason, this alternative is discarded.

**Individual trip (discarded design alternative)**
Calculations at the level of individual trips can be relevant too for CountEmissions EU. However, it does not give a good representation of the transport service at average, thus affecting the comparability between various services. For instance, the emissions generated at the level of an individual trip may substantially depart from typical emissions from this service due to an accident or other unexpected event taking place while performing the operation. In addition, it requires efforts to allocate the fuel consumption of a vehicle to a specific trip. The relevance, accuracy and applicability are therefore lower as for the granularity at TOC level.

**Per activity at hub (selected design alternative)**
For hubs the comparability GHG emissions data is higher when emission are expressed per activity. This requires, however, that energy consumption per type of machine or activity is monitored or that these data are available otherwise (via models or defaults). As this may require additional efforts from stakeholders, applicability for stakeholders is less. However, in case the data is available, accurate and relevant emission figures can be calculated.

### *Allocation parameter for allocation to transport services*

The CountEmissions EU methodology should lead to GHG emissions accounting at the level of transport services to inform transport service users about their GHG emissions.
This means that emissions from a transport operation, that often serves more than one user, should be allocated to the different users. To do so, existing methodologies/standards use specific metrics for allocation (see Annex A).

The different metrics identified are:
- **real tonne-kilometre**: the amount of freight in tonnes multiplied by the actual distance (in kilometre) over which it is transported;
- **real passenger-kilometre**: the number of passengers multiplied by the actual distances (in kilometre) over which they are transported;
- **tonne-kilometre SFD**: the amount of freight in tonnes multiplied by the shortest feasible distance (SFD) between origin and destination;
- **passenger-kilometre SFD**: the number of passengers multiplied by the shortest feasible distance (SFD) between origin and destination;

- **tonne-kilometre GCD**: the amount of freight in tonnes multiplied by the shortest distance between origin and destination, measured along the surface of the Earth (Great Circle Distance – GCD);
- **passenger-kilometre GCD**: the number of passengers multiplied by the shortest distance between origin and destination, measured along the surface of the Earth.

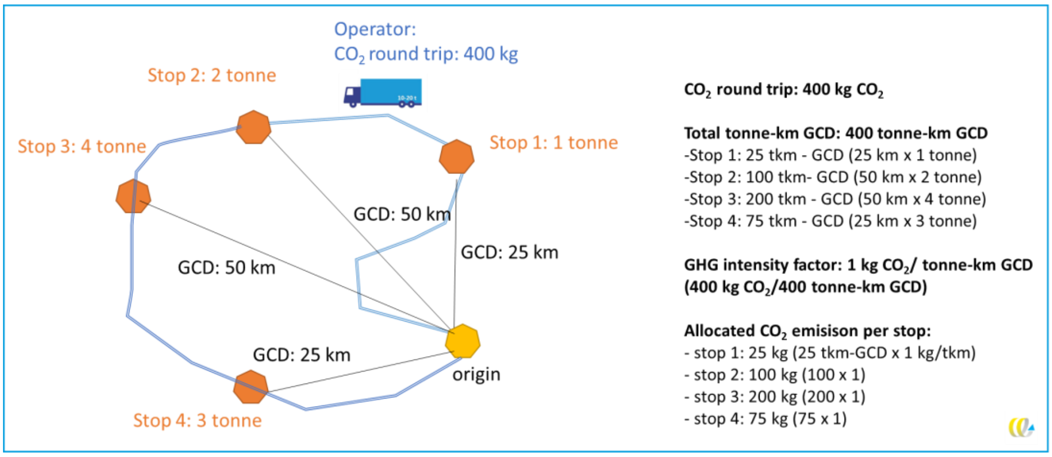
The various allocation parameters are explained in more detail in Textbox 11.

**Textbox 11 - Illustration of allocation of emissions based on various types of allocation parameters**

Figure 16 shows how allocation works for a distribution trip, when based on tonne-kilometre GCD. In this example, it is assumed that the total GHG-emissions of a roundtrip are 400 kg $CO_2$. For every stop in the roundtrip the direct tonne-kilometre GCD are calculated by multiplying the tonnes delivered with the GCD-kilometre. The tonne-kilometre GCD are then summed over the different stops. The GHG intensity factor for the trip can be calculated by dividing the total $CO_2$ by the sum of the tonne-kilometre GCD. By multiplying again the tonne-kilometre GCD per stop with the intensity factor the $CO_2$-emissions can be calculated for the different stops and are thereby allocated. This allocation can be done for a single round trip, as shown in the example, but also, for example, for all the trips from a distribution centre in a year.

Allocation based on tonne-kilometre SFD works in a similar way, but the applied distances are different. Allocation based on real tonne-kilometre requires the monitoring of tonne-kilometre from stop to stop for all deliveries. A delivery at the end of the route will have more real kilometres then a delivery at the start of the route. The allocation factor of a stop, in this case, will depend on the position of the stop in the delivery round.

**Figure 16 - Illustration of allocation of $CO_2$ emissions of distribution trip to stops based on tkm-GCD**




For freight transport, the tonne-kilometre (real/SFD or GCD) is used in all current methodologies/standards (see Annex A) as the standard allocation parameter. However, current methodologies also allow other metrics than tonnes, when this better fits the sector activity. Depending on the sector, tonne-kilometre can be replaced by $m^3$-kilometre or container-kilometre for example.

The methodology of allocation also results in GHG intensity factors, i.e. the amount of $CO_2$ per allocation parameter (e.g. tonne-kilometre GCD). The GHG intensity factors give an indication of the environmental performance of the transport service. The intensity factors can be shared between transport service operators, organisers and users to allow them to calculate their emissions related to their specific tonne-kilometre or passenger-kilometre.

Based on the analysis of the various allocation parameters, all of them are selected as design alternatives for the policy measures (see Table 61). The rationale for this is discussed in more detail hereafter.

**Table 61 - Selected and discarded design alternatives for policy measure element 'Allocation parameter'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| – real passenger-kilometre;<br>– tonne-kilometre SFD and passenger-kilometre SFD;<br>– tonne-kilometre GCD and passenger-kilometre GCD. | – real tonne-kilometre. |

**Real tonne-kilometre and passenger-kilometre (selected design alternative for passenger transport, discarded design alternative for freight transport)**
Allocation of emissions based on real passenger- or tonne-kilometre is quite common and therefore applicable and acceptable. However, real tonne-kilometre can be difficult for combined transport or distribution trips as it requires to monitor the real driven kilometres per delivery. Moreover, the allocation in a delivery round, quite arbitrarily, depends on the way the route is driven and services at the end of a distribution round will get allocated more GHG emissions than services at the beginning of the route. GLEC and the EN 16258 standard, therefore, propose tonne-kilometre-SFD and GCD for the allocation within distribution trips (see Annex A). Also an interviewed operator of freight greening programmes mentioned this drawback of using real tonne-kilometre as allocation parameter. For (public) passenger transport it is often easier to monitor real passenger-kilometre as trains and public transport busses drive the same routes every time, which makes the metric also more accurate and reproducible. Intensity factors based on real passenger-kilometre or tonne-kilometre do not allow for a good comparison on efficiency as detouring will not be reflected in the GHG intensity factor (McKinnon 2015, TNO, 2021).

**Tonne-kilometre SFD and passenger-kilometre SFD (selected design alternative)**
Applying allocation based on tonne-kilometre SFD is already included in some of the current GHG methodologies, such as GLEC, and is also part of the concept ISO 14083 (see Annex A). The method has proven to be well applicable as no detailed routing data are needed and is also acceptable for stakeholders, although the methods is not commonly known in the transport sector. To our knowledge allocation of passenger-kilometre based on passenger-kilometre SFD is not being practised yet. We expect acceptability therefore to be lower for passenger transport. Allocation based on tonne-kilometre SFD or passenger-kilometre SFD improves accuracy, comparability, and reproducibility as compared to real-passenger and tonne-kilometre. The allocation is independent of the route. Shortest feasible distance can be interpreted in different ways though, and may depend on the route planner, the mode of transport and the moment in time.

**Tonne-kilometre GCD and passenger-kilometre GCD (selected design alternative)**
Also applying allocation based on tonne-kilometre GCD is already included in current GHG methodologies, such as GLEC and Top Sector Logistics, and is also part of the concept ISO 14083 (see Annex A). The method has proven to be well applicable as no detailed routing data are needed. It is applied in some of the calculation tools (e.g. BigMile, see Annex A). The method is also acceptable for stakeholders, although the methods is not commonly known in the transport sector. To our knowledge allocation of passenger-kilometre based on passenger-kilometre GCD is not being practised yet, except in aviation to allocate between passengers and freight. We expect acceptability therefore to be lower in passenger transport. Allocation based on tonne-kilometre GCD or passenger-kilometre GCD improves accuracy, comparability, and reproducibility as compared to real-passenger and tonne-kilometre, but also as compared to the SFD metrics as the great circle distance between two locations is a constant factor and does not depend on route planners, new infrastructure or modes. When great circle distance (GCD) is applied then only one interpretation of the metrics is possible giving high accuracy, comparability reproducibility and robustness (TNO, 2021).

### *Allocation granularity for allocation to transport services*

The allocation granularity refers to the level within a transport chain at which allocation is performed. We have identified the following three design alternatives for this policy element:
- **company level** (e.g. average for transport company): total (e.g. annual) emissions at the level of transport companies are allocated to specific services;
- **Transport Operation Category (TOC) level** (e.g. average between hubs.): total (e.g. annual) emissions for each TOC are allocated to specific services;
- **trip level - journey specific**: total emissions for a specific trip are allocated to specific services.

Based on the analysis of these design alternatives on a set of criteria, the TOC level and trip level are selected (see Table 62). This is in line with the design alternatives selected for the methodological element 'minimum level of granularity of emission calculation'. Also the allocation of emission is best performed at the level of TOC, which is in line with most analysed methodologies (Annex A). Allocation at trip level might be needed in special cases, such as to include data from hired transport. This is all explained in more detail below the table.

**Table 62 - Selected and discarded design alternatives for policy measure element 'Allocation granularity'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| – TOC level;<br>– trip level - journey specific. | – company level. |

**On company level (discarded design alternative)**
Allocation of the total emissions at company level gives no insight in the emissions related to a specific service. For example, in case of a multimodal operator this would mean that the total $CO_2$ emissions of different modes would be allocated to all services, even when only one mode is involved in the specific service. The relevance for CountEmissions EU of such a method is therefore low. It is, however, not complex to make the calculations as no detailed information on the fuel consumption is needed (only total annual fuel consumption at the company level). Acceptability and applicability therefore score well. Results, however, are not accurate for the specific service and cannot be compared to others.

**TOC level (selected design alternative)**
As explained for the policy element 'Minimum level of granularity of emission calculation', allocation is also preferably performed at the level of TOCs. Between hubs, where transport activities are performed with similar vehicle types, the GHG intensity factors calculated for allocation are representative for the type of operation and can be compared to others performing similar activities. The relevance of allocation at this level is therefore high.
The fuel consumption data needs to be detailed at TOC level, which is possible for most companies. There are tools available to make the allocation exercises (e.g. BigMile, see Annex A). We therefore expect applicability and acceptability to be rather good.
The allocation at TOC level gives good insight in the network performance of an operator and is quite well representative for a specific journey. Therefore, accuracy and comparability of this design alternative is considered to be relatively high.

**Trip level – journey specific (selected design alternative)**
With allocation at trip level, information can be more detailed. This may be relevant for chartered transport trips, as then data for that specific chartered trip is required. Trip level specific data may also provide relevant insight to transport operators on opportunities to improve the logistical efficiency of such trips, particularly in case these trips differ from the average trips made by the operator. Also situation specific influences, such as weather and traffic conditions, are better expressed. For the transport service user, that wants to choose between or evaluate two transport service operators, the average performance on the TOC might be more valuable and relevant. Allocation at trip level also requires details of fuel consumption figures on trip level, which makes this alternative less well appliable and acceptable by stakeholders. Accuracy is better though. When a transport service operator makes a specific trip for a transport service user, journey specific allocation might be needed.

### *Flexibility in calculation approach*

If more approaches are possible for calculations, CountEmissions EU could put requirements on the use of the different approaches. There are, for example, different approaches to apply allocation between passengers and freight in aviation or at ferries. The reference methodology may provide more or less freedom to entities to make their own decisions on the calculation approach.
For this issue, we consider the following design alternatives:
- The user can choose the calculation approaches from a predefined list. There are no requirements on the use of calculation approaches.
- The required calculation approaches depend on the stakeholder group applying the calculations and is adapted to data availability and common practice of the stakeholder group. For example, passenger transport service operators can use real kilometres to express $CO_2$ intensity values for allocation whereas freight transport service operators have to use either intensity values based on SFD- or GCD-kilometre.
- The calculation approaches are ranked from most preferable to least preferable and labelled. The calculation approaches are labelled to express the quality of the method. The user can choose the calculation approach, with a corresponding label expressing the quality of the applied approach.
- The calculation approach with best accuracy, reproducibility and comparability is prescribed for all users. This might be required from a certain date, which is earlier for some stakeholder (e.g. transport service operators) than for others (e.g. transport service organisers or users).

Based on analysis, three of these design alternatives are selected to be considered for the policy measures (see Table 63). This is discussed in more detail below the table.

**Table 63 - Selected and discarded design alternatives for policy measure element 'Allocation granularity'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| – The required calculation approach depends on the stakeholder group applying the calculations.<br>– The calculation approaches are ranked from most preferable to least preferable and labelled.<br>– The calculation approach with best accuracy, reproducibility and comparability is prescribed for all users. | – The user can choose the calculation approach from a predefined list. |

**The user can choose the calculation approach from a predefined list. There are no requirement on the use of calculation approaches (discarded design alternative)**
Some of the current GHG methodologies/standards allow more than one calculation approach (see Annex A). The CEN EN 16258, for example, highlights calculation on real distance metrics, but also recommends SFD or GCD for distribution calculations and allows other metrics as well. For users of the method/standard, it makes it easier to be in line with the methodology and this increases applicability and acceptability. However, the ambiguity of the EN 16258 Standard is one of the reasons different GHG emissions accounting methods and frameworks, such as the GLEC Framework, Objectif $CO_2$, EPA, SmartWay and others use different metrics (TNO, 2021). Some of the methods are less accurate, and comparability and reproducibility also will be low when the choice for the method is completely left to the users of the methodology.

**The required calculation approach depends on the stakeholder group applying the calculations (selected design alternative)**
The choice for a certain calculation approach could also be differentiated to different type of users according to their capability and common practice. For example, passenger transport service operators can use real kilometres to express $CO_2$ intensity values for allocation, as they are used to this, whereas freight transport service operators have to use either intensity values based on SFD- or GCD-kilometres. This design alternative will have a rather good acceptability and applicability as it is adapted to the user. Because there is more alignment in the method, accuracy comparability and reproducibility will score better for this design alternative than for the first one.

**The calculation approaches are ranked from most preferable to least preferable and labelled (selected design alternative)**
Current methodologies/standards sometimes allow more than one option, but clearly state a preference for one of the options. The draft ISO Standard (ISO, 2022), for example, allows to leave out the GHG emissions of energy production infrastructure when figures are not available and it is clearly stated that these emissions are excluded. The preference, however, is to include these emissions. When the preferences are labelled clearly, differentiating between best practises and alternative practises, there is an incentive for users to adopt in time the best quality label, whereas for now they can choose for the best applicable option. Acceptability and applicability therefore score high for this alternative. Like the previous design alternative, there is alignment in the method making accuracy comparability and reproducibility score better than the first design option.

**The calculation approach with best accuracy, reproducibility and comparability is prescribed for all users (selected design alternative)**
The most prescriptive alternative is to prescribe a specific calculation approach to be used for all GHG emissions calculations. As this will be the most accurate approach resulting in high levels of reproducibility and comparability, this alternative scores high on these quality criteria. On the other hand, this alternative does not provide any flexibility to users and hence may in some cases complicate GHG emissions accounting for stakeholders (e.g. as they are required to collect data that are poorly available). Therefore, this alternative is considered to be slightly less applicable and acceptable for stakeholders than the other design alternatives.

**Overview of selected and discarded design alternatives for policy measures**
Table 64 gives an overview of all 42 design alternatives (numbered for reference) that have been analysed and shows which ones are selected (green) and which are discarded (orange).

Table 64 - Overview of selected and discarded design alternatives per policy element

| Element | Design alternatives | | | |
|---|---|---|---|---|
| **Scope of emission calculation** | | | | |
| Geographical scope | 1) Global | 2) EU | | |
| Type of emissions included | 3) $CO_2$-emisisons | 4) Non-$CO_2$ GHG emissions from fuel combustion | 5) Non-$CO_2$ GHG emissions from refrigeration | |
| | 6) Global warming effect of non-$CO_2$ emissions of aviation at high altitudes | 7) Black carbon emissions | | |
| Activity boundaries of the methodology | 8) Vehicle propulsion emissions (TTW) | 9) Emissions from auxiliary processes (TTW) | 10) Emissions from leakage and spills (TTW) | 11) Emissions from hub activities |
| | 12) Emissions from energy provision (WTT), excluding energy infrastructure construction | 13) Emissions from construction and dismantling of energy production infrastructure | 14) Life-cycle GHG emissions of vehicle construction, maintenance and disposal | 15) Life-cycle GHG emissions of vehicle infrastructure construction, maintenance and disposal |
| Intended users | 16) Transport service operator | 17) Transport service organiser | 18) Transport service user | |
| Use perspective (ex ante, ex post) | 19) Ex post | 20) Ex ante short term | 21) Ex ante calculations for long-term scenarios | |
| Emission perspective | 22) Service average GHG emissions | 23) Time/situation specific average GHG emissions | 24) Marginal GHG emissions | |
| **The method of emission calculation and allocation to transport services** | | | | |
| Minimum level of granularity of emission calculation | 25) Total GHG emissions of transport operator and/or hub operator | 26) Total GHG emissions of transport service user (freight) or organiser | 27) Transport service type | 28) Transport Operation Category (average over period) |
| | 29) Single vehicle | 30) Individual trip | 31) Per activity at hub | |
| Allocation parameter for allocation to transport services | 32) Tonne-kilometre | 33) Passenger-kilometre | 34) Tonne-kilometre SFD | |
| | 35) Passenger-kilometre-SFD | 36) Tonne-kilometre GCD | 37) Passenger-kilometre-GCD | |
| Allocation granularity for allocation to transport services | 38) Company level | 39) Transport Operation Category level | 40) Trip level - journey specific | |
| Flexibility in calculation approach | 41) The user can choose the calculation option from a predefined list | 42) The required calculation approach depends on the stakeholder group applying the calculations | 43) The calculation approaches are ranked from most preferable to least preferable and labelled | 44) The calculation option with best accuracy, comparability is prescribed for all users |

* Design alternatives in green are selected for policy measures, design alternatives in orange are discarded.

### C.3.3 Defining a longlist of methodologies

The reference methodology for the CountEmisisons EU initiative can be newly developed within the initiative, but CountEmissions EU can also refer to an existing methodology. From the analysis of the state of play of GHG emissions accounting (see Annex A), we have identified the following methodologies that cover all modes of transport (and both passenger and freight transport) and that could be used by CountEmissions EU to refer to:
- Article L1431-3 of the French Transport Code (Objectif $CO_2$);
- Corporate Value Chain (Scope 3) Standard of the GHG Protocol;
- Product Environmental Footprint (PEF)/Organisation Environmental Footprint (OEF);
- CEN Standard EN 16258;
- ISO 14083.

Table 65 shows how the selected design alternatives are covered by the different existing calculation methodologies (see also Table 45 in Annex A on standards and methodologies).

**Table 65 - Confrontation of existing methodologies with selected design alternatives**

| Policy elements | Article L1431-3 of the French Transport Code | Corporate Value Chain (Scope 3) | PEF/OEF | CEN Standard EN 16258 | Concept ISO 14083 |
|---|---|---|---|---|---|
| **Scope of emission calculation** | | | | | |
| Geographical scope | France | Global (1) | | | |
| Type of GHG emissions | $CO_2$-eq of combustion and refrigeration (3, 4, 5) | | | | |
| Activity boundaries | Well-to-wheel propulsion and auxiliary processes (excl. energy infra) (8, 9, 12) | Well-to-wheel propulsion and auxiliary processes (incl. energy infra) + hubs leakages and spills (8, 9, 10, 11,12 ,13) | | Well-to-wheel propulsion and auxiliary processes (excl. energy infra) (8, 9, 12) | Well-to-wheel propulsion and auxiliary processes (incl. energy infra) + hubs, leakages and spills (8, 9, 10, 11, 12, 13) |
| Intended user | Transport service operator, organiser and user (16, 17, 18) | Transport service organiser and user (17, 18) | Transport service operator, organiser and user (16, 17, 18) | | |
| Use Perspective | Ex post and ex ante short-term (19, 20) | | | | |
| Emission perspective | Service average GHG emissions (22) | Not defined (focus on product/company average GHG emission) | | Service average GHG emissions (22) | |
| **The method of emission calculation and allocation to transport services** | | | | | |
| Minimum level of granularity of emission calculation and allocation | TOC level and trip level (28, 39 ,40) | Not defined | Not defined | TOC level and trip level (28, 39, 40) | TOC level and trip level and per hub activity (28, 31, 39, 40) |

| Policy elements | Article L1431-3 of the French Transport Code | Corporate Value Chain (Scope 3) | PEF/OEF | CEN Standard EN 16258 | Concept ISO 14083 |
|---|---|---|---|---|---|
| Metrics for GHG intensity factors and allocation | Based on passenger-kilometre or tonne-kilometre (32, 33) | Not defined | Not defined | All alternatives (32-37) | Based on tonne-kilometre or passenger-kilometre SFD or GCD (34-37) |
| Flexibility in calculation approach (e.g. input data and metrics) | The user can choose the metrics from a predefined list (not selected) (41) | Not defined | Not defined | The user can choose the metrics from a predefined list (not selected) (41) | The required calculation method depends on the stakeholder group applying the calculations (42) |

From Table 65 it becomes clear that most selected design alternatives are covered by the existing methodologies. There are, however, a few important exceptions:

- Article L1431-3 of the French Transport Code applies a national scale. All other methodologies apply a global scale.
- Article L1431-3 of the French Transport Code and the CEN Standard do not cover the emissions of leakages and spills, hub activities and the emissions of construction and dismantling of energy production infrastructure. The other methodologies do cover the emissions of all relevant transport/logistic activities.
- The Corporate Value Chain (Scope 3) Standard does not consider transport operators, but only transport users and organisers. The other methodologies do cover all types of entities.
- The Corporate Value Chain (Scope 3) Standard and the PEF/OEF do not give specific guidance on allocation of emissions for transport. Both methods allow for allocation rules, but they are not specified. These two standards, therefore, can only be used by CountEmissions EU when additional calculation rules for allocation are added (see below).
- Article L1431-3 of the French Transport Code recommends the use of the real tonne-kilometres as allocation parameter instead of the preferred SCF or GCD tonne-kilometres. Both the CEN Standard and ISO do allow the use of these allocation parameters for freight transport. ISO does, however, provide more guidance on which allocation parameter should be used.
- As for the methodological element ‘flexibility in calculation approach’, both Article L1431-3 of the French Transport Code and the CEN Standard provide more than preferred flexibility to the users on the approach to be chosen for the calculations of GHG emissions. ISO 14084 does provide more guidance on the calculation approach to be applied.

Instead of using an existing methodology/standard as reference methodology for CountEmissions EU, also the development of a new reference methodology could be considered. Based on current developments and discussions with the Commission, we have identified the following possible new methodologies:

- **A complete new reference methodology**: this methodology should provide more guidance to entities accounting emissions than the current methodologies/standards, resulting in more accurate and better comparable results. The methodology will cover all preferred design alternatives selected in Section C.3.2.

- **A common reference methodology based on ISO 14083, but with additional elements and increased accuracy**: on some methodological elements, ISO 14083 still provides quite some flexibility to users. This may negatively affect the accuracy and comparability of the GHG emission figures calculated. This new methodology, therefore, builds on ISO 14083, but provides more guidance on methodological elements where ISO leaves some room to users. These are elements like:
  - *Definition of Transport Operation Category (TOC) per market segment*.
    The Transport Operation Category is the level at which emissions are allocated to services and for which the same emission intensity factor is applied (g/tkm GCD or SFC). Transport chain elements (legs) within this category should apply this intensity factor. Within ISO it is up to the user to define the Transport Operation Category. Different competitors might apply differently the boundaries of a Transport Operation Category, which might lead to incomparable results. A new methodology could foresee in defining these rules.
  - *Time aggregation*: ISO 14083 recommends to base the emission calculations on the annual average emissions on each TOC, trip or hub activity, but allows different time periods as well when explained by the user. Instead of leaving it to the users, this new reference methodology may define per transport segment the cases in which the user can deviate from applying the annual average emissions on each TOC, trip or hub activity.
  - *Allocation parameter*: ISO 14083 provides users the opportunity to make use of both tonne-kilometre GCD or SFD (for freight transport) and passenger-kilometre GCD or SFD (for passenger transport) as allocation parameter. In this new reference methodology only allocation based on GCD-kilometres is allowed.
  - *Alternatives for mass-based allocation:* as mentioned in Annex C.3.2, the tonne-kilometre (real, SFD or GCD) is usually applied as the standard allocation parameter. However, for some types of freight transport (e.g. parcel delivery) other metrics than tonne-kilometre are more appropriate, e.g. $m^3$-km or container-km. ISO 14083 leaves it up to the user whether he/she would like to use another metric and which one. In this new methodology, a metric is defined (and prescribed) for each transport segment.
- **New Product Environmental Footprint Category Rules for transport, including rules for transport services**. The general PEF/OEF framework does not provide much guidance on the calculation of GHG emissions at the transport service level, as was discussed above. For this new methodology, therefore, specific category rules (i.e. set of calculation rules) for transport will be developed within the PEF/OEF framework. In this way, more coherence with the European Commission's product environmental footprint methodology is sought. The PEF method already offers a guide to develop emission factors compliant with the method (JRC, 2020a) and compliant emission factors datasets (EC, 2022), with emission factors for transport in the Sphera dataset. With category-specific rules for transport, the transport industry can further develop the environmental footprint calculation of their own product (i.e. the movement of goods or people). Therefore, it is important that these category rules allow allocation of GHG emissions to services, like ISO 14083 (instead of to physical goods, as the current category rules developed within the PEF/OEF are doing). In line with the general approach followed within the PEF/OEF, these new PEF Category Rules for transport would cover the life cycle emissions of transport, a scope which is broader than in the other methodologies on the longlist. For this study, we do assume that only GHG emissions (and not other emissions and environmental impacts) are considered in the Category Rules.

## C.3.4 Screening of the methodologies on specific criteria

The eight methodologies on the longlist are screened on the following criteria:
- completeness of methodology (Does it cover the relevant design alternatives?);
- acceptability and applicability for users;
- accuracy and comparability;
- coherence with industry initiatives and other policy initiatives.

Table 66 shows the results of the screening analysis of the methodologies on these criteria.

**Table 66 - Screening analysis of methodologies for CountEmissions EU**

| Methodology | Completeness | Acceptability and applicability of users | Accuracy and comparability | Coherence with industry initiatives and other policy initiatives |
|---|---|---|---|---|
| Article L1431-3 of the French Transport Code | 3 | 3 | 3 | 4 |
| Corporate Value Chain (Scope 3) Standard of the GHG Protocol | 4 | 4 | 4 | 3 |
| PEF/OEF | 4 | 4 | 4 | 3 |
| CEN Standard EN 16258 | 3 | 2 | 3 | 4 |
| Draft ISO 14083 | 2 | 1 | 2 | 2 |
| A new reference methodology | 1 | 5 | 1 | N/A |
| A common reference methodology referring to ISO 14083 | 1 | 2 | 1 | 3 |
| New PEF Category Rules for transport, including rules for transport services ISO 14083, alike | 2 | 3 | 2 | 2 |

Scores from 1-5 range from high to low.

From the existing methodologies/standards, the (draft) ISO 14083 norm is most complete on the scope and calculation/allocation methods (see Table 65 in Section C.3.3). There was also broad support from all types of stakeholders at the stakeholder workshop (and confirmed by several stakeholders at the interviews) that the common reference methodology of CountEmissions EU should be aligned with the most sophisticated current methodologies, like ISO 14083. Therefore, stakeholder acceptability is considered high for ISO 14083. Accuracy and comparability of output will be high with ISO 14083, as discussed above, although the methodology leaves some room to users to make their own decisions, which negatively affects comparability of results. The ISO 14083 has been developed with the support of many stakeholders and also allows coherence with other policy initiatives, such as the RED. Coherence with industry initiatives and other policy initiatives therefore is good.

From the other existing methodologies/standards, particularly the CEN Standard EN 16258, and to a lesser extent, Article L1431-3 of the French Transport Code are considered reasonable alternatives. Both are already used and therefore (to some extent) acceptable and applicable for users. However, in their scopes they are more limited than ISO 14083, e.g. as emissions of hubs and from leakages and spills are not included. Also the methodologies do not give direction on the use of specific calculation options to be made, leaving much room to users to make their own methodological decisions. For example, the CEN Standard allows the use of all relevant types of allocation parameters, while this is limited to tkm/pkm GCD and SFD within ISO 14083 concept. Therefore, these methodologies produce less accurate and comparable GHG emissions figures than ISO 14083. As the CEN Standard will be withdrawn and replaced by the ISO 14083 Standard, the standard is/will not (be) coherent anymore with both industry initiatives (ISO 14083) and policy initiatives. The same is true for Article L1431-3 of the French Transport Code, which currently also relies on the CEN standard. For these reasons, both CEN and Article L1431-3 of the French Transport Code are both discarded.

As mentioned above, the Corporate Value Chain Standard of the GHG Protocol and the general PEF/OEF framework do not give specific guidance for allocation of transport emissions to transport services. Although highly valuable for accounting the GHG emission of companies or products, these methodologies are considered less complete and accurate than the other existing methodologies for accounting the GHG emission of transport services. For these reasons they are also expected to result in lower levels of comparability in emission figures produced. Acceptability and applicability also score lower (when it concerns emissions accounting for transport services) compared to other existing methodologies, as the methods do not give complete guidance for GHG accounting of transport services. Although broadly coherent with other initiatives, the methods are not aligned with specific calculations methodologies developed by the transport market/ industry (e.g. concerning allocation rules), resulting in a medium score on coherence with industry initiatives and other policy initiatives. For these reasons, these two methodologies are discarded.

A new reference methodology to increase the accuracy and comparability by providing more direction on specific methodological elements that are currently not strictly defined by ISO 14083, will score lower on acceptability and applicability by users as it will be more demanding. This also became clear from the results of the stakeholder consultation, which clearly showed (through the various consultation activities) that all types of stakeholders prefer that the CountEmissions EU reference methodology should be built on existing methodologies. When this common reference methodology refers to ISO 14083, thereby acknowledging most of the agreement made by the stakeholders in process of establishing ISO 14083, the coherence with market initiatives will be reasonably good (score 3). When a complete new methodology is created, the support of stakeholders will be very low. Because of the increased accuracy and comparability, considering this new methodology as reference methodology for CountEmissions EU is interesting, even though it results in less stakeholder support. As this new methodology referring to ISO 14083 scores higher on acceptability than the complete new methodology, the former is retained for inclusion in the policy options.

Finally, the new Product Environmental Footprint Category Rules for transport (including rules for transport services like in ISO 14083) will have the same score as ISO on completeness and accuracy, as the methodology on well-to-wheel emissions is considered to be similar as ISO 14083[77]. The new PEF Category Rules, however, will be more demanding on the data to be collected and the calculations to be executed as it concerns a complete life-cycle analysis for GHG emissions. Therefore, the score on acceptability and applicability is lower than that for ISO 14083. This also reflects the lower support from stakeholders to include life cycle emissions in the methodological framework of CountEmissions EU (see Section C.3.2). However, as discussed before, there are some groups of stakeholders (e.g. the beneficiaries of transport services, i.e. shippers and passengers) who seem to be in favour of inclusion of life cycle emissions. Finally, the PEF Category Rules will be less coherent with industry initiatives like ISO, but obviously be more coherent with some policy initiatives (particularly the PEF/OEF initiative of the

[77] This is an assumption, as these new category rules are not developed nor considered yet.

Commission). Because of the preference of some stakeholder groups to include life-cycle emissions in the CountEmissions EU framework and the alignment of this methodology with some policy initiatives, the new PEF Category Rules for transport are retained for inclusion in the policy options.

### C.3.5 Selection of methodologies

Based on the analysis presented in the previous section, we retain three methodologies:
1. ISO 14083.
2. New Product Environmental Footprint Category Rules for transport, including rules for transport services.
3. A common reference methodology based on ISO 14083, but with additional elements and increased accuracy.

## C.4 Input data and sources

Harmonising input data is of importance to make emission calculations comparable and reproducible. Setting requirements on the (type of) input data to be used will clearly contribute to harmonising GHG emissions accounting. When requirements are clear also verification of the calculations is easier.

Current methodologies distinguish three categories of input data (see Annex A):
1. **Primary data**: primary data are values of an activity (e.g. trip or hub operation) that have been realised and measured. Primary data include energy consumption figures, origin-destination data of persons and freight, quantities of passengers and freight delivered kilometres travelled.
2. **Secondary data: modelled data**: modelled data can be used when primary data are incomplete. Modelling makes use of default values and primary data input to perform emission calculations.
3. **Secondary data: default emission intensity factors**: default emission intensity factors are values from literature. Default emission intensity factors range from averages to very differentiated values. For transport, emissions intensity factors are often expressed in GHG emissions per tonne-kilometre, passenger-kilometre or per vehicle-kilometre.

All three categories of data should be based on energy consumption figures and energy emission factors (emission per litre of diesel or kWh of electricity). Energy emission factors are another type of input data needed for any methodology.

In this section, we consider policy measures to harmonise input data. As the definition of harmonised input data consists of various elements, we first conduct two supporting steps: 1) identification of policy measure elements and 2) analysing the different design alternatives of these elements on specific criteria. The results of the supporting steps are used as input for the standard screening analysis (see Sections C.4.3 to C.4.5).

### C.4.1 Supporting Step A: Identification of policy measure elements

From the exploratory interviews and the analysis of current standards and methodologies (see Chapter 2), we have identified the following methodological elements for input data:
- **Type of input data for GHG calculation**: the input data can be primary data from operators based on fuel consumption, modelled data or default data.
- **Harmonisation of default emission intensity factors** (expressed in GHG emissions per tonne-kilometre or per kilometre): databases with default emission intensity factors can be of importance when no primary data from transport service operators is present.

Harmonisation of the databases will make calculations more comparable. It is for example of importance that defaults emission intensity factors are based on the same database of energy emission factors.
- **Harmonisation of energy emission factors**: energy emission factors are needed in all calculations, either with primary or default data.

Table 67 gives an overview of the different policy elements and identified design alternatives. The design alternatives are further elaborated in the next section where they are also being analysed.

**Table 67 - Policy elements and design alternatives for harmonisation of input data**

| Policy element | Design alternatives |
|---|---|
| Type of input data allowed for GHG calculation | Primary data from transport service operators only. |
| | Primary data on transport operations from the operators should be used. In case this is not possible, the use of modelled data and emission intensity factors is allowed. |
| | The user is free to choose between primary, modelled data or default intensity factor can be used. |
| Harmonisation of default emission intensity factors (expressed in GHG emissions per tonne-kilometre or per kilometre) | The creation of databases with default intensity factors is left to the market. |
| | A centralised EU database with emission intensity factors will be developed. Use of data from external databases, when its quality has been assured at the EU level, is allowed as well. |
| | Default emission intensity factors are harmonised in a centralised EU database. |
| Harmonisation of energy emission factors | The creation of databases with energy emission factors is left to the market. |
| | Energy emission factors are harmonised in a centralised EU database. Specific energy emission factors can be developed in line with methods recognised by the EU. |
| | Energy emission factors are harmonised in a centralised EU database. |

## C.4.2 Supporting Step B: Analysis of policy measure elements

We have analysed the different design alternatives of the methodological elements listed above on the criteria presented in Textbox 12. The criteria have been identified based on literature (e.g. reporting principles of the GHG Protocol (WRI & WBCSD, 2004) and on discussion with the Commission. These criteria are the same as the ones used for the screening analysis of the methodology, resulting from the fact that input data are closely related to the methodology. Only the criterion ‘relevance’ is not assessed, as input data are relevant as such.

**Textbox 12 - Definition of screening criteria**

- **Applicability by stakeholders:** the complexity the reporting entity encounters when to applying the element in the reporting.
- **Acceptability by stakeholders:** the extent to which stakeholders are willing to apply the element in the reporting, taking into account the efforts needed and the value they get out of it.
- **Accuracy:** the extent to which the reported emissions are free of errors and faithfully represent the actual emissions.

- **Comparability:** the extent to which the element allows for meaningful comparisons of GHG emissions over time and between reporting entities (in the same market).
- **Reproducibility:** the extent to which different organisations using the same methodology and data would arrive at the same GHG emission estimates.
- **Robustness:** the frequency with which the element has to be updated over time and the amount of effort that requires.

We have scored the design alternatives of the methodological elements on a 1-5 scale corresponding to a colour scale from green to red. The interpretation of this scale is presented in Table 51.

Table 68 gives an overview of the design alternatives of the different policy measure elements and the results of the screening analysis of these design alternatives. The analysis is based on the results of the analysis of the state of play (see Annex A), the stakeholder consultation (see Annex G) and literature. The argumentation of the scores is described per policy measure element below the table.

**Table 68 - Screening analysis of design alternatives related to type of input data for GHG calculation**

| | Applicability by stakeholders | Acceptability by stakeholders | Accuracy | Comparability | Reproducibility | Robustness |
|---|---|---|---|---|---|---|
| **Type of input data for GHG calculation** | | | | | | |
| Primary data from transport service operators only. | 4 | 4 | 1 | 1 | 1 | 1 |
| Primary data for transport operations from the operators should be used. In case this is not possible, the use of modelled data and emission intensity factors is allowed. | 1 | 1 | 3 | 3 | 3 | 3 |
| The user is free to choose: primary, modelled data or default intensity factors can be used. | 1 | 2 | 4 | 4 | 4 | 3 |
| **Harmonisation of default emission intensity factors (expressed in GHG emissions per tonne-kilometre or per kilometre)** | | | | | | |
| The creation of databases with default emission intensity factors is left to the market. | 3 | 2 | 4 | 4 | 4 | 2 |
| A centralised EU database with emission intensity factors will be developed. Use of data from external databases, when its quality has been assured at the EU level, is allowed as well. | 2 | 1 | 1 | 2 | 2 | 2 |
| Default emission Intensity factors are harmonised in a centralised EU database. | 1 | 2 | 3 | 3 | 1 | 3 |
| **Harmonisation of energy emission factors** | | | | | | |
| The creation of databases with energy emission factors is left to the market. | 3 | 3 | 4 | 4 | 4 | 2 |
| Energy emission factors are harmonised in a centralised EU database. Specific energy emission factors can be developed in line with methods recognised by the EU. | 1 | 1 | 1 | 1 | 2 | 2 |
| Energy emission factors are harmonised in a centralised EU database. | 2 | 3 | 3 | 3 | 1 | 2 |

## Type of input data for GHG emission calculation

For the type of input data we have identified the following design alternatives:
- Primary data from transport service operators only.
- Primary data for transport operations from the operators should be used. In case this is not possible, the use of modelled data and emission intensity factors is allowed.
- The user is free to choose: primary, modelled data or default emission intensity factors can be used.

From these three design alternatives, the second one is selected as is shown by Table 69. The rationale for this selection is discussed below the table.

**Table 69 - Selected and discarded design alternatives for policy measure element 'Type of input data for GHG calculation'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| – Primary data for transport operations from the operators should be used. In case this is not possible, the use of modelled data and emission intensity factors is allowed. | – Primary data from transport service operators only.<br>– The user is free to choose: primary, modelled data or default emission factors can be used. |

### *Primary data from transport service operators only (discarded design alternative)*

When only primary data from transport service operators are allowed for GHG accounting, GHG calculations will have a high accuracy, comparability and reproducibility. With the use of primary data the GHG calculations are closest to reality and little assumptions need to be made. The method is therefore also robust. Because of these reasons, stakeholders broadly recognise the added value of using primary data instead of default or modelled data. At the stakeholder workshop, for example, the use of primary data was supported by all participants.

Despite this shared preference for the use of primary data, stakeholders also recognise the difficulties for companies to collect these data. Theoretically, transport operators should be able to use primary data, as the required data are directly related to their business activities. However, as indicated by an interviewed transport operator, the various types of primary data required for emissions accounting (i.e. fuel consumption figures, transport performance data) is often collected by different departments within a company, which complicates the use of these data for emission calculations. Moreover, another interviewed transport operator mentioned that clients are often not interested in the way GHG emissions figures are calculated (i.e. based on primary or default data), incentivising operators to choose for the least expensive type of data, i.e. default data. For transport users/organisers, the use of primary data is even more complicated than for transport operators (Stevens et al., 2018). These companies are dependent on the data provided by the transport operator. When primary data is present and shared, the method it is well applicable. However, this kind of data is not commonly shared between operators and users, as was also discussed in Section 3.3.2. Because of these arguments, applicability and acceptability by stakeholder of only using primary data is scored low (4). This is also the reason to discard this design alternative.

### *Primary data on transport operations from the operators should be used. In case this is not possible, the use of modelled data and emission intensity factors is allowed (selected design alternative)*

In this case transport operators should use primary data. Modelled and default data are only allowed when primary data from the transport operator are not available. In this case applicability and acceptability will particularly be better for transport service users (e.g. shippers) and organisers, as accounting for emissions can also been done when the transport operator does not deliver primary data. However, modelled and default data are not as accurate as primary data and also comparability with other companies will be lower (e.g. a competitor might use the same default data, while actual emissions of the competitor are higher/lower). Reproducibility will also be lower than for the previous alternative, as more options for calculation are possible. This alternative also requires a regular update of default emission intensity factors and hence is less robust than using only primary data.

As mentioned above, stakeholders prefer the use of primary data, although they also see complications for doing this in all circumstances. This design alternative addresses this fear. As suggested by an operator of freight greening programme who joined the stakeholder workshop, a label awarded to companies using primary data could be used to incentivise the use of primary data without mandating it. A labelling scheme based on data quality is mentioned by several interviewed stakeholders (i.e. transport associations, a supplier of transport management systems, an operator of a freight greening programme) as an option to incentivise the use of primary data as well.

### *The user is free to choose: primary, modelled data or default intensity factors can be used (discarded design alternative)*

When the use of either primary modelled or default data is up to the user, accuracy comparability and reproducibility will score lower than in the previous alternative, as the use of input data is not aligned at all. Applicability by stakeholders is good as the user will have more options to obtain input data and can choose what fits best to him. As many of the consulted stakeholders prefer the (stimulation of the) use of primary data (see above), stakeholder acceptance is considered to be lower than for the previous design alternative. As this design alternative results in less accurate, comparable and reproducible GHG emission figures than the previous design alternative, while it is not better applicable or acceptable to stakeholders, it is discarded.

## Harmonisation of default emission intensity factors

For the harmonisation of default emission intensity factors (in g/tkm, g/pkm or g/vkm) we have identified the following design alternatives:
- The creation of databases with default emission intensity factors is left to the market.
- A centralised EU database with emission intensity factors will be developed. Use of data from external databases, when its quality has been assured at the EU level, is allowed as well.
- Default emission intensity factors are harmonised in a centralised EU database.

Based on a screening analysis, the second and third design alternative are selected as the most preferred ones (see Table 70). This is discussed in more detail below the table.

**Table 70 - Selected and discarded design alternatives for policy measure element 'Harmonisation of default emission intensity factors'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| — A centralised EU database with emission intensity factors will be developed. Use of data from external databases, when its quality has been assured at the EU level, is allowed as well.<br>— Default emission intensity factors are harmonised in a centralised EU database. | — The creation of database with default emission intensity factors is left to the market. |

### *The creation of databases with default emission intensity factors is left to the market (discarded design alternative)*

Because of the wide number of transport options with different modes, vehicle types and passenger and freight loads, a wide variety of emission intensity factors is needed to model GHG-emissions as good as possible. When the databases with emission intensity factors are created by the market, the market can determine which default factors are needed. However, for transport operators and users/organisers it may be difficult to find the right emission intensity factors, i.e. to find the available databases and to determine which factors are most appropriate for their transport services. This finding was mentioned by one of the transport operators interviewed. Applicability by stakeholders is, therefore, considered moderate for this alternative. Because of the flexibility provided to users, stakeholder acceptance for this design alternative is considered to be relatively high. However, as discussed at the stakeholder workshop, stakeholders also prefer some more harmonisation of emission intensity factors. Based on that argument, stakeholder acceptance is scored a 2 instead of a 1. Leaving the creation of an emission intensity factor database to the market does not guarantee that the factors created by different market parties are aligned with each other and based on the same assumptions. This alternative therefore scores low on accuracy, comparability and reproducibility of GHG emissions calculations end hence is discarded.

### *A centralised EU database with emission intensity factors will be developed. Use of data from external databases, when its quality has been assured at the EU level, is allowed as well (selected design alternative)*

In this design alternative an EU centralised database is created, which can be elaborated with external databases that contain data in line with the centralised database and which quality is assured at the EU level. In this alternative, there is much more alignment between emission intensity factors than in the previous design alternative, which improves accuracy, comparability and reproducibility of GHG emission calculations (and to some extent also stakeholder acceptance). Still, when more external databases are created, there might turn up some differences between databases. We expect applicability by stakeholders to be higher than for the previous design alternative, as the centralised database facilitates transport operators and users to choose the right emission intensity factors. The input from the sector makes sure that all important data will be included making the dataset robust. The centralisation of the database also allows for alignment of the emission intensity factors with other EU recommended databases, such as for the PEF/OEF (Sphera) or by the EEA (e.g. COPERT).

*Default emission intensity factors are harmonised in a centralised EU database (selected design alternative)*

When only one EU centralised database with emission intensity factors is created, reproducibility of GHG emission calculations will be optimal as a clear dataset is presented for calculations. Accuracy and comparability will be less than with the previous design alternative, as the differentiation in data will be more limited. Detailed emission calculations require disaggregated intensity factors, reflecting differences in emission levels between transport segments and countries/regions. Such a level of detail is more difficult to obtain with one centralised database, as no optimal use can be made of the expertise and capabilities of the players in the various transport segments. Another problem with a centralised database is that all data need to be updated centrally by the EU and new technologies or fuels need to be added regularly. The robustness of the dataset will, therefore, be a real challenge. By allowing different sectors to make updates, as in the previous design alternative, the robustness of the database is much better guaranteed. Acceptability is expected to be lower than for the previous design alternative, as market parties need to conform to the limitations of the centralised database. Applicability, on the other hand, is expected to be (slightly) higher, as there is just one database from which default factors could be taken. Finally, centralisation of the database does allow for alignment of the emission intensity factors with other EU recommended databases, such as for the PEF/OEF (Sphera) or by the EEA (e.g. COPERT).

### Harmonisation of energy emission factors

Independent of the type of input data used (i.e. primary, default or modelled data), energy emission factors (e.g. in gram $CO_2$ per MJ) are required to calculate GHG emissions of transport services. Therefore, the development of a database with harmonised fuel emission factors is key for CountEmissions EU to ensure harmonised GHG emissions figures. It is of importance as default energy emission factors from different sources can differ significantly, even for conventional fuels (see Table 9 in Section 3.3.2).

An important aspect in the harmonisation of the energy emission factors is the choice of global warming potentials (GWPs) to be applied for the emission factors. GWPs are multipliers applied to GHG emissions like methane and nitrous oxide to equate the impact they have on the global temperature with that of $CO_2$. For example, the GWP for nitrous oxide ($N_2O$) is 273 (IPPC, 2021), indicating that one tonne of $N_2O$ has a climate impact that is 273 times higher than one tonne of $CO_2$. Harmonised GWPs ensure that harmonised $CO_2$-equivalent emission factors for various energy sources are defined. We assume that a set of GWPs is defined for each of the design alternatives described below.

For the harmonisation of energy emission factors we have identified the following design alternatives:

- The creation of databases with energy emission factors is left to the market.
- Energy emission factors are harmonised in a centralised EU database. Additionally, specific energy emission factors can be developed in line with methods recognised by the EU.
- Energy emission factors are harmonised in a centralised EU database.

From these three alternatives, the second one is selected for further consideration (see Table 71). This is explained in more detail below the table.

**Table 71 - Selected and discarded design alternatives for policy measure element 'Harmonisation of energy emission factors'**

| Selected design alternatives | Discarded design alternatives |
|---|---|
| – Energy emission factors are harmonised in a centralised EU database. Specific energy emission factors can be developed in line with methods recognised by the EU. | – The creation of database with energy emission factors is left to the market.<br>– Energy emission factors are harmonised in a centralised EU database. |

### *The creation of databases with energy emission factors is left to the market (discarded design alternative)*

Energy emission factors are relatively constant factors and consist of combustion emissions (tank-to-wheel emissions) and energy production emissions (well-to-tank emissions).
It concerns a relatively limited number of data records as compared to possible data records for emission intensity factors. Because of the limited amount of data records in the database, a single database taking into account EU regulations for GHG emission factors of fuel (e.g. the Fuel Quality Directive) might be preferred to create clarity for stakeholders. When databases with energy emission factors are created by the market, several different databases might be created, generating confusion amongst stakeholders. Acceptability and applicability by stakeholders is, therefore, expected be relative low compared to a single EU centralised database, as stakeholder might be uncertain about how to find the correct values in the different databases. Furthermore, there is no guarantee that the emission intensity factors created by different market parties are aligned with each other.
This alternative therefore scores low on accuracy, comparability and reproducibility of GHG calculations as well. For these reasons, this design alternative is discarded.

### *Energy emission factors are harmonised in a centralised EU database. Additionally, specific energy emission factors can be developed in line with methods recognised by the EU (selected design alternative)*

In this alternative a centralised database is created, whereas at the same time for specific energy carriers, such as biofuels and synthetic fuels, specific emission factors can be established, as long as they are in line with the methods approved by the EU. Energy emission factors for biofuels can be approved, for example, when these have been calculated following the rules of the Fuel Quality Directive (Council Directive 2015/652/EU). This alternative also allows alignment of the EU centralised database and datasets used by other public organisations, like the IMO and ICAO. Applicability and acceptability of this design alternative will be good as the energy emission factors will be easy to apply, having a clear dataset, but also allowing emission factors of specific fuels when needed. This alternative is also delivering accurate figures and good comparability. Reproducibility is good too, but might be more challenging for the specific emission factors.

### *Energy emission factors are harmonised in a centralised EU database (discarded design alternative)*

When only one EU certified database with energy emission factors is created, applicability and acceptability will be good, but less than in the previous option, as the database will not contain or allow for emission factors of producer specific energy carriers (e.g. biofuels). Accuracy and comparability will, therefore, also be lower. Reproducibility of GHG emission calculations will be optimal as the emission factor database is limited and clear. Because of the lower accuracy, comparability, applicability and acceptability compared to the previous design alternative, this alternative is discarded.

### Overview of selected and discarded design alternative for policy measures

Based on the screening analysis presented above, Table 72 gives an overview of all selected (green) and discarded (orange) design alternatives for the various policy measure elements.

**Table 72 - Policy elements and design alternatives for harmonisation of input data**

| Policy element | Design alternatives |
|---|---|
| Type of input data allowed for GHG calculation | Primary data from transport service operators only. |
| | Primary data on transport operations from the operators should be used. In case this is not possible, the use of modelled data and emission intensity factors is allowed. |
| | The user is free to choose: primary, modelled data or default intensity factors can be used. |
| Harmonisation of default emission intensity factors (expressed in GHG emissions per tonne-kilometre or per kilometre) | The creation of databases with default intensity factors is left to the market. |
| | A centralised EU database with emission intensity factors will be developed. Use of data from external databases, when its quality has been assured at the EU level, is allowed as well. |
| | Default emission Intensity factors are harmonised in a centralised certified EU database. |
| Harmonisation of energy emission factors | The creation of databases with energy emission factors is left to the market. |
| | Energy emission factors are harmonised in a centralised EU database. Specific energy emission factors can be developed in line with methods recognised by the EU. |
| | Energy emission factors are harmonised in a centralised EU database. |

* The green design alternatives have been selected for policy measures, the orange ones are discarded.

## C.4.3 Defining longlist of policy measures to harmonise the input data

From the combination of the selected design alternatives, the following two policy measures can be defined:

1. The use of primary data is recognised and centralised databases for default values (containing both emission intensity factors and energy emission factors) are established at EU level (by European Environment Agency). Specific energy emission factors (e.g. for biofuels) can be developed in line with methods recognised by the EU. Modelled data are used in conformity with the reference methodology.
2. The use of primary data is incentivised and centralised databases for default values (containing both emission intensity factors and energy emission factors) are established at EU level . Quality assurance of external databases operated by third parties is provided at EU level (by European Environment Agency). Specific energy emission factors (e.g. for biofuels) can be developed in line with methods recognised by the EU. Modelled data are used in conformity with the reference methodology.

## C.4.4 Screening of the policy measures to harmonise the input data

Because the longlist which has been created from the design alternatives in the previous step is limited to only two reasonable policy measures, no further screening analysis is performed.

### C.4.5 Selection of policy measures to harmonise the input data

The selected policy measures for harmonised input data are:

1. The use of primary data is recognised and centralised databases for default values (containing both emission intensity factors and energy emission factors) are established at EU level (by European Environment Agency). Specific energy emission factors (e.g. for biofuels) can be developed in line with methods recognised by the EU. Modelled data are used in conformity with the reference methodology.
2. The use of primary data is incentivised and centralised databases for default values (containing both emission intensity factors and energy emission factors) are established at EU level . Quality assurance of external databases operated by third parties is provided at EU level (by European Environment Agency). Specific energy emission factors (e.g. for biofuels) can be developed in line with methods recognised by the EU. Modelled data are used in conformity with the reference methodology.

## C.5 Harmonised emissions output data and transparency

Harmonising output data of GHG emissions accounting (i.e. results from emissions calculations shared between transport operators and users/organisers, transport organisers and users, or transport users and customers) may have some benefits. First, it facilitates the sharing of comparable data between entities along the supply chain, which may be particularly beneficial as companies have to request/provide data to a large number of other companies, all using their own data output formats (see Section 3.3.5). At the stakeholder workshop, this point was acknowledged by a representative from a network implementing a green transport programme, emphasising the added value harmonised formats for output data would have on data sharing. Furthermore, setting requirements for the output data format may help to address the reluctance of operators to share sensitive operational data. As was explained in Section 3.3.3, operators are often hesitant to share fuel consumption data as they fear that this will provide shippers information on their cost structure. By defining the output data in such a way that only a minimum of information needs to be shared (e.g. GHG intensity factors expressed in g $CO_2$ per tonne-kilometre GCD), will make data sharing less sensitive (see Section 6.3.2 for more details).

In this section, we consider policy measures to stimulate the harmonisation of output data. Requirements on how such a harmonised format should look like are outside the scope of this analysis, although we provide in Section 6.3.2 some first ideas.

### C.5.1 Defining longlist of policy measures to harmonise output data

Based on (exploratory) stakeholder interviews, the analysis of the state of play of GHG emissions accounting in the transport sector (see Annex A) and discussions with the Commission, the following policy measures for incentivising the use of harmonised output data have been identified:

1. The EU provides minimum requirements for the harmonised format of emissions output data.
2. The EU provides recommendations for the harmonised format of emissions output data.

### C.5.2 Screening of the policy measures to harmonise output data

The policy measures for incentivising the use of harmonised output data are screened on the following four criteria:

1. **Effectiveness**: extent by which the policy measures ensure that harmonised formats for output data are used.

2. **Legal feasibility**: extent by which the policy measures are legally feasible (e.g. enforceable).
3. **Applicability for stakeholders**: efforts required from companies to apply GHG emissions accounting.
4. **Stakeholder acceptance**: level by which the policy measures are accepted by the transport operators/users.

Table 73 shows the results of the screening analysis of both policy measures on the four criteria.

**Table 73 - Screening analysis of policy measures to incentivise harmonised output data**

| | Effectiveness | Legal feasibility | Applicability for stakeholders | Stakeholder acceptance |
|---|---|---|---|---|
| Minimum requirement for harmonised output data | 2 | 3 | 2 | 2 |
| Recommendations for harmonised output data | 4 | 1 | 3 | 2 |

* Score 1-5; Score 1: high probability; Score 5: low probability.

By providing minimum requirements for harmonised formats for output data, it is ensured that all output data is to some extent provided in the same way. This policy measure is, therefore, considered to be rather effective. Certainty on the use of harmonised formats may also improve the applicability of GHG emissions accounting by stakeholders. Although in the short term they may have to put in some more efforts (e.g. to integrate the harmonised output format within their GHG emissions accounting approach), on the long term it may result in less efforts to share data between players along the supply chain. Enforceability of the policy measure will become difficult as long as GHG emissions accounting is (to some extent) voluntary. In those cases, governments do not know which companies apply emissions accounting, which hampers the monitoring and enforcement of the use of the minimum requirements for the output data formats. Enforcement can only be based on infringements that are reported by other companies. Based on discussions at the stakeholder workshop, no strong resistance from stakeholders to this policy measure exists. As mentioned above, further harmonisation of output data formats was mentioned by representative from a network implementing a green transport programme as a tool to facilitate data sharing along the supply chain. Other participants of the workshop did not disagree with this statement.
Proving recommendations on the harmonised output data formats is legally less complex (as no enforcement is needed). However, this alternative is less effective, as it is not ensured that everyone will apply the recommended formats. This will also harm the applicability for stakeholders, as less harmonisation may result (in the long run) in more efforts required from the stakeholders involved. As for the other policy measure, no issues with respect to stakeholder acceptance are expected.

### C.5.3 Selection of policy measures

Based on the results of the screening analysis provided in Section C.5.2, we consider the provision of minimum requirements for harmonised output data as the most reasonable policy measure. This measure is more effective in ensuring that comparable data is shared, improving the comparability of the results of GHG emissions accounting and facilitating the uptake of accounting by individual companies. The main disadvantage of this policy measure is that it is difficult to enforce in case GHG emissions accounting is not mandatory.

## C.6 Sectoral implementation support

To facilitate the use of a harmonised methodology for GHG emissions accounting, horizontal (sectoral) guidelines may be useful. In this section we screen the policy measures that can be used to provide such guidelines.

The methodological framework provided by CountEmissions EU need to be as clear as possible to have no misinterpretations and to harmonise calculations as much as possible. As for most existing methodologies (e.g. CEN EN 16258, GLEC, the draft ISO 14083 Standard, PEF/OEF), the methodology contains guidance on the interpretation of the most important calculation rules. This guidance needs to be included for CountEmissions EU too, or reference should be made to existing standards or methodologies.

However, from the interviews[78] and the targeted survey[79] it became clear that horizontal guidelines are expected to be needed as well. It should be mentioned, however, that from the four shippers participating in the targeted survey, only one see the need for such guidelines. As mentioned by an operators of a freight greening programme in a targeted interview and acknowledged by some representatives from transport associations at the stakeholder workshop, horizontal guidelines are already being developed by private parties (see Textbox 13). These guidelines address specific calculation and/or allocation issues that occur within that sector, considering at least:

1. (Sector specific) interpretation of the methodology.
2. Formulas for the calculation process.
3. Calculation examples relevant for that specific sector.
4. (Reference to) sector specific default emission factors.

[78] Only one interviewee (representative of a transport association) discussing guidelines mentioned that one general guideline should be sufficient. This interviewee, however, also argued that the common methodology to be applied within CountEmissions EU should not be too complex in order to ensure that smaller companies have the ability to apply that methodology quite easily. According to this interviewee, a more simplified methodology reduces the need for more detailed and sector specific guidelines. The other five interviewees discussing this topic (two transport associations, a public authority and two operators of freight greening programmes) are in favour of the development of horizontal guidelines.

[79] 23 out of 28 respondents answering the questions on this topic in the targeted survey mentioned that they see a role for horizontal guidelines as part of CountEmissions EU.

**Textbox 13 - Current guidelines**

There are currently already several stakeholders which have produced guidelines for the implementation of GHG emissions accounting in the transport sector. A distinction can be made between general guidelines and horizontal or sector-specific guidelines. Examples from the first category are:

- The **GLEC framework** contains an extensive guideline aimed to support transport operators in calculating GHG emissions. The guidelines contain an overview of calculation steps, default emission factors, and suggestions for presentation.
- Although the documentation on the **ISO Standard** (ISO, 2022) and **CEN Standard** (CEN, 2012) are not real guidelines, they contain sections providing general guidelines for the calculations as well as specific guidelines for the allocation for combined transport. The ISO Standard also provides guidance for specific issues, like black carbon emissions and emissions from use of ICT equipment and data servers related to transport.
- ADEME has set up a guide document to help transport professionals implement the **French regulation on carbon reporting** (ADEME, 2019). The guide provides legislative background, calculation steps as well as specific emission factors for the French context.

Examples of horizontal guidelines are:

- **Lean & Green** offers specific guidelines for different sectors including Inland Waterway Transport, Parcels and mail as well as refrigerated goods.
- **CEFIC**, together with Smart Freight Centre, has developed a specific guideline for GHG emissions accounting of transport services in the chemical industry transport chain (SFC & CEFIC, 2021). These guidelines described how the GLEC methodology can be applied in this specific sector. The methodology is explained in line with the specificities of the chemical industry transport chain and sector-specific default values are presented.
- **CLECAT** has provided a guideline on GHG emissions accounting for freight forwarders and logistic services (Schmied & Knörr, 2012).
- The **Clean Cargo working group** has established GHG emissions accounting guidelines for the container shipping sector (BSR, 2015).

In general, both types of guidelines provide a user-friendly walkthrough of the methodology including practice examples of GHG calculations. Horizontal guidelines additionally provide elaborations for that specific sector in order to resolve sector specific issues. For example, for parcel transport this includes guidance on the allocation of emissions data towards individual parcels for distribution trips.

The guidelines in general contain the following topics:

- formulas for the calculation process;
- calculation examples;
- tips and tricks on data collection and calculations;
- target setting;
- explanation of terminology;
- (sector specific) interpretation of methodology;
- reporting structure;
- further greening possibilities and assistance.

## C.6.1 Defining longlist of policy measures to implement horizontal guidelines

Guidelines can be developed by the European Commission and member states, but also by the market. We identified the following five policy measures for implementation of sectoral guidelines:

1. EU provides horizontal guidelines.
2. Member states provide sectoral guidelines.
3. The development of horizontal guidelines is left to the market.

4. EU provides recommendations on topics for horizontal guidelines, but the actual development of the guidelines is left to the market.
5. EU provides rules on the topics to be addressed in the horizontal guidelines and certification of the guidelines is mandatory. In the certification process independent verifiers check whether the guidelines meet the conditions set by the EU and are in line with the methodological framework of CountEmissions.

### C.6.2 Screening of the policy measures to implement sectoral guidelines

The five policy measures for the implementation of sectoral guidelines are screened on the following five criteria:

1. **Consistency with common methodological framework**: level of certainty that the guidelines well align with the common methodology (and harmonised input and output data) of CountEmissions EU.
2. **Alignment with specificities of specific sector**: level by which the guidelines cover all relevant issues with respect to GHG emissions accounting that are specific for that sector (e.g. specific emission factors).
3. **Certainty that guidelines will be developed**: extent by which guidelines will be developed for transport sectors where they are needed.
4. **Stakeholder acceptance**: level by which the guidelines are accepted by the players in the relevant sectors.
5. **Flexibility to apply necessary modifications**: extent and speed by which the guidelines are updated when needed (e.g. because new and better default emission factors have become available).

Table 74 shows the results of the screening analysis of the various policy measures on the five criteria.

**Table 74 - Screening analysis of policy measures to implement sectoral guidelines**

| | Consistency with common methodological framework | Alignment with specificities of specific sector | Certainty that guidelines will be developed | Stakeholder acceptance |
|---|---|---|---|---|
| EU provides sectoral guidelines | 1 | 3 | 1 | 4 |
| Member states provide sectoral guidelines | 2 | 3 | 1 | 4 |
| Left to the market | 4 | 2 | 3 | 3 |
| EU provides recommendations on topics for guidelines (but development is left to the market) | 3 | 2 | 3 | 2 |
| EU provides rules on topics to be covered by sectoral guidelines and mandatory verification | 2 | 2 | 3 | 4 |

* Score 1-5: Score 1: high probability; Score 5: low probability.

When horizontal guidelines are developed by the European Commission (or individual member states) there is high certainty that the guidelines will be developed and will be consistent with the common methodological framework of CountEmissions EU. It is less certain that the issues that need to be addressed for a specific sector are all covered, as the EU (or member states) may lack some knowledge to identify these specific issues or to effectively deal with them. As mentioned by an interviewed operator of a freight greening programme, a good understanding of the sector considered is required to develop effective guidelines. Therefore, involvement of parties from the specific sector is probably required. This was, for example, done in the development of the sectoral guidelines for the chemical industry, where the GHG emissions accounting knowledge of Smart Freight Centre was combined with knowledge on transport in the chemical sector of CEFIC (SFC & CEFIC, 2021) Because of the potential shortcomings in addressing sector specific issues, support of the market may be lower for guidelines developed by the EC (or member states) as well. This seems to some extent to be reflected by the results of the targeted survey, which show that a minority (7 out of 23 respondents) think that the European Commission should be responsible for these guidelines.

When the development of guidelines are left to the market the alignment with the needs of the market may be better (as argued above). The probability that guidelines are developed, however, is lower compared to the situation where the guidelines are developed by the EU (or member states). Although the current situation where private parties take action in the sectors where additional guidance is needed shows that horizontal guidelines are developed without public intervention, it is not guaranteed that this will happen for every transport sector/segment. Leaving the development of sectoral guidelines to the market provides the risk that these guidelines are not (fully) in line with the common methodological framework. Support by the market might not be optimal when different approaches for guidelines are initiated.

By providing recommendations on the topics to be covered by the horizontal guidelines, the EU may improve the quality and consistency of the guidelines developed by the market. For this reason, a public authority interviewed recommended a monitoring role of the EU in the development of such guidelines.

Finally, by providing mandatory rules on the topics to be covered by the guidelines and oblige certification of the guidelines, the quality and consistency of the sectoral guidelines may be further improved compared to the previous policy measure. However, it may lower the acceptance of stakeholders, as it may require more efforts (and hence costs) from private parties. For that reason, a freight transport service user and a supplier of transport management systems mentioned at the stakeholder workshop that certification of sectoral guidelines is not preferred.

### C.6.3 Selection of policy measures

Based on the results of the screening analysis presented above, we see the development of the horizontal guidelines by the EU as the most reasonable alternative. This policy measure ensures that the guidelines are developed for all segments and will be in line with the common reference methodology. The Commission may cooperate with the market (e.g. transport segment associations) to ensure that specificities of the segment are covered well.

## C.7 Conformity

This section deals with possible verification measures. It is important to define what we mean by the term ‘verification’ in the context of CountEmissions EU. It is the set of processes in place to ensure GHG emissions accounting in the EU transport system is performed according to the harmonised methodological framework. Verification by this definition can apply to data inputs (e.g. emissions intensity factors used for calculations), whether or not the relevant calculation method was followed correctly, and data outputs (e.g. whether or not the data is shared in the appropriate units and format). Here, we mainly focus on verification of the results of GHG emissions accounting, which requires verification of data inputs and calculation methods. If both input data and calculation method is verified, this implies that also the results of the accounting process is verified.

Certification is a separate issue and is integrated with the other policy areas, for example certification of horizontal guidelines (see Annex C.6) or calculation tools (see Annex C.8). There is one aspect of certification that relates to verification approaches. In the case that verifiers from the private sector are used (for example similar to the approach taken in the EU MRV) to oversee the verification processes above, these verifiers may be certified. A list of certified verifiers would then be maintained and communicated to relevant transport actors.

Among stakeholders there is a broad support for some kind of verification system. In the stakeholder survey, 0 from the 28 respondents suggested no verification system should be implemented. And also among the interviewed stakeholders, the majority is in favour of some kind of verification scheme in order to increase the reliability of the GHG emissions figures and hence the uptake of GHG emissions accounting. There are, however, a few stakeholders opposing a verification scheme. According to a transport association, (mandatory) verification should not be implemented because of the high costs. A supplier of transport management systems fears that the design of a verification scheme would delay the development of a harmonised GHG emissions accounting scheme and should therefore be postponed till a later stage.

### C.7.1 Defining longlist of policy measures for verification

Based on the analysis of the state of play (Annex A), the analysis of other EU/international policies (Annex B), stakeholder interviews and desk study, the following longlist of feasible policy measures is developed:

1. Mandatory verification of input data and calculation processes
   - by EU accredited third bodies;
   - by member state accredited third bodies.
2. Mandatory verification of input data and calculation processes for entities with a size above a certain threshold
   - by EU accredited third bodies;
   - by member state accredited third bodies.
3. Mandatory verification of input data and calculation processes
   - by the EU;
   - by member states
4. Voluntary verification of input data and calculation processes
   - by EU certified third bodies;
   - by member state certified third bodies.

For all policy measures, the calculation process applied by companies (internal calculations or calculation tools) are certified, such that annually can be verified whether the certified process has been applied. In addition, the use of input data is verified annually by sample checks (this implies not every calculations for all transport services are checked).
This approach is in line with suggestions from stakeholders. During the interviews such an approach was mentioned by a transport association, a public authority and two operators of freight greening programmes.

### C.7.2 Screening of the policy measures for verification

The policy measures for verification are analysed against the following five criteria:

1. **Effectiveness**: the extent by which the output of GHG emissions accounting are accurate and reliable.
2. **Consistency**: the extent by which the verification procedure provides consistent results.
3. **Legal feasibility**: extent by which the verification approach is legally feasible (e.g. enforceable).
4. **Applicability for stakeholders**: efforts required from stakeholders to execute the verification.
5. **Stakeholder acceptance**: support from the stakeholders.

The screening analysis is based on the analysis of the state of play (see Annex A and Annex B), the interviews and own reasoning supported by literature or knowledge of other regulatory efforts.

**Table 75 - Screening analysis of policy measures for verification**

| | Effectiveness | Consistency | Legal feasibility | Applicability by stakeholders | Acceptability by stakeholders |
|---|---|---|---|---|---|
| Mandatory verification of input data and calculation processes, by EU accredited third bodies. | 1 | 1 | 1 | 3 | 2 |
| Mandatory verification of input data and calculation processes, by member state accredited third bodies. | 2 | 2 | 1 | 3 | 3 |
| Mandatory verification of input data and calculation processes for entities with a size above a certain threshold, by EU accredited third bodies. | 3 | 3 | 1 | 2 | 2 |
| Mandatory verification of input data and calculation processes for entities with a size above a certain threshold, by member state accredited third bodies. | 4 | 4 | 1 | 2 | 3 |
| Mandatory verification of input data and calculation processes by the EU. | 1 | 1 | 1 | 3 | 4 |
| Mandatory verification of input data and calculation processes by member states. | 2 | 2 | 1 | 3 | 4 |
| Voluntary verification of input data and calculation processes, by EU accredited third bodies. | 4 | 4 | 1 | 1 | 2 |
| Voluntary verification of input data and calculation processes, by member state accredited third bodies. | 5 | 4 | 1 | 1 | 3 |

* Score 1-5: Score 1: high probability; Score 5: low probability.

Mandatory verification of input data and calculations processes for all entities result in the highest levels of effectiveness and consistency, as it covers all transport services. Effectiveness and consistency will be higher for EU centralised verification schemes compared to national coordinated schemes, as for the latter it cannot be ensured that verification is organised by every member state in the same way. By exempting some entities from the requirement to let their calculation processes and input data used verify (e.g. by introducing a threshold for entities for which verification is obliged or by making verification fully voluntary), the effectiveness and consistency will reduce, as is reflected by the scores in Table 75.

On the other hand, mandatory verification may result in high administrative costs for companies, particularly for SMEs (CE Delft et al., 2014). The costs of verification was a general concern of the stakeholders interviewed. For example, a public authority refers to the French scheme for GHG emissions accounting, where transport operators complain on the relatively high verification costs. For this reason, the mandatory verification schemes score less on stakeholder applicability. Voluntary verification schemes, on the other hand, score high on this criterion, as particularly companies for which the costs of verification are outweighed by the benefits will choose for verification of their emissions accounting exercises. Also the verification schemes using company size thresholds are better applicable for companies, as the companies who are confronted with relatively the highest verification costs (i.e. SMEs) are exempted.

From the stakeholder consultation it became clear that a majority of the stakeholders prefer to have a third party in charge of the verification process. As mentioned in the stakeholder workshop, third parties can guarantee a high quality verification process while preserving confidentiality. Only one of the interviewed transport associations prefers a (simple) verification process carried out by a public authority, as this may result in lower cost. Therefore, we consider verification schemes using (certified) third bodies as more acceptable to stakeholders than schemes run by public authorities. Furthermore, no clear shared picture on how the verification scheme should be designed arise from the stakeholder consultation. Therefore, mandatory and voluntary schemes run by third bodies are considered to be equally acceptable for stakeholders. In general, stakeholders' acceptance of schemes with third bodies accredited by the EU is higher than of schemes with member states accredited bodies, as the former schemes results in a more harmonised verification scheme in the EU (and hence more certainty to internationally operating companies).

### C.7.3 Selection of policy measures for verification

Based on the results of the screening analysis, we retain the following three policy measures for verification:
1. Mandatory process and data verification for all entities falling under the scope of CountEmissions EU is established at EU level(mandatory scheme). This policy measure is expected to be most effective, but at the same time may result in highest administrative costs.
2. Mandatory process and data verification for entities above a certain size falling under the scope of CountEmissions EU is established at EU level. By exempting SMEs from mandatory verification, the administrative burden for companies can be lowered. However, this results in a lower effectiveness of the verification scheme.
3. Voluntary process and data verification for all entities are established at EU level. This policy measure results in the lowest administrative costs for companies, but is also the least effective one.

## C.8 Complementary measures

One specific type of a complementary measure is considered, i.e. calculation tools. These are tools that support transport operators and/or users to calculate (and allocate) emissions of their transport services. There are two types of calculations tools currently used for transport GHG emission accounting:
1. Tools to model emissions based on limited primary data. These tools use default values where primary data is not available. For example, these tools can calculate GHG emissions based on primary data on kilometres and default fuel intensity factors per kilometre for a specific vehicle (e.g. EcoTransit).

2. Tools for GHG emission calculation and allocation to services (e.g. BigMile). In addition to the first category of tools, these tools can also be used to allocate the emissions to individual transport services.

Calculation tools are expected to contribute to the take up of GHG emissions measurement and calculations, as is explicitly mentioned by three transport associations and two operators of freight greening programmes in the interviews. Also the majority of the participants in the stakeholder survey (18 out of 28 respondents) acknowledge the added value of these supporting tools. This support is slightly higher for SMEs (66%: 6 out of 9 respondents) than for larger companies (63%: 12 out of 19 respondents).

### C.8.1 Defining longlist of policy measures to implement calculation tools

Based on the analysis of existing calculation tools (see Annex A), the (exploratory) stakeholder interviews (see Annex G) and discussions with the Commission, the following four policy measures for the implementation of calculation tools have been identified[80]:

1. EU or member states provide calculation tool(s).
2. Market provides calculation tool(s).
3. Market provides calculation tool(s), but with recommendations from the EC.
4. Market provides calculation tool(s) certified by EU recognised bodies.

### C.8.2 Screening of the policy measures to implement calculation tools

The four policy measures for the implementation of the calculation tools have been assessed on the following six criteria:

1. **Consistency with common methodological framework**: level of certainty that the tools well aligns with the common methodology (and harmonised input and output data) of CountEmissions EU.
2. **Certainty on reliability and accuracy of the tool**: level of certainty that the tool provides reliable and accurate results.
3. **Alignment with specificities of specific sectors**: level by which the tool is able to cover all relevant issues with respect to GHG emissions accounting that are specific for that sector (e.g. use of specific emission factors).
4. **Support by the market:** level by which the tools are accepted by the stakeholders.
5. **User costs:** costs users have to make to apply the tool.
6. **Flexibility to apply necessary modifications:** extent and speed by which the tools are updated when needed (e.g. because new and better default emission factors have become available).

Table 76 shows the results of the screening analysis of the various policy measures on the six criteria.

[80] The policy measures are focusses on the implementation of the calculation tools. The specifications of the tools are outside the Scope of this study.

**Table 76 - Screening analysis of policy measures to implement calculation tools**

| | Consistency with common methodological framework | Certainty on reliability and accuracy of the tool | Alignment with specificities of specific sectors | Support by the market | User costs | Flexibility to apply necessary modifications |
|---|---|---|---|---|---|---|
| EU or member states provide calculation tool(s) | 1 | 1 | 4 | 3 | 1 | 4 |
| Market provides calculation tool(s) | 4 | 4 | 2 | 2 | 2 | 3 |
| Market provides calculation tool(s), but recommendations from the EC | 3 | 3 | 2 | 2 | 2 | 3 |
| Market provides calculation tool(s) certified by EU recognised bodies | 2 | 2 | 2 | 1 | 4 | 2 |

* Score 1-5: Score 1: high probability/low costs; Score 5: low probability/high costs.

From the four policy measures, the one where calculation tool(s) are developed by the EU score best on consistency with the harmonised methodology, reliability and accuracy. The alignment with sector specific needs is lower as the EU may lack the knowledge to identify these specific issues or to effectively deal with them in the development of a tool. This may also lead to lower market support, as is reflected by the stakeholder survey, which shows that only 6[81] out of 27 respondents indicate that technical support tools (such as calculation tools) should be provided by the EU (and only one respondent – a transport service user – mentioned member states). User costs might be lower than by provision by the market, as only a single tool will be developed by the EU or member states instead of many commercial ones (economies of scale). Finally, because of time-consuming procedures at the EC, quick modifications of the tool(s) may be difficult.

When the development and implementation of the calculation tools is completely left to the market, consistency with the harmonised methodology, reliability and accuracy are probably lower than in case the tool(s) is developed by the EC. However, market support is expected to be higher, as was reflected by the stakeholder consultation. As mentioned above, only a minority of the respondents to the survey prefer technical support tools to be developed by public authorities. This point is emphasised by several interviewees. Particularly two operators of freight greening programmes suggest that the tools could be best provided by private companies, as these are better aware of the specificities of transport segments or countries. At the stakeholder workshop, a supplier of transport management systems and several transport associations mention that market parties can build on software tools that are already developed, resulting in higher levels of stakeholder acceptance and probably lower development costs. Finally, private parties are more flexible than governments to quickly modify the tools, but benefits of doing this should exceed the costs.

By certifying the tools, the EC may improve the quality and consistency of the calculation tools developed by the market. The need to certify the tools is also clearly reflected by the stakeholder consultation, as 23 of the 28 respondents expect that these tools are certified by an independent body. Only 1 transport service user do not see the added value of

[81] Two transport service users, two transport associations, a pubic authority and an individual transport operator.

certification of the tools[82]. Also at the interviews, only one stakeholder explicitly disagrees with the added value of certification of calculations tools: according to a supplier of transport management systems history showed that setting up reporting requirements for tools (e.g. withing GLEC) proved to be sufficient to gain tool acceptance. Because of the broad support for certification of tools, the fourth policy measure is expected to have the highest support from the market. From all market initiatives, this alternative also provides the highest level of consistency with the harmonised methodology, reliability and accuracy. By setting specific conditions for regular updates of the tool, any required modifications of the tool will be implemented relatively quickly. Against these benefits, there are the relatively higher user costs (amongst other due to the mandatory certification). However, the additional costs compared to other policy measures are expected to be relatively limited.

### C.8.3 Selection of policy measures

Based on the analysis presented in Section C.8.2, we retain two policy measures. First, the policy measures where the market provides the calculation tool(s) certified by EU recognised bodies. This policy measure has the highest support by the stakeholders and is expected to result in high levels of reliability, accuracy and consistency with the common methodological framework. Second, the policy measure where the calculation tools are developed by the EU is retained, as this measure results in the highest reliability, accuracy and certainty to be consistent with the common methodological framework.

## C.9 Applicability

The policy area 'applicability' cover policy measures that ensure that the CountEmissions EU initiative is effectively implemented and hence GHG emissions accounting will be taken up at a higher level and a more harmonised way than in the baseline scenario. This can, for example, be done by making calculation of GHG emissions of transport services mandatory for all transport operators and users or by providing voluntary recommendations to transport operators on the use of the common methodology for GHG emissions accounting.

As the policy measures in this area consist of various elements, we started the screening analysis with two supporting steps: A) identification of policy measure elements, and B) analysis of policy measure elements on specific criteria. The results of these supporting steps are used as input for the standard screening analysis (see Sections C.9.3 to C.9.5).

### C.9.1 Supporting Step A: Identification of policy measure elements

Based on the exploratory interviews, the literature review (e.g. CE Delft et al. (2014)) and internal discussions, four elements for the policy measures in this area are distinguished:
1. **Type of policy instrument**: relevant aspects in this respect are whether the instrument is normative or recommending and whether it is voluntary or mandatory.
2. **Regulated entity**: the entity which is directly subject to the policy instrument.
3. **Coverage of transport segments**: which transport segments are covered by the policy instrument.
4. **Geographical scope of transport activities to be covered**: which transport activities and related GHG emissions are targeted by the policy instrument.

[82] Four respondents have no opinion on this issue.

For each of these elements, there are different design alternatives to operationalise them. The design alternatives identified for this study are shown in Table 77. These are discussed in more detail in Section C.9.2.

**Table 77 - Overview of policy measure elements and relevant design alternatives for these elements**

| Element | Design alternatives | | | |
|---|---|---|---|---|
| Type of policy instrument | Voluntary recommendations | Voluntary opt-in | Binding opt-in | Mandatory accounting |
| Regulated entity | Transport operator/ organiser | Transport user | Both transport operator/ organiser and user | |
| Coverage of transport segments | All transport segments | Only passenger transport | Only freight transport | Only large companies |
| Geographical scope of transport activities covered | To/from EU | To/from EU + last mile | | |

## C.9.2 Supporting Step B: Analysis of policy measure elements

For each of the policy measure elements identified in Section C.9.1, the most relevant design alternatives have been identified and analysed on the following five criteria:

1. **Effectiveness:** extent by which the policy measure element addresses the relevant problem, i.e. the limited uptake of GHG emissions accounting in the transport sector (see Section 3.2).
2. **Legal feasibility**: extent by which the design of the policy measure element is legally feasible (e.g. enforceable).
5. **Applicability for the stakeholders**: efforts required from the regulated entity to conform with the policy measure element.
6. **Stakeholders' acceptability:** the level of support from relevant players in the transport market for the specific policy measure element.
7. **Coherence with other (relevant) EU/global policies**: extent by which the policy measure element is in line with comparable elements in other EU/global policies.

The analysis of the various policy measure elements on these criteria is discussed below.

### Type of policy instrument

Based on CE Delft et al., (2014), the results of the exploratory interviews (see Annex G) and discussions with the Commission, we identified four possible policy instruments[83]:

1. **Voluntary recommendation**: calculation and reporting of GHG emissions is fully voluntary, but it is recommended to apply the common methodological framework.
2. **Voluntary opt-in**: calculation and reporting of GHG emissions is voluntary, but in case the regulated entity calculates GHG emissions and it decides to do this in line with the CountEmissions EU framework, it is obliged to correctly apply this framework.
3. **Binding opt-in**: calculation and reporting of GHG emissions is voluntary, but in case GHG emissions are calculated, use of the common CountEmissions EU framework is mandatory.
4. **Mandatory accounting**: the regulated entity is obliged to calculate GHG emissions according to the common methodological framework. Reporting of GHG emissions is voluntary.

[83] Mandatory calculation and reporting of GHG emissions is out of Scope of this study.

Table 78 presents the results of the analysis of the four types of policy instruments on the five criteria.

**Table 78 - Analysis of type of policy instruments**

| Type of policy instrument | Effectiveness | Legal feasibility | Applicability for stakeholders | Stakeholders' acceptability | Coherence with other EU/global policies |
|---|---|---|---|---|---|
| Voluntary recommendation | 5 | 1 | 1 | 3 | 1 |
| Voluntary opt-in | 4 | 4 | 2 | 2 | 1 |
| Binding opt-in | 3 | 4 | 2 | 2 | 1 |
| Mandatory accounting | 2 | 2 | 4 | 2 | 1 |

* Score 1-5: Score 1: high probability; Score 5: low probability.

The uptake of GHG emissions accounting will be higher for a mandatory than a voluntary scheme (CE Delft et al., 2014). For that reason, mandatory accounting will be the most effective scheme in addressing the problem of limited uptake of GHG emissions accounting in the transport scheme, followed by the binding opt-in variant (as here all regulated entities applying GHG emissions accounting should apply the common methodological framework). The voluntary opt-in and voluntary recommendations (where the choice to apply the common methodological framework is completely free) are less effective.

Enforceability of the opt-in variants is complex, as the government does not know with these instruments which companies do apply GHG emission accounting (and hence should apply the common methodological framework). Entities not (correctly) applying the CountEmissions EU framework within these variants should be reported as committing an infringement by supply chain partners or competitors. Mandatory verification of the data and calculation processes may help in this respect, as this may provide prove to supply chain partners or competitors that the CountEmissions EU framework is not (correctly) applied. However, the legal feasibility of these variants are considered relatively low. Enforceability of mandatory accounting is possible, e.g. by requiring transport operators/ users to annually report on their GHG emissions accounting and sample checking whether these activities meet the requirements set by the CountEmissions EU initiative.
The voluntary recommendations variant is, from a legal perspective, the most simple one as no monitoring and enforcement from the government is required.

As the participation to the CountEmissions EU initiative is voluntary for the first two policy instruments, these are well applicable for stakeholders. Only stakeholders wanting and possibly already capable to apply GHG emissions accounting has to do so. For the same reason, the binding opt-in variant is well applicable for stakeholders. The applicability of mandatory accounting is lower, as with this instrument also stakeholders not familiar with GHG emissions accounting has to implement it. As these stakeholders (e.g. many SMEs) will often lack the capability to apply detailed GHG emissions calculations (Tolke & McKinnon, 2021), this will result in a significantly higher administrative burden (CE Delft et al., 2014).

Stakeholders differ with respect to the acceptability of the various types of policy instruments. The stakeholder survey shows that only two respondents (a public authority and a provider of a transport greening programme) are in favour of a fully voluntary scheme, while the other 26 respondents prefer a more mandatory scheme. The opinions on the extent to which the scheme should be mandatory do, however, differ significantly. The same picture arise from the stakeholder interviews. Four transport associations and two associations representing transport users prefer a voluntary scheme, as they believe this would already provide a good incentive to take up (harmonised) emissions accounting. On the other hand, eleven stakeholders (with various backgrounds) prefer a more mandatory scheme, for all companies or just for some companies (e.g. large ones). One transport association explicitly mention a binding opt-in scheme as the preferred alternative. As a fully voluntary scheme seems to be slightly less preferred than the more mandatory schemes, voluntary recommendations are scored lowest on stakeholder acceptability. The other three alternatives are considered to be equally acceptable to stakeholders.

Finally, all types of policy instruments are coherent with other relevant EU/global policies. One possible issues may be the fact that some maritime and aircraft operators are excluded from GHG emissions accounting by the EU MRV of $CO_2$ emissions from maritime transport and CORSIA respectively (see Annex D in the separate Annex report accompanying this report), but this issue is dealt with in the discussion on which transport segments should be covered by the policy instrument (see below).

Based on the analysis above, we conclude voluntary recommendations are probably not effective in addressing the problems underlying the CountEmissions EU initiative. Therefore, this policy instrument is discarded. Both opt-in alternatives as well as mandatory accounting are considered as reasonable alternatives. Mandatory accounting is probably more effective and better implementable from a legal point of view, while the opt-in variants are better applicable for stakeholders.

## Regulated entity

Based on the analysis of current standards, methodologies, GHG reporting schemes and green incentive programmes and relevant policy measures (see Annexes A and B) as well as the results of the stakeholder interviews, we have identified the following alternatives for the regulated entity (i.e. the entity directly subject to the policy instrument):
- transport service operator/organiser;
- transport users. For passenger transport, the transport users are passengers and it is not feasible to appoint them as regulated entity. Therefore, this alternative is not considered for passenger transport below;
- both transport service operators/organisers and users.

Table 79 presents the results of the analysis of the three alternatives for the regulated entity.

**Table 79 - Analysis of regulated entity**

| Regulation entity | Effectiveness | Legal feasibility | Applicability for stakeholders | Stakeholders' acceptability | Coherence with other EU/global policies |
|---|---|---|---|---|---|
| Transport operators/organisers | 3 | 1 | 1 | 2 | 2 |
| Transport users | 2 | 1 | 3 | 2 | 3 |
| Both operators/organisers and users | 1 | 1 | 2 | 2 | 2 |

* Score 1-5: Score 1: high probability; Score 5: low probability.

Appointing shippers as regulated entity in the situation that primary data is requested to be used by the common methodological framework guarantees that all players in the transport market are involved in GHG emissions accounting. As pointed out by an interviewed provider of freight greening programmes, in this case shipperswill request the required data from transport operators, such that the latter entities are indirectly obliged to account for their GHG emissions as well. In case transport operators/organisers are appointed as regulated entity, there is no guarantee that shippers will be involved in the process (or will receive the information). Therefore, this alternative is considered as less effective in addressing the problem of limited uptake of GHG emissions accounting. The other side of the coin is that the involvement of more players will result in a higher administrative burden (CE Delft et al., 2014), and therefore appointing transport users as regulated entity is considered as less applicable for stakeholders than appointing transport operators/organisers. As by appointing both operators/organisers and users as regulated entity, there will be both demand and supply of relevant data for GHG emissions accounting, which may improve the applicability for stakeholders.

From a legal point of view, all alternatives are feasible. For example, the current EU MRV of $CO_2$ emissions of maritime transport and CORSIA have appointed transport operators as regulated entity, while the French Transport Code is an example of a policy where transport users are appointed as regulated entity (see Annexes A and B). Most private GHG emissions reporting schemes and green incentive programmes (e.g. GLEC, LEAN & Green, SmartWay, TK'Blue) cover both transport operators/organisers and users (see Annex A).

In most existing policies covering (to some extent) GHG emissions accounting (e.g. EU MRV of $CO_2$ emissions of maritime transport, IMO DCS, CORSIA, EU ETS for aviation), the transport operator is the regulated entity (see Annex D of the Annex report accompanying this report). Appointing the transport user as regulated entity would therefore not be coherent with those policies. On the other hand, some new policy developments like the Corporate Sustainability Reporting Directive (CSRD) consider requirements on providing GHG emission figures by transport users, in which case appointing transport users as regulated entity within CountEmissions EU is more coherent.

From the analysis above, we conclude that appointing both transport operators/organisers and users as regulated entities has benefits in terms of effectiveness and coherence.

## Coverage of transport segments

Excluding some segments of the transport sector from the CountEmissions EU initiative may be an option to lower the administrative burden for the market (e.g. by excluding transport operators that do not have the capabilities to apply GHG emissions accounting) and/or to lower the regulation costs for the government (less efforts are needed for monitoring and enforcement) (CE Delft et al., 2014). We considered the following four alternatives with respect to the coverage of transport segments:

- All segments are covered.
- Only passenger transport is covered (and hence freight transport is excluded).
- Only freight transport is covered (and hence passenger transport is excluded).
- Only large companies are covered (as the administrative burden of GHG emissions accounting is relatively larger for SMEs than for large companies (Tolke & McKinnon, 2021).

Table 80 presents the results of the analysis of these four alternatives.

**Table 80 - Analysis of coverage of transport segments**

| | Effectiveness | Legal feasibility | Applicability for stakeholders | Stakeholders' acceptability | Coherence with other EU/global policies |
|---|---|---|---|---|---|
| All transport segments | 1 | 1 | 3 | 2 | 3 |
| Only passenger transport | 4 | 1 | 3 | 4 | 3 |
| Only freight transport | 3 | 1 | 3 | 4 | 3 |
| Only large transport operators/users | 4 | 2 | 1 | 1 | 2 |

* Score 1-5: Score 1: high probability; Score 5: low probability.

Covering all segments of the transport sector is most effective in addressing the problem of limited uptake of GHG emissions accounting. This effectiveness is lowered significantly as only passenger transport is considered, as the $CO_2$ emissions of this segment is roughly about one third of the total $CO_2$ emissions directly targeted by the CountEmissions EU initiative (see Section 2.4.3). Furthermore, the analysis of the problem in Chapter 3 shows that the problem of limited uptake of GHG emissions accounting (and its underlying drivers) exists for both for passenger and freight transport. By the same reasoning it can be explained that only covering freight transport will reduce the effectiveness of CountEmissions EU significantly. The arguments mentioned above are also valid for the coverage of only large transport operators/users, particularly as the majority of the operators in road transport and IWT are SMEs. In addition, by only targeting large transport operators, no level playing field for transport operators with respect to the availability of GHG emission figures exist, which hampers the comparability of transport operators on this aspect. This latter disadvantage can be addressed by appointing large transport users/ organisers as regulated entity, as these will then involve all operators within their supply chain (also the smaller ones) into the process of GHG emissions accounting.

All alternatives seems to be feasible from a legal point of view. Only considering passenger or freight transport may have some (minor) legal implications for transport modes combining passenger and freight transport on the same vehicle (e.g. belly freight aviation, ferries), although the main issue in this respect is the methodological question how to allocate emissions between passengers and freight. As discussed in Annex C.3, there are effective solutions to deal with this issue. As for the alternative to only cover large companies, the definition of 'large companies' as well as checking whether individual companies do meet that definition may have some minor difficulties from a legal point of view.

Excluding (part of the) SMEs from the CountEmissions EU initiative may significantly lower the total administrative burden of the scheme (CE Delft et al., 2014), as particularly SMEs are currently lacking the capabilities and resources to apply GHG emissions accounting (see Section 3.3.5). Therefore, the alternative to only cover large companies scores best on applicability and acceptability for stakeholders. Several interviewees (i.e. a public authority, a supplier of transport management systems, a transport company) mentioned that focussing on large companies should be a good first step in applying the CountEmissions EU initiative. Broadening the scope to other companies a later stage might be possible. Other interviewees (with a broad range of backgrounds) prefer to cover all transport segments and users/operators from the start in order to ensure a full level playing field. Two operators of freight greening programmes suggest, however, to allow for different levels of detail in calculations or input used. This would allow companies that have not (yet) access to high quality data (primary data) to start with emissions accounting, while at the same time companies that are able to apply more sophisticated calculated are incentivised to do so. One of these operators also suggest that different requirements could be considered for different transport segments or company types (e.g. SMEs) in order to limit the administrative burden of GHG emissions accounting.

As discussed before, mandatory accounting may conflict to a certain extent with policies like EU MRV for $CO_2$ emissions of maritime transport and CORSIA, as these initiatives exempt some small transport operators from GHG emissions calculation and reporting (see Annex D of the Annex report accompanying this report). As a consequence, the first three alternatives on the coverage of transport segments are not fully coherent with existing policies in case mandatory accounting is applied.

Based on the analysis above, we conclude that covering all transport segments is the most effective alternative. There may be some minor conflicts with existing policies like EU MRV and CORSIA, but these seems to be solvable. The alternatives to cover only passenger or freight transport or large companies seems not be reasonable based on the analysis carried out above and hence will therefore be discarded.

### *Geographical scope of transport activities to be covered*

The geographical scope of the policy instrument is the EU. This implies that all transport services that are carried out within the EU are within the scope of the instrument. But what about the services that have an origin and/or destination outside the EU? There are two main alternatives to define for these transport services the geographical scope of the transport activities:

1. **To/from EU**: all transport activities related to the trip to or from the EU + the transport activities within the EU. In this case, the kilometres made by train to travel from the airport in New York to the hotel are outside the scope for a holiday trip from Amsterdam to New York.
2. **To/from EU + last mile kilometres**: all transport activities from the final origin/ destination outside the EU to/from the EU + the transport activities within the EU. In this case, the kilometres made by train to travel from the airport in New York to the hotel are within the scope for a holiday trip from Amsterdam to New York. This approach may be more aligned with the travel options that are often offered by travel companies.

**Table 81 - Analysis of geographical scope of transport activities to be covered**

| Geographical scope | Effectiveness | Legal feasibility | Applicability for stakeholders | Stakeholders' acceptability | Coherence with other EU/global policies |
|---|---|---|---|---|---|
| To/from EU | 2 | 1 | 1 | 1 | 1 |
| To/from EU + last mile | 1 | 3 | 3 | 1 | 2 |

* Score 1-5: Score 1: high probability; Score 5: low probability.

As the second alternative encompasses all transport activities related to a transport service, it provides a better estimation of the GHG emissions associated to this service. The second alternative provides, therefore, a more fair comparison of GHG emissions at the level of transport services and hence may be considered more effective. However, as the 'last mile' part of the trip is often relatively small, the impact of including these transport activities in the calculation is often limited. Therefore, the difference in effectiveness is probably small.

From a legal point, the second alternative will be less feasible, as it covers transport activities outside the EU and hence outside the legal jurisdiction of the EU. For example, mandatory verification of primary data from transport operations outside the EU may be legally difficult to implement by the EU. For stakeholders, both alternatives are probably acceptable. The first option, however, requires less efforts from stakeholders as they don't have to calculate the emissions for the 'last mile'. This task may be demanding as it may require that data is provided by non-EU transport operators (which may be more complex than receiving data from EU-based operators, particularly as non-EU operators are not familiar with the requirements set by the CountEmissions EU initiative). Allowing the use of default values for the non-EU last mile operations may lower this burden.

The geographical scope 'to/from EU' is fully coherent with the scope applied by policies like EU MRV of $CO_2$ emissions of maritime transport and CORSIA (see Annex D of the Annex report accompanying this report). This is not the case for the second alternative, as the potential 'last mile' trip to the final origin/destination is not considered in these policies. However, it would mainly require that some additional data has to be collected in addition to the data collected to comply with the current policies.

Based on the analysis above, we conclude that the alternative 'to/from the EU' is the most reasonable one for the geographical scope of transport activities to be covered by the instrument.

### C.9.3 Defining longlist of policy measures

The analysis carried out in the previous section shows that on all elements except one (type of policy instruments), there is one preferred design alternative. Therefore, it is not necessary to define a longlist of policy measures and analyse those measures on specific criteria in order to select the reasonable policy measures. This step of the approach has, therefore, not been carried out.

### C.9.4 Screening of policy measures

As explained in the previous section, this step of the analysis have not been carried out.

### C.9.5 Selection of policy measures

By combining the preferred design alternatives for the various individual elements, three policy measures were defined. These instruments are presented in Table 82.

**Table 82 - Overview of policy instruments**

| Element | Policy measure 1 | Policy measure 2 | Policy measure 3 |
|---|---|---|---|
| Type of policy instrument | Voluntary opt-in | Binding opt-in | Mandatory accounting |
| Regulated entity | Both transport operators and users/organisers | | |
| Coverage of transport segments | All transport segments | | |
| Geographical scope of transport activities covered | Transport to/from EU + within EU | | |

## C.10 Overview of discarded policy measures

Table 83 provides an overview of the discarded policy measures, including a short description of the reason(s) for discarding them. An overview of the retained policy measures can be found in Section 6.3.2.

**Table 83 - Overview of discarded policy measures**

| Policy measure | Short description | Reason(s) for discarding |
|---|---|---|
| **Methodology** | | |
| Article L1431-3 of the French Transport Code | Methodology applied for accounting well-to-wheel $CO_2$-eq emissions of all transport (both passenger and freight) starting and/or ending in France. | – This methodology has a national scope, requiring some elaborations to be applied at the EU/global scale.<br>– Not all relevant activities resulting in emissions are within the scope of this methodology, e.g. emissions of hub activities and leakages and spills.<br>– The methodology will be aligned with ISO 14083, once it is published. Therefore, there is no added value of using this methodology as common reference methodology instead of ISO 14083. |
| Corporate Value Chain (Scope 3) Standard of the GHG Protocol | International standard for accounting of Scope 1-3 $CO_2$-eq emissions at the corporate level. This standard is not specifically developed for transport emissions. | – No specific guidance for allocation of transport emissions to transport services is provided by the standard. Therefore, no certainty is provided on the level of comparability and accuracy of GHG emissions figures at the transport service level.<br>– As the standard is targeting the calculation of emissions at the corporate level, applying the methodology for calculating emissions at the service level is complex. |
| PEF/OEF | EU methodology to calculate life-cycle environmental impacts of products or organisations. This is a general framework and not specifically developed for transport emissions. | – No specific guidance for allocation of transport emissions to transport services is provided by the methodology. Therefore, no certainty is provided on the level of comparability and accuracy of GHG emissions figures at the transport service level.<br>– As specific calculation rules (i.e. category rules) for transport are missing, application of the methodology by companies is complex.<br>– Limited support from stakeholders, as the scope of this methodology significantly differs from the scope of the industry initiatives in this field (i.e. ISO 14083). |
| CEN Standard EN 16258 | EU Standard for calculation and declaration of energy consumption and greenhouse gas (GHG) emissions related to any transport service (both passenger and freight). | – Not all relevant activities resulting in emissions are within the scope of this methodology, e.g. emissions of hub activities and leakages and spills.<br>– The standard leaves much room to companies to make their own decisions (e.g. on the allocation parameter to be applied), resulting in significant variance in output values. Therefore, it does not lead to the level of harmonisation intended to be achieved with the common reference methodology.<br>– The CEN Standard will be withdrawn once ISO 14083 is published. |

| Policy measure | Short description | Reason(s) for discarding |
| --- | --- | --- |
| A new reference methodology | A complete new reference methodology is developed. This methodology provides much guidance on emissions accounting, resulting in high levels of accuracy and comparability.<br>The methodology will cover all preferred design alternatives. | – Lack of acceptability from stakeholders, who want a methodology that is in line/based on the current/emerging methodologies. |
| **Harmonised input data** | | |
| – | – | – |
| **Harmonised output data** | | |
| Recommendations for harmonised output data | The EU provides recommendations for the harmonised format of emissions output data. | – There is no guarantee that everyone will use the recommended formats and hence that all output data is provided in the same format.<br>– As output data may not be harmonised, more efforts are required from stakeholders to calculate emission figures (as required data is shared in different formats and hence require some processing before it can be used in the calculations). |
| **Sectoral implementation guidelines** | | |
| EC provides guidelines | The EC provides a set of implementation guidelines for specific transport segments | – As the EC is less aware of the relevant specificities of each transport segment with respect to GHG emissions accounting, development of the guidelines by the EC may result in lower levels of alignment with the sector-specific needs than provision by the private sector.<br>– Stakeholders seem to prefer the guidelines to be developed by the private sector (see above).<br>– Because of time-consuming procedures at the EC, quick modifications of the guidelines will be more difficult for the EC than for the private sector. |
| Member states provide guidelines | Each member state provides a set of implementation guidelines for specific transport segments | – Same reasons as for the policy measure 'EC provides guidelines'. |
| Private sector provide guidelines | The provision of sectoral guidelines is done by the private sector. There is no involvement from public authorities at all. | – Risk on inconsistencies between the guidelines and the common reference methodology and harmonised data requirements set by the CountEmissions EU framework (as entities developing the guidelines lack specific knowledge on the CountEmissions EU framework).<br>– Uncertainty whether guidelines will be developed for each sector where these are needed.<br>– Lower stakeholder acceptance as there may be doubt on the consistency of the guidelines with the CountEmissions EU framework. |
| Private sector provide guidelines, but recommendations from the EC | The provision of sectoral guidelines is done by the private sector. The EC provides recommendations on | – Although the EC recommendations may help in aligning the guidelines with the CountEmissions EU framework, there still is a risk on inconsistencies.<br>– Uncertainty whether guidelines will be developed for each sector where these are needed. |

| Policy measure | Short description | Reason(s) for discarding |
| --- | --- | --- |
| | the issues that could be covered (and in what way). | – Lower stakeholder acceptance as there may be doubt on the consistency of the guidelines with the CountEmissions EU framework. |
| | **Conformity** | |
| Mandatory verification by member state accredited third bodies. | Mandatory verification of input data and calculation processes executed by member state accredited third bodies. | – As it cannot be ensured that member states organise the accreditation of third bodies in the same way, verification may be less uniform in the EU compared to a policy measure with EU accredited third bodies. As a consequence, comparability and accuracy of GHG emission figures may differ between countries.<br>– As there may be no full harmonisation of verification processes across member states, there may be more uncertainty (and possibly higher costs) to internally operating companies (e.g. as they have to deal with slightly different verification schemes in each member state). |
| Mandatory verification for entities with a size above a certain threshold, by member state accredited third bodies. | Mandatory verification of input data and calculation processes for large companies (non-SMEs) executed by member state accredited bodies. | – Same reasons as for the policy measure 'Mandatory verification by member state accredited third bodies). |
| Mandatory verification by the EU | Mandatory verification of input data and calculation processes executed by the EU. | – Lack of support from stakeholders, who prefer a verification scheme run by (accredited) third parties. |
| Mandatory verification by member states | Mandatory verification of input data and calculation processes executed by member states. | – Lack of support from stakeholders, who prefer a verification scheme run by (accredited) third parties. |
| Voluntary verification by member state accredited third bodies | Voluntary verification of input data and calculation processes executed by member state accredited third bodies. | – Same reasons as for the policy measure 'Mandatory verification by member state accredited third bodies). |
| | **Complementary measures** | |
| Market provides calculation tool(s) | The development and implementation of calculation tools is left completely to the market. | – There is no certainty that the calculation tool(s) are consistent with the common methodological framework of CountEmissions EU.<br>– There is no certainty that the calculation tool(s) provide accurate and comparable emission figures.<br>– In general, stakeholders prefer some form of certification of the calculation tools. |
| Market provides calculation tool(s), but recommendations from the EC | The development and implementation of calculation tools is left completely to the market. The EU provides recommendations on the minimum requirements of the tools. | – Similar reasons as for the policy instrument 'Market provides calculation tool(s). |

| Policy measure | Short description | Reason(s) for discarding |
|---|---|---|
| The market provides data sharing mechanisms | The development and implementation of data sharing platforms/mechanisms is left completely to the market. | – There is no certainty that data sharing mechanisms are actually developed and implemented.<br>– Security and privacy of the data is not ensured, as there is no external control on these issues.<br>– In general, stakeholders prefer some form of certification of data exchange mechanisms. |
| **Applicability** | | |
| Voluntary recommendations | Accounting and reporting of GHG emissions is voluntary, but application of the common methodological framework is recommended by the EU. | – A fully voluntary scheme is not effective in incentivising the uptake of GHG emissions accounting in the transport and logistics sector.<br>– Not much support for a fully voluntary scheme amongst stakeholders. |

# D Relevant trends and developments for GHG emissions accounting in transport

## D.1 Introduction

In this Annex we discuss the trends and developments that are of importance for the development of the baseline scenario (see Section 6.2) and the expected evolvement of the problems (see Section 3.4). In order to determine the trends and developments we relied on the results of the stakeholder consultation (see Annex G), literature analysis, assessments of the state of the state of play with respect to GHG emissions accounting (Annex A) and ongoing policy developments (Annex B) and discussions with various experts.

We identified three main developments, according to which we structured our analysis:
1. Further GHG emissions accounting harmonisation efforts from the market (Section D.2).
2. Political and legal developments (Section D.3).
3. Technological developments (Section D.4).

These three development contribute a fourth one, the future uptake of GHG emissions accounting by the market (Section D.4).

## D.2 Further GHG emissions accounting harmonisation efforts from the market

### D.2.1 Standardisation

Over the last decade there have been important initiatives from the market with respect to alignment of standards/methodologies for GHG emissions accounting. The most relevant initiative in this respect (for the freight transport sector) is the development of the GLEC framework. GLEC was launched in 2016 following earlier (EU funded) research projects. Within this framework, further harmonisation of the methodology for GHG emissions accounting in logistics has been achieved. A next step for harmonisation is the development of the ISO 14083 Standard, which is planned to be finalised by the end of 2022. According to the stakeholders consulted for this study as well as the experts, this ISO Standard will probably become the dominant standard for GHG emissions accounting in the transport sector. They expect a large uptake of this standard by the market, which will further stimulate the trend toward increased harmonisation that is already happening.

An overview of the intended alignment of various standards/methodologies and calculation tools with ISO 14083 is shown in Table 84. From this table, it can be seen that a majority of standards/methodologies and calculation tools, support tools and databases is already planning to align with ISO 14083. This is in part because the GLEC framework already ensured that there is a reasonable level of harmonization in freight transport (e.g. by certifying calculation tools that are aligned with GLEC). Since the GLEC framework is intending to align with ISO 14083, this automatically means that in many cases the alignment of other initiatives is ensured.

The most common misalignment between current standards/methodologies and calculation tools on the one hand and ISO 14083 on the other hand, is the emissions scope. Whereas many standards/methodologies and tools still are based on a tank-to-wheel scope (see Section 2.3), the ISO 140883 Standard will require a well-to-wheel scope (see Annex A). According to the experts and the stakeholder interviews, there is a trend toward well-to-wheel emissions accounting already. It can be expected that the introduction of ISO 14083 will accelerate this ongoing shift of focus from tank-to-wheel calculations to well-to-wheel calculations.

In specific cases there is also a deliberate deviation from the ISO 14083 methodology. The motivation for such a deviation could be that the specific guidelines of the ISO 14083 draft are considered to be poorly suited for the specific sector/purpose of the existing methodology/standard[84].

**Table 84 - Overview of standards/methodologies and calculation tools and their intention to align with ISO 14083**

| Name | Intention to align with ISO |
|---|---|
| **Standards and methodologies** | |
| EN 16528 | Most likely EN 16258 will be withdrawn once ISO 14083 is approved. This will be determined in the coming months. |
| IATA RP1726 | IATA is aware of the developments for the ISO Standard and the emission allocation in passenger planes and aviation fuel emission factors aligns.<br><br>However, IATA uses a tank-to-wheel approach, whereas ISO is on a well-to-wheel basis. This misalignment can be overcome if users apply a well-to-wheel emissions factor that matches both IATA RP1726 and ISO 14083. |
| IMO EEOI | The basis of the EEOI is aligned with ISO 14083, but they have also come out with other carbon intensity indicators recently which are less well aligned. There has not been direct contact between IMO and the ISO working group. |
| GHG Protocol | Unknown |
| GLEC | Yes (which does not require modifications, as GLEC forms the basis for ISO) |
| Top Sector Logistics method | Yes |
| SmartWay | USEPA SmartWay representatives have been involved directly in the ISO development process and have signed off on the content.<br><br>Currently, the main deviation is a tank-to-wheel approach (this difference can be overcome if the user chooses ISO-compliant well-to-wheel factors). The timescale on which they intend to update the methodology to fully align with ISO is not known. |
| CORSIA | The emission factors for aviation fuel align and CORSIA does have a well-to-wheel approach. However, the scope and purpose differ. |
| Article L1431-3 of the French transport Code/Objectif $CO_2$ | ADEME has been involved in the international ISO working group and is planning to align with the future ISO 14083 Standard. |
| Clean Cargo Working Group | Yes (it already aligns) |
| EU MRV for maritime transport | Currently no intention to further align with ISO 14083. |
| EU ETS for aviation | Currently no intention to further align with ISO 14083. |
| IMO DCS | Currently no intention to further align with ISO 14083. |

[84] An example of this is the Parcel Delivery Environmental footprint, which is discussed in more detail later in this section.

| Name | Intention to align with ISO |
|---|---|
| EN 17837: Parcel Delivery Environmental Footprint (draft) | The PDEF will align with ISO, except for the allocation method. The reason for this is that the specifics of parcel delivery requires a different approach than chosen in the last draft of ISO 14083. |
| **Calculation tools** | |
| CarbonCare | Unknown |
| BigMile | Yes |
| Ecopassenger | Unknown |
| Ecotransit | Yes (through GLEC conformity) |
| Eurocontrol SET | Unknown |
| Greenrouter | Yes (through GLEC conformity) |
| LogEC | Yes (through GLEC conformity) |
| NTM Calc | Unknown |
| Oui.sncf | Unknown |
| REff Tool | Yes (through GLEC conformity) |
| SeaExplorer | Unknown |
| TK-Blue | Unknown |
| TRACKS | Yes (through GLEC conformity) |
| Transporeon | Yes (through GLEC conformity) |

### D.2.2 Sector-specific initiatives

Standardisation efforts by the market, such as ISO 14083 and GLEC, contributes to a further harmonisation and uptake of GHG emissions accounting in the transport sector. For some transport sectors, however, these general standards are modified to better align with the specificities of that sector or alternative standards are developed. This has/may result(ed) in various sector-specific frameworks which are discussed in this section.

The existing sector-specific initiatives are expected to have a positive effect on the uptake of GHG emissions accounting. As these initiatives are more tailored to the requirements of the specific sector and as often sector-specific guidelines and default emission factors are developed, companies are probably more likely to apply GHG emissions accounting.

The effect of sector-specific initiatives on harmonization of GHG emissions accounting in the transport sector are less straight-forward. On the one hand, sector-specific initiatives increase the fragmentation between sectors compared to the use of general guidelines that apply to all sectors. However, this kind of fragmentation can be a positive development, in the sense that it is impossible to create general guidelines that are tailored to all sectors, and hence sector-specific methodologies or input data may result in more accurate and reliable GHG emission figures. The stakeholder consultation and expert interviews showed that the current sector-specific initiatives are aware of the general standardisation efforts by GLEC, CEN and ISO. In general, they intend to align with the future ISO 14083 norm but add more sector-specific guidelines compared to the generic guidelines. Therefore, it can be argued that this fragmentation increases the quality of the calculations. However, it should also be noted that the sector-specific guidelines do deviate from ISO 14083 on some aspects. Notably, the "Parcel Delivery Environmental Footprint (PDEF)" guidelines for the parcels sector, which is currently under development, will advocate a methodology for allocation that is different from the ISO 14083 guidelines. The reason for this deviation is that they argue that the allocation guidelines by ISO 14083 are poorly suited for the parcels sector.

More specifically, the following sector-specific initiatives are currently developed:

- The **EU chemical sector** has developed a sector-specific guideline based on the GLEC framework (SFC, 2021). The methodology was designed in collaboration with the Smart Freight Centre (SFC) and the European Chemical Transport Association (ECTA). The need for a methodology tailored on the needs of the chemical industry stems from a number of industry-specific issues, including the use of weightier-than-average transport; reliance on bulk goods; and the use of pipeline transport, among others. To enforce change across the transport and logistics chain, CEFIC members rely on the SQAS (Safety & Quality Assessment for Sustainability) system. The vast majority of chemical companies use SQAS. Since January 2022, SQAS questionnaires cover the measurement and mitigation of GHG emissions, among other questions. The questionnaire covers Scope 1, 2, and 3 emissions. These differ by mode of transport and activity. For land transport, for instance, Scope 1-2 emissions include the emissions of own vehicles, whereas Scope 3 include all subcontractors, intermodal transport, tank cleaning, as well as warehouses. CEFIC sees SQAS as the main market-driven mechanisms for the chemical industry to ensure that their suppliers in transport and logistics maintain a certain level of environmental performance.
- The **EU parcels sector** is currently developing 'prEN 17837 – Parcel Delivery Environmental Footprint' (PDEF). A complete overview of the information is included in Annex A of the Annex report accompanying this report. In short, PDEF is a sector-specific framework for GHG accounting which is expected to become active in Q1 of 2023. All emissions between pick-up and delivery are included in the scope of the emissions calculations. Because of the global nature of the sector, also pickup or delivery in different continents are part of the scope. However, the methodology does focus on the EU market. The scope of emission calculations is well-to-wheel. The reason for creating this sector-specific framework is that the parcels sector is quite different compared to most freight transport. For example, the unit of emissions per tonne-kilometre is not best suited to determine the environmental impacts of parcels (this is because volume is often the constraining factor). The calculation method of this framework is largely in line with GLEC and the latest draft version of the ISO 14083 norm. However, the methodology for the allocation of emissions to individual parcels deviates from GLEC/ISO 14083. The PDEF includes two options:
  1. The first option is to allocate the emissions based on both volume and weight.
  2. The second option is to allocate an equal amount of emissions to each stop, and divide the emissions between the parcels that are delivered at that stop. The reason for this approach is that whether you need to add another stop to the schedule for a specific parcel has a large impact on the $CO_2$ emissions of the round trip.
- The **Clean Cargo working group** has established GHG emissions accounting guidelines for the container shipping sector (BSR, 2015). Currently this methodology is managed by Smart Freight Centre. We were informed by Smart Freight Sector that the Clean Cargo working group currently represents 85% of the global container market. This high uptake can be explained by a clear customer demand and a relatively concentrated supply market. A factsheet of this methodology is included in Annex A of the Annex report accompanying this report.
- IATA has developed the **Recommended Practice 1728**. The methodology has been developed by the IATA Air Cargo Carbon Footprint (ACCF) working group, and establishes a methodology to measure the $CO_2$ emissions generated by air cargo at shipment level. More detailed information on this methodology is included in Annex A of the Annex report accompanying this report.
- One of the consulted experts also mentioned that the **fashion industry** is planning to develop a sector-specific initiative. However, no further information on this initiative is available (yet).

### D.2.3 Input data

Based on the stakeholder consultation and expert interviews, the main trends for the input data used for GHG emissions accounting are as follows:

- In freight transport, a shift from default emission factors to carrier-specific values is ongoing. Also, carriers improve their ability to measure fuel consumption and are under pressure from shippers to do so. This improving data availability makes it possible to calculate emissions with use of primary data, which reduces the reliance on default emission factors. However, default emission factors remain important in the foreseeable future as primary data is not available for all transport flows.
- Another trend is that greater disaggregation of transport emissions data is asked for by shippers. Whereas currently many shippers only ask transport companies for aggregated emission figures, increasingly often detailed figures on trip, vehicle or consignment level are asked. Also, there is a shift from yearly averages to shorter time scales for reporting. Carriers are helped to achieve this level of detail by companies offering GHG accounting tools such as TRACKS, Transporeon and Project 44.
- If detailed data is available, the use of Artificial Intelligence and Machine Learning can help to measure emissions across company supply chains. There is a growing number of companies that offer these services. However, the uptake of these methodologies is still low.

As mentioned above, there is a transition currently ongoing to greater use of primary energy consumption data. It will, however, take time before every operator can provide this kind of data for all trips in the supply chain. Therefore, databases and average emission factors will remain relevant for the foreseeable future. Two important trends with respect to these databases mentioned by the stakeholders are:

1. There is increasingly more harmonization between databases.
2. The databases become increasingly more specific for vehicle types, geographic regions and business segments. This is a trend that causes increased differentiation between emission figures. However, these differentiations reflect real differences between emissions in different regions, vehicle types and business segments and thereby improve the overall quality of the emission calculations.

## D.3 Policy developments

There are various European and international political and legal developments that contributes to the uptake of GHG emissions accounting in the EU. The relevant initiatives at the EU and global scale are discussed in Annex D of the Annex report accompanying this report. There are a few policies that (indirectly) oblige some transport operators to account for their GHG emissions, i.e. EU MRV for $CO_2$ emissions of maritime transport and IMO DCS (both for maritime transport) and CORSIA and EU ETS for aviation (both for aviation). All these policies require transport operators to calculate $CO_2$ emissions based on primary data (actual fuel consumption) and default figures (or modelling exercises are only allowed for specific groups of operators or to fill gaps. Furthermore, these policies have a tank-to-wheel scope for $CO_2$ emissions (other greenhouse gases are not within the scope) and focus on reporting at vehicle level. It is still uncertain whether reporting obligations on a well-to-wheel scope, for $CO_2$-eq emissions or at transport service level will be enforced on an EU level in the future.

There are also several EU policies or ongoing initiatives that may incentivise the demand for GHG emission figures for transport services. For example, large companies will need to report their Scope 3 emissions for all transport modes due to the Corporate Sustainability Reporting Directive (see Annex D of the Annex report accompanying this report). This would probably significantly boost the uptake of GHG emission calculation for all transport modes. In the revision of the Combined transport Directive it is for instance considered to include GHG emissions among the criteria to define eligible combined transport operations. However, as this revision is still under development, it will not be included in the baseline scenario. Finally, the EU taxonomy may incentivise the demand for GHG emission figures of transport services in case these figures could be used (in the future) to define sustainable products/services.

At the national level, there is currently one relevant public initiative with respect to GHG emissions accounting in transport, i.e. the French Article L1431-3 of the Transport Code which has imposed an ‘obligation on transport service providers to inform their customers of the quantity of greenhouse gases emitted during transport’ since 2017 (Légifrance, 2015). This is intended to enable customers to be able to choose transport operators with the best environmental performance. All trucking companies must comply and provide this information to their clients, but for smaller ones (with less than 50 employees) the methodology is simplified and can rely on industry default values. No other national policies in this field are currently existing or planned within the EU.

## D.4 Technological developments

### D.4.1 Onboard fuel consumption metering and monitoring

$CO_2$ emissions can be directly derived from fuel consumption, taking into account the emissions intensity of the fuel. Fuel consumption can be measured or metered. Aggregate data on the amount of fuel tanked is usually readily available from the financial administration. However, such data generally does not provide sufficient information to allow attribution of the fuel consumed for different trips to different logistic applications, clients or shipments. Detailed fuel consumption metering enables calculation of the fuel consumption at the level of individual trips and subsequent use of these data in attributing GHG emissions to shipments or clients. Such detailed level of attributing emissions to shipments or clients is, currently, not required by the ISO 14083 Standard, nor by the methods used in most other $CO_2$ accounting schemes. It may, however, provide options to further improve the accuracy of GHG emissions accounting in the future.

Most new vehicles, ships and airplanes are equipped with on-board fuel consumption metering systems, which can measure fuel consumption real-time, display actual fuel consumption in-vehicle and transmit data to a back-office. Today, the systems are mainly used to be able to steer on fuel use reductions. For heavy-commercial vehicles, ships and airplanes, the real-time data can be aggregated in fleet management software to give insight in fuel consumption over routes, periods, etcetera, which could enable analyses and optimisation of logistical planning. Real-time data is not used for this purpose; rather data aggregations helps to understand and bring to the light possibilities for optimisation retrospectively, looking back in the data and it’s visualisations.

For current fuel meters there are no, or not very strict requirements for the accuracy or only few requirements with regard to the data quality and uniformity. Manufacturers tend to implement their own data management systems. It is generally noted and also confirmed by tests that fuel consumption meters in cars and trucks show deviations in fuel consumption when this is compared to the volume of refills. While this could partly be caused by uncertainties of the fuel metered at the fuel station, it is thought that most of the difference is caused by the fuel meter in the vehicle. These systems may rely, to a certain extent, on standardised data streams, but often there are no strict requirements as to what signals have to be available or what accuracy systems shall have. Some progress that is made comes from enforcement. For instance, monitoring and reporting schemes in the EU would require the introduction of fuel consumption monitoring and control measures to assure a minimum data accuracy and uniformity. For passenger cars this is currently the case. For road vehicles, further requirements will be worked out under the on-going Euro 7 discussion, also for heavy commercial vehicles. Security and anti-tampering features will also be addressed in this discussion.

With the increase of the importance of data for e.g. monitoring and reporting, emissions accounting or emissions trading, it will become necessary to standardise data streams to assure the uniformity and to define requirements to guarantee a certain accuracy and integrity, preventing fraud. At present this is not yet the case for most sectors.

Below we give a more detailed overview of the technological developments per transport mode.

## Road transport

The monitoring and reporting of on-board fuel and/or energy consumption is regulated in the EU for passenger cars and light duty vehicles (LDV) and regulation for the monitoring on board of Heavy-Duty Vehicles (HDV) is being prepared[85]. The reported monitoring data will mainly be used to follow the trends of real world fuel consumption and $CO_2$ emissions in response to the EU $CO_2$ standards for these vehicles. This would enable the evaluation of the effectiveness of the $CO_2$ regulation. The certification of vehicles requires the $CO_2$ emissions and fuel consumption to be determined over fixed test cycles. Each vehicle (family) has its own typical emission and fuel consumption value. This value may deviate from real fuel consumption because real world operation can differ from the test cycles. The certification value is intended to rank technology in terms of fuel consumption and $CO_2$ emissions, but actual achieved reductions by a certain technology may depend on real driving cycles.

For passenger cars and light commercial vehicles, OEMS are obliged to equip their new vehicles with an OBFCM (On-board fuel and/or Energy consumption Monitoring Device). Members states are required to collect the fuel consumption at roadworthiness tests of these vehicles periodically and transmit this data to the EEA as of 20 May 2023. In order to ensure that it is possible to access real-world fuel and energy consumption data as early as possible, manufacturers should be required to collect such data from new passenger cars and light commercial vehicles registered from 1 January 2021. It is not yet clear how this would work for heavy commercial vehicles as the regulation is still under preparation and various options for data transmission are on the table. However, It is expected that monitoring and reporting using OBFCM will become mandatory too for heavy commercial vehicles within the next few years[86]. Note that accuracy of OBFCM is only verified on a chassis dynamometer at type-approval and has to be within 5% for light-duty vehicles.

[85] For more information about these policies, see the policy factsheets in the Annex report.

[86] Even though on-board fuel consumption meters are not mandatory yet for trucks, such devices are widely used by owners and fleet operators to monitor, aside various other parameters, the fuel consumption of individual vehicles and fleets. Operators can use the information to steer on reduction of fuel consumption by optimizing operations and even driving style.

### Maritime transport

Onboard fuel consumption metering and monitoring at vessel level is already the standard due to the EU MRV regulation (see factsheet in the Annex report) and the amendments to MARPOL Annex VI (see factsheet in the Annex report). Several methods are allowed for the determination of the annual fuel oil consumption in metric tonnes, i.e. bunker delivery notes (BDN's), flow meters or bunker fuel oil tank monitoring (fuel level in the tank). Modern ships have systems that can measure and display actual fuel consumption and aggregated fuel consumption of the engines on-board in most cases. Fuel consumption can be either measured by the engines control unit in case of newer electronically controlled engines and/or by installed fuel meters in combination with tank level meters. Fuel meters and tank level meters can be installed as a retrofit solution for ships with older engines. Third parties offer fuel consumption metering and monitoring systems which can include telematics to transmit data to the back-office of fleet managers. These technological developments contribute to lower the administrative costs of data collection and to increase the quality of the data collected.

### Aviation

Some form of fuel quantity indicator is already required for all aircraft. Aircraft engines generally use fuel flow meters that allow on-board estimation of fuel consumed and available in the tank. Combining these data with fuel uplifted and tank sensors a Fuel Quantity Indication is obtained. This indication is usable for estimation of $CO_2$ emissions and is transmitted together with performance and technical health related airplane data to the ground services. For modern airplanes, flight data services are offered in a similar fashion as for trucks. Real-time or aggregate data is made available through online (cloud) services to a back-office allowing to follow actual flight data for various purposes. This data also includes real-time fuel and $CO_2$ data.

Airplane Health Management provides significant overall fuel and emission performance measures for individual airplanes, enabling operators to improve overall average fleet performance. It is an information tool designed by Boeing and airline users that collects in-flight airplane information and sends it in real time to the ground. A module within the system provides automated monitoring of fuel consumption and calculation of carbon dioxide ($CO_2$) emissions. Airlines can use this information to optimize the operation of individual airplanes as well as entire fleets.

Aeronautical data is also collected on a larger scale mainly for monitoring and reporting purposes. Several platforms are used: The EAD is the world's largest aeronautical information management (AIM) system. EUROCONTROL operate EU's ETS and support facilities to help national authorities and aircraft operators meet their reporting obligations for CORSIA. The EASA data sharing platform collects noise and emissions certificates of aircraft types. The use of SAF (Sustainable Aviation Fuel) is monitored and reported under ETS. Finally, the European aeronautical information services database (EAD) is a centralised reference database of quality-assured aeronautical information that enables users to retrieve and download AIS data in real time.

## D.4.2 Data sharing

Data sharing platforms exist for transport sectors to facilitate various forms of controlled secure data collection, processing and distribution for various reasons such as tracking, emissions trading and reporting. In EU recent research focused on Trusted Secure Data Sharing Space (TRUSTS).

Many transport operators are not eager to share detailed data of fuel consumption with their shippers, because this will disclose information about the costs of their service and shipper may use this information to negotiate for a lower price for the service (see also Section 3.3.3). Although, fuel consumption and associated costs can be estimated with a certain accuracy to arrive at cost estimates, even small margins can be important for individual operators.

In logistics, ICT solutions are being investigated which can collect and aggregate data to make the data available in such a way that no competitively sensitive information is disclosed. For logistics, for example Dynalog DL4DL provides a blueprint for trustworthy data sharing infrastructure for logistics and policy making. It provides a market place for data services, decentralized data sharing, for the logistical sector and ports under Portbase in the Netherlands. IAMconnected is used to obtain digital access to various services. Examples also exist for other sectors. For road transport, monitoring and reporting is regulated, providing emission values for vehicles, enabling monitoring of emissions trends of vehicles and enabling comparison of vehicle emissions and fuel consumption. OBFCM (On-Board Fuel Consumption Meter) allows to compare the emissions values with real world data, so as to monitor for a possible gap. For sea-going shipping, IMO has put in place a data sharing platform which is able to collect and disclose aggregated and anonymised data of fuel consumption of ships.

Digital data-sharing is common practice and used for shipping, aviation and road transport, e.g. on trusted secure platforms. The use of high-resolution, real-time data should be considered only if an accurate attribution of emissions is necessary. In many cases, actual emissions data still requires better standardisation and measures to ensure data-integrity. Aggregate data such as Bunker Delivery Notes in combination with some other parameters could still suffice and satisfy the need to attribute emissions to a certain proxy for transport work, if the demanded accuracy is lower.

The use of big data, AI, high resolution and real-time data require more bandwidth, processing power and data-storage and are more complex and costly to use and operate. The use of these should be balanced against the specific demand, the required accuracy and actuality of being able to relate emissions to a certain transport duty. Big data and AI could enable to evaluate and reveal more complex relations to optimize logistics but it is thought that real-time, high resolution data cannot be used for micro-management in logistics unless a transport system is highly responsive, but this is rarely the case. To assign emissions retrospectively, e.g. to a pallet or parcel, some resolution is necessary but depends on required accuracy. With a mix of shippers, attribution of emissions is necessary to distribute emissions according to the utility each consumed, however, big data and AI are no necessity.

## D.5 Trends in the uptake of GHG emissions accounting by the transport sector

The current uptake of GHG emissions accounting was discussed in Section 2.4.1. In this section we focus on expected development of this uptake and the underlying trends explaining this development in uptake. These trends are defined based on the stakeholder interviews and survey, the information from our experts and the desk study.

The first trend that we identified is an **increasing uptake in GHG emissions accounting**. This increase in uptake is caused by increasing demand from consumers, shippers and the government for emission figures. Even without a further increase in demand from consumers, the uptake is expected to increase in the coming years. This is because old contracts between shippers and transport operators, which usually do not yet specify requirements about the reporting of GHG emission figures, are gradually replaced with new contracts that usually do include requirements for GHG emission reporting. Also, based on the stakeholder interviews, we can conclude that an increased awareness of sustainability by consumers is expected, which will lead to higher pressure on shippers to disclose the sustainability of their products in the future. However, we were unable to find strong evidence in the literature that this will be indeed the case. Also, EU legislation which forces certain transport modes or companies to report their emissions (see Section D.3) is an important stimulus that may cause an increasing uptake over the coming years.

The second trend is **increasing quality of the calculations**. Currently, the quality of GHG emission calculations is not always of high quality. This has multiple reasons, such as the use of poorly suited standard emission factors. With the help of improved calculation standards, support tools, technical capabilities (such as increased quality of onboard measuring and data sharing techniques) and databases, the average quality is improving. It can be expected that this improvement will continue in the near future. However, there are certain barriers, such as unwillingness to share data, which slow this development down.

The following specific improvements in the quality of emission calculations can be distinguished:
- The granularity of calculations increases. Whereas currently most carriers only calculate emissions at company level, an increasing share is able to calculate emissions for individual companies, vehicles or products/passengers that are being transported.
- Another trend is an increase in the use of primary energy data instead of activity based emission factors. The use of primary energy data increases the accuracy of the calculations and therefore also makes it possible to use the calculations for operational optimization purposes. This trend can mainly be seen at large corporations which have the knowledge to perform detailed calculations. Small transport companies often are still unable to calculate their emissions at all and if they do so this is usually in a simplified manner.

# E Case studies

## E.1 Introduction

This Annex presents a set of case studies of transport GHG emissions measurement and calculation by various types of stakeholders. Attention has been paid to gather information on possible impacts, costs and administrative burden and compare them to the benefits in terms of cost efficiency, business opportunities, availability of data and environmental impacts.

The case studies presented have been identified to cover three main topics:
1. Programmes and implementation initiatives:
    - The US EPA SmartWay Program
    - the Chemical Industry and the GLEC Framework;
    - the Logistics Emissions Accounting and Reduction Network project (LEARN);
    - lessons learnt from the development of a long-lived industry standard to calculate $CO_2$ emissions: the Clean Cargo Calculation Standard;
    - DHL Express;
    - Mandersloot.
2. Regulatory efforts:
    - application of Article L1431-3 of the French Transport Code: SNCF GHG calculation methodology for transport services.
3. Tools and platforms:
    - Mobitool;
    - CarbonCare;
    - European Association for Forwarding, Transport, Logistics and Customs Services (CLECAT);

Depending on the actual information available, the structure of the case studies is as follows:
- overview;
- GHG accounting methodology;
- barriers to GHG accounting;
- impacts: economic, social and environmental;
- implication for EU policy design.

## E.2 Programmes and implementation initiatives

### E.2.1 The US EPA SmartWay Program

#### Overview

SmartWay is a voluntary partnership program established in 2004 by the US Environmental Protection Agency (EPA) to reduce greenhouse gas emissions and air pollution from the freight transportation industry. It aims to improve environmental performance, energy efficiency, and sustainability in the sector, which includes trucking, rail, maritime, and logistics operations. The EPA has also collaborated with counterparts in Canada to establish (in 2012) a Canadian branch of the SmartWay program. More than 4000 North American companies are now part of the partnership with at least 3500 of those coming from the United States. This case study focuses on the US EPA program.

Emissions accounting is a key component of the SmartWay system that helps participants monitor their environmental performance and identify areas for improvement. The program provides specific tools and resources (split by mode and activity) for participants to accurately measure, benchmark, and report their emissions, including: greenhouse gases (GHG), nitrogen oxides (Nox), and particulate matter (PM).

## GHG accounting: drivers, scope, choices in accounting methodology.

Key aspects of the SmartWay program's emissions accounting approach include:
- Data collection: participants provide information on their fleet's operations, fuel consumption, and emissions, which is then used to calculate their environmental performance.
- Emissions quantification: the EPA has developed tools which use standardised methodologies and emissions factors to help participants quantify their emissions and energy consumption. These tools are provided for: logistics companies; truck carriers; rail carriers; air carriers; barge carriers; and shippers. A user guide is developed for each tool and partners submit data annually.
- Performance benchmarking: since 2011 the initiative enables participants to compare their environmental performance with industry averages and peer groups, which promotes best practices and helps identify opportunities for improvement.
- Reporting and recognition: participants are encouraged to report their emissions data and progress towards meeting their environmental goals. The EPA recognises high-performing partners with awards and public acknowledgment, promoting a culture of continuous improvement.
- Collaboration and sharing: the initiative fosters collaboration among stakeholders to share knowledge, experience, and best practices in emissions reduction and efficiency.

It is important to acknowledge the benchmarking and reporting dimension of the program, which provides additional functionality with respect to the current scope of CountEmissions EU. SmartWay is designed to take advantage of competitive pressures in the transportation market by providing purchasing managers with environmental performance information that shippers can use to assess and select firms based on their environmental performance.

SmartWay has three types of partners: shipper partners (organisations that ship freight); carrier partners (businesses that carry or move goods for shippers); and logistics company partners (firms that hire freight carriers and manage freight shipments for shippers). There is also an ‘affiliates’ category for organisations that do not fall into these categories but want to participate in SmartWay. Note that deep sea shipping is not included into the scope at this moment, however SmartWay has a memorandum of understanding (MoU) with the Clean Cargo Working Group to include their ocean going freight trade lane emission factors into SmartWay, and SmartWay is initiating coding changes in the tools and database to execute on this aspect. Emissions from transhipment points (e.g. ports, hubs, DCs) are not included into the scope at the moment. However, SmartWay is exploring the potential to include emissions from distribution hubs.

The headline incentive from SmartWay (to encourage voluntary participation) is an integrated set of no-cost, peer-reviewed sustainability accounting and tracking tools to help companies make informed freight transport choices. These tools are then supposed to help registered partners to measure, benchmark, and report emissions and to improve freight efficiency and environmental performance across their supply chain.

SmartWay computes different KPIs for the different user types as shown by Table 85.

**Table 85 – SmartWay KPIs**

| **Emission measurement unit measured per year per pollutant ($CO_2$, $NO_x$, $PM_{10}$, $PM_{2.5}$, black carbon)** | **Shipper** | **Logistics company** | **Multimodal carrier[21]** | **Air carrier[22]** | **Truck carrier[23]** | **Rail carrier[24]** | **Barge carrier[25]** |
|---|---|---|---|---|---|---|---|
| tonnes (total emissions) | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| g/mile | ■ | ■ | ■ | ■ | ■ | | ■ |
| g/tonne-mile | ■ | ■ | ■ | | | ■ | ■ |
| g/average payload tonne-mile | | | | ■ | ■ | | |
| g/thousand cubic foot-miles | | | | | ■ | | |
| g/thousand utilized cubic foot-miles | | | | | ■ | | |
| g/railcar-mile | | | | | | ■ | |
| g/truck-equivalent-mile | | | | | | ■ | |

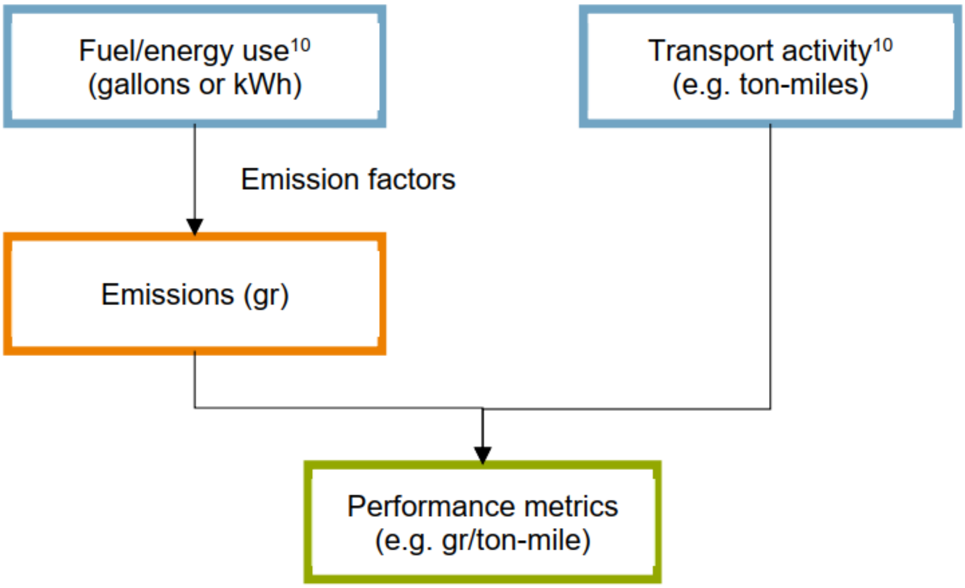
Source: Davydenko et al. (2019)

## Methods and tools

SmartWay is centred on the use of tools, which are introduced in the previous section. The computations are hidden from the user. The underlying detailed methodology is provided in the documents related to each tool, which can be found (updated each year) on the SmartWay website.

The general approach is similar to the approach of the other common carbon accounting methods for freight transport (e.g. GLEC). Fuel and energy use are converted to emissions (CO2, NOx, PM2.5, PM10 and black carbon), which are divided by the transport activity to calculate the performance metrics. Both fuel/energy use and transport activity are input per year and then disaggregated (see Figure 17).

**Figure 17 – SmartWay approach**




The specifics of the SmartWay methodology is that it produces not only CO2 emission output, but also computes the emissions of other pollutants (NOx, PM2.5, PM10 and black carbon). SmartWay provides a conversion table for the quantity of fuel expressed in gallons to be converted into grams of CO2. The table implies that the use of 1 litre of diesel fuel results in 2.69 kg of CO2 emissions, which is a Tank-To-Wheel (TTW) conversion factor. It can be concluded that SmartWay uses TTW emission factors (Davydenko et al., 2019). Emissions related to cooling (e.g. reefer) are included in the calculation. The SmartWay description does not include any guidance on emissions related to infrastructure and vehicle chain.

## Impacts

The impacts associated with the implementation of SmartWay have been reported on since 2004. Over that same period (according to the SmartWay program itself, they used a USD$1.5 million budget to save partners $6.1 billion collectively while reducing fuel consumption by 50 million barrels of oil and air pollutants (235,000 tons of nitrogen oxides, 9,000 tons of particulate matter). They claimed to have avoided the addition of 16.5 million metric tons of GHG emissions to 2011. SmartWay currently (as of 2022) reports a saving of 357 million barrels of oil- equivalent along with the avoidance of 152 million metric tons of CO2, 2.7 million short tons of NOx, and 112,000 short tons of PM since 2004 by its partners.[87] They claim a fuel cost saving for the industry of $47.6 billion, which contributes directly to lower consumer costs. The program highlights that the distribution of positive impacts is overwhelmingly in communities near ports, borders and truck stops. The methodology used to arrive at these figures is not provided.

87 See: https://www.epa.gov/smartway/smartway-program-successes; or alternatively the SmartWay Program Highlights for 2022 at https://www.epa.gov/system/files/documents/2023-02/420f23007.pdf

## Costs

There has not been a large amount of detail collected on costs associated with SmartWay. The EPA budget allocated directly to SmartWay is not revealed as a line item in EPA budget plans. Between 2004 and 2011 the program reportedly provided more than USD$30m in financing to help truck owners, especially small- and medium-sized firms, buy cleaner, more fuel-efficient trucks. It had a direct budget over that period of USD$1.5m.

Stakeholder classify economic costs in three distinct categories.

- Administrative costs: participation in the SmartWay Initiative requires time and resources for data collection, emissions accounting, and reporting. These efforts may include staff time, software, and training expenses. Although these are limited with the focus on centralised tools. In addition to the resource demand imposed on carriers, the SmartWay team at EPA expend a sizable percentage of their staffing budgets on administrative activities to ensure collection and management of good quality data from the partners (access to this data is a large part of the value of the program).
- Investment costs: to improve environmental performance, participants invest in more fuel-efficient vehicles, technologies, or infrastructure. Primarily to reduce fuel use or freight activity. Examples include the adoption of aerodynamic equipment, low-rolling-resistance tires, or anti-idling technologies. These activities result in additional capital costs, but the costs are arguably taken on through better decision making processes facilitated by the increased quality of emissions information.
- Ongoing operational costs: Companies may face higher ongoing operational costs, such as increased maintenance expenses or additional training for drivers to adopt more fuel-efficient driving practices. Again these costs are arguably taken on through better decision making processes facilitated by the increased quality of emissions information.

## The evolution of costs associated with data collection

One of the most critical elements of SmartWay is data collection and benchmarking. Trucking companies that participate in SmartWay are responsible for completing annual reports that require data related to operations such as fleet composition, activity summaries, fuel consumption, etc. These reports are completed manually and the time needed to complete SmartWay submissions varies from a few hours up to several days according to stakeholder interviews. The variation results from: the fleet’s size and sophistication (in its data recording practices); and familiarity with the SmartWay reporting process.

The emergence of telematics technology, driven to a large extent by regulatory requirements that commercial drivers maintain electronic logs, provides a strong future opportunity to standardise and automate data collection, management and reporting processes. In addition to providing location tracking, telematics systems and electronic logging devices (ELDs) connect to on-board diagnostic (OBD) ports in vehicles and thus have access to the extensive operations data collected by various systems such as the engine, emissions aftertreatment systems, transmission and driveline, and chassis. Electronic logging device regulations will require that virtually all commercial trucks operating in the United States and Canada have automated data collection.

Data collection and quality assurance represents a significant percentage of fleets’ overall time spent engaging with the SmartWay program. Automating SmartWay data collection and submission is a value proposition for fleets, SmartWay staff, and telematics providers. All of the interviewees in 2019 research conducted by Ben Sharpe expressed a desire for SmartWay to modernize the data collection and reporting methods in the program (Sharpe, 2019). The fleet and trucking association representatives stated that automating much of the SmartWay data process could save them time and money and allow them to participate more fully in the program (Sharpe, 2019). A common theme in the interviews was also that data privacy must be a major focus if automatic data collection is to be successfully implemented (Sharpe, 2019). A telematics company interviewed reported that they would soon market automatic SmartWay report creation to prospective customers. Costs are expected to reduce.

## Benefits

As summarised earlier, among the benefits claimed to result directly from the program are:

- Fuel savings: By adopting more fuel-efficient technologies and practices, companies can save on fuel costs. According to the EPA, from 2004 to 2022, SmartWay partners saved over 357 million barrels of oil, which translates to a cost savings of more than USD$47.6 billion.
- Emission reductions: SmartWay partners have significantly reduced their emissions, improving air quality and mitigating climate change. As of 2022, the EPA reported that partners had prevented the 152 million metric tons of $CO_2$, 2.7 million short tons of $NO_x$, and 112,000 short tons of PM.
- Enhanced reputation: By participating in the initiative, companies can demonstrate their commitment to sustainability and environmental responsibility. This can lead to improved brand image, customer loyalty, and potential business opportunities.
- Cost-sharing and collaboration: Participation in the SmartWay Initiative provides opportunities to collaborate with other stakeholders, share best practices, and access resources to reduce the costs associated with implementing sustainable solutions. SmartWay enables companies across the supply chain to exchange performance data. With consistent, quality-checked information and tools, SmartWay helps companies spend less time figuring out their freight supply chain footprints.
- Regulatory compliance: By proactively reducing emissions and adopting cleaner technologies, companies can stay ahead of potential future regulations and avoid potential fines and penalties.

A lot of the benefits claimed relate to truck purchases of SmartWay partners. The trucking industry is responsible for a large proportion of emissions and stakeholders control their fleet composition more easily than other aspects of their supply chain. An important point is that the fleet of SmartWay partners is related to the fleet of non-SmartWay firms. To reduce the age of their trucks, they must sell their used trucks when they are relatively newer. Non-SmartWay firms are the most likely buyers of these older trucks. The composition of the used truck market then changes to include more newer trucks creating a spillover effect. Estimates related to trucking are therefore likely an underestimate of the true effect.

While all other benefits are claimed by the program itself, recent (2023) research by Scott and co-authors evaluates the SmartWay Program using difference in difference methods to assess partner (trucking) firms against non-partner firms (Scott et al., 2023). The results demonstrate that participation in the EPA SmartWay program can facilitate a significant reduction in greenhouse gas emissions. The results show that after the start of SmartWay, firms that joined invested in newer trucks relative to firms that did not, with about a year reduction in average truck age several years after the program began. SmartWay also had a larger effect on firms that own their trucks compared with firms that outsource ownership, and sustained participation increased the program's effectiveness. They estimated that between 2012 and 2019 the SmartWay Program reduced commercial transportation emissions from operations by 25.2 million metric tons of $CO_2$ (equivalent of almost 15.2

billion truck-miles) by increasing the incentive to invest in newer, cleaner trucks alone. The latest research suggests the EPA program level claims are credible.

## E.2.2 The Chemical Industry and the GLEC framework

### Overview

This case study discusses the methodology used and various drivers and barriers related to the calculation of GHG emissions of the transport and logistics within the chemical industry of the EU. Currently, the EU's chemical industry is fully regulated to monitor and report GHG emissions, but the transport sector is not. To address this gap, the Smart Freight Centre, in partnership with the *Conseil Européen des Fédérations de l'Industrie Chimique* (CEFIC) and a group of transport sector companies, developed the Global Logistics Emissions Council (GLEC) framework in 2016 to support the chemical industry in accounting for its transport emissions.[88] The GLEC framework focuses on the chemical industry's cargo needs, which includes transport modes like road, rail, inland waterways, short and deep sea, air and pipeline transport, while also considering intermodal transport.

### GHG Accounting Methodology

In the GHG accounting methodology for the chemical industry, as defined in the GLEC framework, all the GHG emission values are calculated as well-to-wheel (WTW) values in kg of $CO_2$-eq Within the GLEC framework, there is an expectation that the operator of the transport, irrespective of mode, has access to the energy/fuel consumption information necessary to calculate their total emissions using the following formula:

$$GHG\ emissions\ (mass\ of\ CO2e) = fuel\ or\ energy\ consumption \cdot WTW\ emission\ factor$$

where:
- fuel or energy consumption is per amount of energy used;
- well-to-wheel emission factor is well-to-wheel emission factor in kg $CO_2$-eq per amount of fuel used.

However, in cases where the data provided by an operator is incomplete, the chemical company must calculate the GHG emissions using the following formula:

$$GHG\ emissions\ (mass\ of\ CO2e) = GHGemission\ intensity \cdot transport\ activity$$

where:
- GHG emission intensity is equal to the mass of $CO_2$-eq/tkm;
- total transport activity of Logistics Service Providers (LSP) is expressed in tonne-kilometre.

For the logistics operator's convenience in reporting data to the chemical industry in a meaningful way, it makes sense for the carrier to tailor the information to the industry's needs by following simple steps, as outlined below.
- Step 1: Break up your total transport into categories.
- Step 2: Calculate fuel consumption by category.
- Step 3: Calculate total GHG emissions.

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88 Smart Freight Centre (2021), Calculating GHG transport and logistics emissions for the European Chemical Industry, Module 5 of the GLEC Framework written in partnership with CEFIC. Available at the following link.

- Step 4: Calculate the emission intensity.
- Step 5: Carrier reporting to its chemical industry client. According to the guidance in the GLEC Framework on reporting, the LSP should report the activities that fall within the overall contract, whether provided using its own assets or those of subcontracted of transport and logistics operators.

According to stakeholders, there are multiple motivations for the chemical industry to opt for GHG emissions accounting within its logistics chain. They are as follows.
- Legal obligation: there are legal obligations for the sector regulated by the emission trading system (ETS) or other carbon-related schemes within the EU. Though the manufacturing aspect of the chemical industry is regulated within the ETS, the logistics and transport are not. However, this does act as a motivator within the transport industry to self-regulate itself.
- Customer request: in line with the interviews conducted with the stakeholders, it was found that a LSP would measure its emissions if the customers ask for it through the SQAS (Safety and Quality Assessment for Sustainability) scheme.
- Corporate Social Responsibility (CRS): carbon auditing and reporting has become an essential proponent of CSR.
- Participation in industry-wide surveys and benchmarking exercises: to improve their carbon credentials, industries undertake such exercises to demonstrate carbon reduction.
- Identification of opportunities for cutting carbon while improving efficiency.
- Assessing the impact of carbon on logistics decisions and investments.
- Evaluating carbon emissions in operations over time.

## Barriers to GHG Accounting

Stakeholders report they are facing multiple barriers to GHG accounting, including:
- The global nature of the emissions, especially when it comes to long-distance shipment. An EU-wide approach for intracontinental transport using land transport is considered sensible, while transcontinental sea and air transport are not.
- The complexity of transport and logistics activities in the chemical industry, with several tiers of sub-contractors, makes it challenging to accurately track emissions and environmental performance.
- The relationship between chemical producers and their LSPs is challenging as calculating the distance a given order has travelled.

## Impacts: economic, social and environmental

The impacts of GHG emissions accounting appear to mainly revolve around the effects of introducing the SQAS system. The introduction of a questionnaire section on GHG emissions in 2022 helped to improve the comparability of LSPs, and, more broadly, to manage and mitigate emissions. SQAS also includes sections on training; and a section on emission-reduction strategies at the supplier level.

## Implication for EU policy design

Our consultations with stakeholders highlighted a preference for sector-specific accounting schemes. There is a preference also for the introduction of a voluntary scheme, at least over the short-term. Verification and certification are also important. Currently, the stakeholders rely on the SQAS system, which most chemical companies use. It covers transport services, tank cleaning, warehousing, rail operators, and distributors of chemical products. The stakeholders see SQAS as the primary market-driven mechanism for the chemical industry to ensure that their suppliers in transport and logistics maintain a certain level of environmental performance. However, even though SQAS is an independent system implemented by more than 60 third-party auditors, it is not yet a certification system.

## E.2.3 The Logistics Emissions Accounting and Reduction Network project (LEARN)

### Overview

The LEARN project is a network of a broad-based group of organisations which empowers businesses to reduce their carbon footprint across global logistics supply chains and helps them make informed decisions resulting in reduced emissions and improved efficiency. LEARN partners work closely with organisations, initiatives and existing networks, like, Global Logistics Emissions Council (GLEC), industry associations and initiatives related to logistics emissions reduction.

This case study reports the findings on the work carried out in LEARN WP4 on testing and validation of the practical applicability of the agreed framework for harmonised GHG emission calculation, i.e. GLEC framework v1.0 and the eco-label concept in complex logistics settings.

Within this study, the goal of testing and validation is four-fold.
1. Understand company needs and motivation concerning carbon footprinting and accountancy.
2. Test the applicability and practicality of the GLEC Framework and suggest an improvement.
3. Help businesses advance their carbon footprinting and carbon accountancy.
4. Draw lessons on GLEC Framework implementations to improve and scale the process for further implementations.

### Methodology

The testing and validation achieved a diverse business representation. Thirty-eight companies agreed to participate in testing and validation activities and confirmed their participation by signing the Consent Form[89]. A company participating in a LEARN test case, also referred to as a testbed company, determines GHG emissions, expressed in units of CO2e of the specified transport and logistics activities.

The testbed partner companies include representatives of all transport modes, including intermodal transport and terminal operators, covering different geographical regions within Europe and worldwide. Testbed companies were of varying sizes and represented professional carriers, intermediaries, freight forwarders, and shippers using transport and logistics solutions.

[89] European LEARN Project (2018), LEARN Deliverable 4.4 Testing Results, European Commission. Available at: www.nucms.nl/tpl/learn/upload/D%204.4%20Testing%20results%20-%20FINAL.pdf.

LEARN project consists of emissions calculations for each testbed and an analysis of the accompanying discussions and information exchanges between the LEARN partners and the pilot partners. For this, a detailed questionnaire[90] was developed covering topics related to:
- the motivation of the companies to introduce or extend carbon foot printing and carbon accountancy;
- collection of real-world experiences with implementations of the GLEC framework;
- footprint computation and data availability;
- emission data exchange needs, capabilities and practice;
- application of the GHG calculation method in the context of eco-labelling;
- applicability of the method and expectations toward its applicability, particularly the GLEC framework.

## Findings and recommendations

Findings related to the application of GHG accounting and GLEC framework are as follows.
- Most testbed partners were intrinsically motivated to get insights into their transport and logistics GHG emissions.
- The companies were motivated to apply a commonly recognised GHG emission computation methodology for reporting purposes, thus accepting the usage of the GLEC framework methodology. However, some potential testbed partners expressed concerns about the implementation costs and overall impact on GHG emission reduction potential in highly optimised transport chains.
- A prior experience with carbon foot printing is a facilitator and an obstacle simultaneously for the testbeds, as experience in quantifying GHG emissions makes it easier to implement the new method. However, the companies may have used a different method, which produces a different result, making it difficult to realign it with the GLEC method.
- The newcomer companies face a steep learning curve requiring third-party support to ensure a proper understanding and implementation.
- The testing has shown that there is a challenge related to data collection and data sharing. For instance, computation of the consumption factor and data exchange between the companies can be challenging.
- The computation of consumption factors requires two data elements: the fuel use data and transport activity data. The carriers generally have a good insight into their fuel use data, but the availability of transport activity data is not always assured.
- There is also an issue related to a consistent application of the distance measures, as carriers and shippers may have misaligned distance values, partly due to the lack of knowledge of intermediate points on the transport network of shippers and also due to the use of different methods to specify the distance that is, by definition, different (Great Circle Distance versus planned versus actual distances).

Recommendations related to the future version of the GLEC framework, as stated in the study, are:
- GLEC framework may consider allowing a consistent use of other shipment measures rather than restricting weight as the only option, providing more fine-tuned default consumption factors, and providing more specifications related to data exchange between supply/transport chain parties.
- GLEC pays attention to the softer issues related to carbon foot printing and carbon accountancy related to building trust and education activities.

[90] European LEARN Project (2018), LEARN Deliverable 4.4 Testing Results, European Commission. Available at: www.nucms.nl/tpl/learn/upload/D%204.4%20Testing%20results%20-%20FINAL.pdf

- Being a workable methodology for carbon foot printing and carbon accountancy for logistics and transport chains, the GLEC Framework should concentrate on becoming a recognised standard.
- The testing and validation activity of the LEARN project provides feedback to GLEC such that the lessons learned are to be taken into account in the next version of the framework. After that, standardisation, preferably at the ISO level, should be the next step in its development.

Findings related to the application of GHG calculation method in the context of eco-labelling:

- It is important to note that the testing and validation activity of the LEARN project does not provide a blueprint for a future eco-labelling scheme.
- Most of the testbed partners, who expressed their opinion on the eco-label found the concept useful or potentially useful.
- The companies participating in an eco-labelling scheme would use the results to stand out from the competition and recruit new customers.
- The companies understand that the market may use an eco-label for a 'quick-and-dirty' assessment of the transport options. Therefore, the survival and well-being of the business may depend on it. Hence, there is a need for a fair, transparent and not-too-costly eco-labelling scheme.
- The companies give slight preference to the performance-based eco-labelling scheme. However, companies understand the implication of realising it in practice due to the heterogeneity of the transport market and difficulty in achieving consensus on the technical and organisational sides of the implementation.

Hence, the 'GLEC Declaration' template that addresses the harmonised reporting of emissions results between the transport provider and customer and in public reporting provides the first step towards performance-based reporting. Also, further industry consultation would be necessary to develop and introduce a comprehensive, multi-criteria eco-labelling scheme for the transport and logistics sector.

### E.2.4 Lessons learnt from the development of a long-lived industry standard to calculate $CO_2$ emissions: the Clean Cargo calculation standard

#### Overview of the regulatory environment for shipping emissions

According to the Kyoto Protocol, international shipping emissions cannot be attributed to any specific country. Nonetheless, at the global and European level, regulations do exist. The International Maritime Organization (IMO) has been working on the issue of shipping emissions with a particular emphasis on the Sustainable Development Goal (SDG) 14, which aims to '*conserve and sustainably use the oceans, seas and marine resources for sustainable development*'. The IMO took into account shipping emissions for the first time in 1973, tackling the air pollution caused by shipping and preventing it with the International Convention for the Prevention of Pollution from Ships (MARPOL).

MARPOL was amended in 2016, with the additions in the Annex of the resolution MEPC.278(70)91. This amendment has created a mandatory data collection system for fuel oil consumption of ships over 5,000 Gross Tonnes. Large ships are asked to provide the methodology and processes used to collect data and report it to their Flag States. Once received, the data is transferred to an IMO Ship Fuel Oil Consumption Database.

91 IMO (2016). Resolution MEPC.278 (70). Available at the following link.

At the time that this regulation was implemented, the EU system for monitoring, reporting and verification (MRV) of CO2 from maritime transport was entering in force. The MRV asks each ship that is over 5,000 Gross Tonnes in European Economic Area ports to report key data, when transporting goods and passengers. The data includes CO2 emissions, fuel consumption, and distance travelled. In order to align the two systems of the IMO data collection system and the MRV system, the European Commission adopted a proposal to revise its MRV system in 2019 and facilitate the system combination.[92]

## The Clean Cargo Carbon Emissions Accounting Methodology

Clean Cargo focuses on a specific type of shipping emissions, those emitted by container vessel. Established in 2003, Clean Cargo is a partnership which has developed its own accounting methodology. Its membership covers over 85% of global ocean container capacity, and it includes:

- Carriers: Maersk, MSC, CMA CGM, ONE, and 15 others;
- Freight forwarders: Bolloré, DB Schenker, BDP International, DSV, and 23 others;
- Shippers: H&M, Nestle, Primark, Tesco, and 21 others.

The Clean Cargo Working Group (CCWG) calculation methodology[93] is the only industry standard that calculates emissions of container shipping. The CCWG dataset has a unique level of aggregation, and the data has the advantage of being primary, directly coming from the container carriers. The CCWG Standard is based on the guidelines of the GHG Protocol supply chain, of the IMO Energy Efficiency Operational Indicator, and the European EN 16258 Standard. It is also complementary to the GLEC framework, Clean Cargo being member of the GLEC initiative.

Reference to the GLEC is made when calculating emissions on a large scope basis, so that carriers can report their other transports-related emissions too. For example, the carrier we have interviewed attempts to cover the Scope 1 to 3 using the CCWG and GLEC methodologies; the first scope being their own network, the second scope being the energy supply-chain and the third scope, the most challenging, being their vendors.

Concerning the scope, the main approach is a tank-to-wheel (TTW), or 'tank-to-propeller', approach. Nevertheless, it can be adjusted to include well-to-wheel (WTW) emissions by its users, like our interviewee does. Furthermore, the CCWG methodology only includes CO2 emissions that mainly comes from fuel combustion and relies on a CO2 emission factors, which are the CO2 emitted per cargo transported on a certain distance.

The basic principle of the emission factors is to be multiplied with the number of twenty-foot equivalent container unit (i.e. TEUs) transported and the distances sailed. When calculating, a Carbon Calculation Clause must be filled with specific information, such as which emission factors are used, what are the sources to determine the distances, etc. Other factors are taken in account, like the utilization factor, the average percentage of container slots actually occupied. Finally, the verification of the calculation is done by a third-party, which has to be a ship-classification society that has some experience and follows a precise verification process developed by CCWG.

The Clean Cargo initiative has identified several motivations for GHG accounting. First, it enables shippers and forwarders to better assess their footprint and select their suppliers

[92] European Commission page on the Revision of the Shipping MRV Regulation. Available at the following link.

[93] BSR (2015). Clean Cargo Working Group Carbon Emissions Accounting Methodology. Available at the following link.

based on their environmental performance. Secondly, reporting can also help carriers to improve this environmental performance, making data-driven decisions. Environmental improvements can result in direct advantages in terms of, for instance, fuel efficiency. Reporting can also have competitive advantages. The growing importance of environmental, social, and governance (ESG) standards means that sustainability reports can be used as a tool to attract capital from investors and financial institutions. Moreover, the stakeholders we interviewed for this case study highlighted the reputational gains arising from carrying out transport activities in a greener way. Furthermore, reporting helps to avoid greenwashing accusations.

### Barriers to the adoption of emissions accounting

Some difficulties were encountered by the CCWG methodology, in the effort of harmonising the calculation processes of the different actors, and in making the data more precise. For instance, the CCWG is investigating ways to make distance adjustments: the distance chosen is the shortest, though ships often deviate from their routes. Therefore, the CCWG identified that the difference with the actual distance was around 15% and work on new adjustments.

Another barrier is the accessibility of data, because it could be commercially sensitive information that is not easily disclosed. For example, suppliers may not give information about their shipping routes. Our interviewee explained the verification is still too restrained, dealing only with the product-level emissions verification, and could instead verify the entire calculation method. This would ensure the scalability of their work. Finally, stakeholders mentioned the need for new trainings for the SMEs, as they do not necessarily have the resources to carry out data collection and reporting.

### Impacts of emission accounting

Stakeholders report that, in addition of maximising access to capital and attracting investors, reporting GHG emissions ensures abatement cost-sharing. The emissions visibility brings customers that are willing to share part of their costs. Moreover, a harmonised calculation framework is valuable, because it allows customers to compare product offerings, and enables a high-quality reporting. It also avoids double reporting, and incompatible datasets from on actor to another. It frees up additional resources for performance improvements, and progress towards a better carbon footprint.

### Implications for the design of EU policy

There appears to be no consensus in the industry as to whether calculations should focus on well-to-wheel or tank-to-wheel. Additionally, the unit of accounting remains open to discussion. The CCWG methodology is opting for reporting CO2 only, while at least one stakeholder suggested that reporting in CO2e should also be made mandatory. A single unit could therefore be chosen by the European Commission. The verification of calculation could also be more extensive to ensure everyone uses the same method, and stakeholders expressed interest in having a certification scheme in place. Finally, any harmonised accounting framework should be designed, while taking into account the need to align with the IMO data collection system, to facilitate reporting.

## E.2.5 The Carbon Footprinting initiative: insights on multimodal emission accounting and reporting for the Dutch logistics sector (Topsector Logistiek)

### Overview

Since 2012, with its 'top sectors' policy, the Dutch government has been investing in the digitalisation and innovation in several strategic sectors. Logistics — including several modes of transport (i.e. road, rail, air, and sea transport) — is among these sectors.
The 'top sectors' policy aims at fostering the industry's international competitiveness. It also has the objective to make the logistics sector reach net zero emissions. This goal aligns with several EU initiatives, including the GHG emission reduction target of at least 55% by 2050; the European Green Deal, and its Carbon pricing axis; as well as the Corporate Sustainability Reporting Directive (CSRD).

### GHG accounting: drivers, scope, choices in accounting methodology

Since it applies to various different modes of transport, the Carbon Footprinting methodology is based on, among others, the Green House Gas protocol EN 1625894, the GLEC framework[95], and the Clean Cargo Work Group methodology[96]. Moreover, Carbon Footprinting already takes into account ISO Standard ISO 14083[97], which should enter into operation by the start of 2023. Underlying all these methodologies, calculations are based on the COFRET performance indicators (CPIs)[98]. Carbon Footprinting advocates for the use of primary data to the maximum possible extent. The Carbon Footprinting initiative is gradually being adopted in the Dutch logistics industry reporting, but it is also used outside of the Netherlands, for instance by the Lean&Green programme[99]. Located in over fourteen countries, Lean&Green includes over 500 logistics providers.

### Barriers to GHG accounting adoptions

The Carbon Footprinting initiative starts from the premise that the main barrier to emissions accounting in the logistics sector is the lack of standardisation. The use of different standards and methodologies creates significant challenges for the comparison and exchange of data. Moreover, stakeholders reported that existing methodologies for emission accounting remain at an excessively aggregate level, yielding almost no operational clues to improve one's emission performance after accounting.

Data constitutes an additional challenge. Allocating emissions to individual carriers is reportedly too challenging, an issue which is compounded by the complexity of the transport network—with several activities being outsourced to second- and third-tier suppliers. The Carbon Footprinting initiative has made it a priority to include time in the calculations — time driven, as well as spent waiting, in a congestion, or loading or unloading. Including the degree of capacity utilization in the calculations— i.e. whether, and to what extent a carrier drivers at full capacity — is considered another key priority.

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94 Green House Gas Protocol website: link.
95 GLEC framework page: link.
96 Clean Cargo Work Group Methodology (2015): link.
97 ISO (2022), draft of the Standard 14083: link.
98 Carbon footprinting page on COFRET: link.
99 Lean & Green Europe website: link.

## Impacts: economic, social and environmental

The impact of Carbon Footprinting's targeted approach is reportedly large for individual firms. According to the stakeholders interviewed for this study, a lean approach to emission accounting which includes time and capacity utilisation and relies on primary data can yield significant gains in terms of operational optimisation. Accounting can enable logistics firms to gain insights into their operational performance. In this context, environmental improvements are a by-product of operational optimisation, as they result from companies cutting down on fuel use.

Positive changes arise because firms are able to leverage the analytics insights arising from emissions accounting to revise their planning and activities. Stakeholders report outcomes including a reduction of kilometres per order, as well as in empty running kilometres and CO2 per unit. The load also appears to improve, with transport activities being more fine-tuned to demand. More indirect impacts might also emerge. These include greater cooperation in supply chains, between competing transporters, and also between shippers and transporters; and innovation, with logistics providers choosing to upgrade their fleets or to switch to electric vehicles.

## Implications for the design of EU policy

This case study highlights the challenges inherent in emission accounting across different transport modes, greatly reducing the comparability and operability of data. Stakeholders recommended creating a unified methodology, setting a common ground for emission accounting between different transportations mean, defining the scope, well-to-wheel or tank-to-tank, the type of emissions calculated, the emission factors, and a more precise way to define distances and time calculations. The simplicity of calculations and the need for primary data were also highlighted, alongside the main 'selling point' of emission accounting and business optimisation.

### E.2.6 DHL Express

DHL Express performs multiple transport activities, with air transport being the most important one: 94% of their total transport related GHG emissions originates from air transport activities. Next to air transport, DHL Express offers road transport: line haul and last mile pick-up and delivery. To offer the most sustainable transport operations as possible, for aviation the main option is using sustainable aviation fuel. Currently, DHL is one of the biggest market uptakers of sustainable aviation fuel.

## GHG emissions accounting

Since 2010, DHL Express applies GHG emissions accounting and reports GHG emissions to its customers. Only the last two years there is a slight increase in customers demand for this kind of information.

DHL is obligated to report their aviation-related emissions falling under the scope of the EU ETS. However, GHG emissions accounting does not stop at air transport and inside Europe, but is also done outside of Europe and for other transport modes. For aviation, the accounting methods are outlined by EU ETS and/or CORSIA. As a result, there are clear guidelines how to account for the GHG emissions of aviation. For road transport this is not (yet) the case which makes it more difficult to retrieve the GHG emissions from third party haulers.

Already in 2010 DHL developed its own tool to calculate GHG emissions for their airline operations. GHG emission accounting is primarily based on fuel consumption, either from own operations or the supply from partner airlines. Not all partner airlines are willing to share this information, and hence relation management is needed for this. At the same time, DHL also captures input data for road transport. The data needed is vehicle type, fuel type and the number of mileage. Using an average fuel consumption figure (retrieved from an own database), the GHG emissions can be calculated. Actual miles driven are used in the calculations and not great circle distances (GCD).

DHL operates globally, which is why electricity emissions factors (which differ between countries) from the International Energy Agency (IEA) are used. All other emission factors are sourced from EN 16258. Each year, the emissions factors are updated. Results can be viewed in $CO_2$-eq as well as just $CO_2$. Furthermore, it can be split up into tank-to-wheel and well-to-wheel.

GHG emissions accounting is done on a monthly basis. It takes around 2 working days each month, which included everything around GHG emissions accounting. The system and data are already there. It takes a little bit of time taking the data out, getting the engine running and some extra controls. DHL continuously improve the system, by yearly updates to enhance and improve the model with, for example, additional fuel types. The amount of costs for the software is difficult to indicate by DHL as it is part of the whole internal financial software system. No specific budgets are required when an update is requested or necessary.

## Current GHG emissions accounting limitations

When DHL started with their emission accounting their biggest challenge was to correctly apply the GHG Protocol methodology to their business. Internally, data quality is always a topic. Ten years ago, the fuel type for delivery and pick-up vans was unknown. It takes a few years to develop the requirements to specific functions that produce this data to capture for instance the fuel type. To capture the data, a request is made to the operations team, which is in contact with the supplier asking them to collect this data for their journeys. To collect the data, the operations team need to follow almost the same procedures independent of whether the data has to come from own employees or subcontractors. As an example, a courier needs to:

- login to the system (opening the route, start moving);
- scanning the car information;
- capturing mileages.

## GHG emissions accounting impacts

GHG emissions are inevitable. Reducing GHG emissions is done by training drivers to reduce fuel consumption. In addition, tires are replaced in time to ensure less rolling resistance. So far, GHG emissions accounting is mainly used for reporting and the results from accounting are not discussed at operational level. Instead of emission reduction targets, the operational team has tangible targets such as to operate 60% electric vans by 2030 or to use at least 30% Sustainable Aviation fuel in its operations. At operational level, there are no specific decarbonisation targets yet. The main focus is on less energy consumption. Only at management level the initiatives taken on operational level are translated into $CO_2$ reporting and decarbonization.

Next to the above initiatives and the use of sustainable aviation fuels, DHL Express further focus on the use of green electricity and there is a programme to electrify operations and facilities. At the facilities there are energy management guidelines, for example by switching off the lights at the facility when there is no need for light. For aviation, reducing consumption is much more difficult. There is a fuel optimization program, about how to ascend and descend. But it is very hard to influence since it depends on a lot of factors, for instance the weather conditions. Due to the GHG emission accounting DHL Express has an understanding of their emissions and where they can further improve but also where it is more difficult to reduce emissions.

#### EU policy design implications

DHL indicates that there are already a lot of standards (e.g. GHG Protocol, EU ETS) and emission factors. Therefore, they propose that the EU links the existing protocols and standards into a framework as much as possible to not further complicate what is needed in order to comply.

### E.2.7 Mandersloot[100]

#### Overview

Mandersloot is a logistics service provider, founded in 1964 in the Netherlands. In the late 1960s, they started transport operations between the Netherlands and Eastern Europe, in addition to their domestic transport operations. In 2007, they decided to fully focus on the transport between the Netherlands and Eastern Europe, mainly Poland.

Mandersloot is specialised in temperature-controlled transport. The transported products are mainly flowers and plants, vegetables and fruit, and packaged products like meat and fish. They primarily deliver to retail businesses in combination with detailed distribution to construction stores.

#### GHG emission accounting

Since 2020, Mandersloot uses BigMile for their GHG emissions accounting. BigMile is a SaaS (software as a service) platform, which calculates multi-modal transport-related carbon emissions. Currently, the data – in csv or Excel files – must be entered manually. One of the hardest and most time-consuming tasks for GHG emissions accounting using the BigMile tool is collecting all data and subsequently ensuring that the data is complete. Data preparation and insertion takes at least between 6 – 18 working hours each month. The next step planned is to standardise the data collection using API's. An Application Programming Interface (API) connects two applications or computer programs to ensure communication and data exchange between them. Connecting BigMile and the data collection system can ensure real-time insights in the GHG emissions.

The GHG emissions are expressed in $CO_2$-eq, and a distinction can be made between well-to-tank and tank-to-wheel emissions. 50% of the data is primary data, coming from own data source like the Transport Management System (TMS) and Advanced Planning and Scheduling (APS) packages as well as fuel related systems. For the other 50%, fuel related data is not available because of subcontracting reasons. No default values from the

[100] See www.mandersloot.eu/en.

literature are used, but the emissions are based on own calculations by Mandersloot, using a loading meter (LDM) kilometre coefficient and the distance travelled. The distance travelled is calculated using geocodes, meaning the actual kilometre travelled is used and not great circle distances (GCD) or shortest feasible distances (SFDs). All trips – which have an origin, destination and load (LTL) – are converted to LDM unit (per kilometre) and send to BigMile.

BigMile contains an algorithm which calculates and assigns GHG emissions to certain trip legs using the distance and the ratio of shipment size and resource. In the GHG emission calculation and allocation, the energy demand of a depot is also considered. The KPIs that are calculated by the software are total $CO_2$-eq emissions, $CO_2$-eq/LDM and $CO_2$-eq/LDM.km.

## Barriers to GHG accounting methodology

A limitation of the BigMile tool is the data interpretation. For example, the $CO_2$-eq emissions per LDM may increase, while the $CO_2$-eq emissions per LDM.km decrease (e.g. because of the COVID-19 pandemic). The transported volumes per customers decreased, resulting in less $CO_2$-eq emissions per LDM.km, while due to lower volume the $CO_2$-eq emissions per LDM increased. Background knowledge is needed to explain these results. Furthermore, the tool does not automatically give full insight in which transport processes or activities can be improved, but such insights must be derived manually. It currently only gives aggregated insights, not (yet) for specific customers, products, trips or transport modes.

Due to the lack of this specific information regarding, among others, products groups, temperature ranges, trailer information and fuel consumption, no big changes have (yet) been made to reduce the transport related GHG emissions. If in the future these limitations are addressed and insights are gained on where GHG emission reduction has the biggest effect, GHG emission accounting can be used to reduce GHG emissions.

## Impacts: economic, social, environmental

Every year, a single license for BigMile must be bought which costs between € 10–20 k. In addition, there are labour costs for data preparation, analyses and interpretation. The first takes around 1–2 working days per month, the second and latter around 1–3 working days per three months.

GHG emissions accounting is thus not (yet) used for reducing the GHG emissions. Currently, the main focus to reduce GHG emissions is to optimize transport planning (for example, by using different and more flexible departure times). Efficiency in load degrees automatically means more environmentally sustainable operations because there are less GHG emissions per loading meter.

## EU policy design implications

Although no real changes have yet been made to reduce GHG emissions after Mandersloot started using BigMile, the tool has certainly added value. It is important to involve logistics service providers from the start of the framework development.

The most important thing is that the calculation method for KPIs as $CO_2$-eq/LDM(.km) will be harmonised in the future to make a fair comparison (between companies). Currently, everyone calculates GHG emissions using different methods and techniques (well-to-tank/ tank-to-wheel or both) and the interpretation differs between companies. It is all about the details of your business. In the ideal situation there is a harmonised framework which everyone can implement in their software solutions that ensures that GHG emissions are calculated in a standardised manner.

According to Mandersloot, this is, however, a utopia because developers from the different solutions can use different methods to approach such a methodological framework within their software. It is therefore essential that there will be clear guidelines for implementation of this harmonised framework in the software, to avoid discussion.

## E.3 Regulatory efforts

### E.3.1 Application of Article L1431-3 of the French Transport Code: SNCF GHG calculation methodology for transport services[101]

#### Brief overview

The calculation methodology used by SNCF complies with the methodology guide published by the French government as regards the information on GHG emissions originating for transport services[102].

In order to promote lowest emissions in transport, Article L1431-3 of the French Transport Code provides that any persons who market or organize a transport service for people, goods or removals must provide the beneficiary of the service with information on the quantity of GHG emitted by the mode or modes of transport used to provide this service. Articles from D. 1431-1 to D. 1431-23 of the French Transport Code set the calculation principles common to all modes of transport. They specify the procedures for informing the beneficiary as well as the timetable for implementing the provisions. The methodology is based on the European Standard relating to the calculation and declaration of energy and GHG emissions from transport services (EN 16258).

The quantities of GHGs taken into account are those emitted during the operation of modes of transport and those originating from the upstream phase of production of energy sources (e.g. refining, transport, distribution, etc.). The information on the quantity of GHG emitted is determined for each segment of the itinerary travelled during the transport activity.

#### GHG accounting: drivers, scope, choices in accounting methodology

The French Transport Code describes the general methodology allowing the transport company to calculate the quantity of energy consumed for each segment of the itinerary, by performing the product of the distance-based energy consumption rate of the mode of transport used by the distance travelled. The quantity of energy is multiplied by an emission factor specific to each type of energy. This factor establishes the correspondence between the quantity of energy consumed and the quantity of GHG emitted. The values of

[101] SNCF (2022). Greenhouse gases information for transport services, Social, Territorial and Environmental Commitment Department. Document available here.

[102] See Méthodologie pour le calcul et la déclaration de la consommation d'énergie et des émissions de gaz à effet de serre (GES) des prestations de transport (fret et passagers) (2012). Document available here.

the GHG emission factors of the various energy sources are available on the website of the French authority Agence de l'environnement et de la maîtrise de l'énergie (ADEME).

When it comes to the GHG calculator of SNCF, the carbon footprint of rail passenger activities is estimated by multiplying the distance travelled[103] by the average amount of $CO_2$-eq emitted per passenger-kilometre, according to the type of train operated. Notably, SNCF GHG calculator distinguishes by 5 types of train as follows: TGV INOUI, TGV OUIGO, Intercités, TER et Transilien.

For each type of train, the average amount of CO2e emitted per kilometre travelled is calculated for each year by dividing the energy consumption of the previous year (applying a CO2e emission factor according to the type of energy)[104] by the average volume of passengers transported during the previous year and the distance they travelled (i.e. passenger-kilometre based on Scope 3 input data). Accordingly, the calculation methodology provides the amount of GHG emitted as follows.

$$GHG\ emissions\ (gCO2e/km) = \frac{\sum \begin{matrix} electricity\ consumption\ \cdot electricity\ emission\ factor + \\ diesel\ consumption\ \cdot diesel\ emission\ factor + \\ biodiesel\ consumption\ \cdot biodiesel\ emission\ factor \end{matrix}}{passenger \cdot km}$$

Following a methodological change introduced by ADEME for the electricity emission factor, SNCF has chosen to introduce the average national mix value and no longer use a specific value for rail traction electricity. On the one hand, this methodological choice allowed SNCF to harmonise the calculator with international practices. On the other hand, it determined an increase of the French emission factors, as shown in Table 86.

**Table 86 - Emission factors by type of passenger train service (gCO2e/kWh)**

| Time | Intercities | TGV | Transilien | TER |
|---|---|---|---|---|
| Before 2019 | 5.29 | 1.73 | 4.75 | 24.81 |
| After 2019 | 6.73 | 2.71 | 7.04 | 26.93 |
| Variation | 27.2% | 56.6% | 48.2% | 8.5% |

Source: SNCF (2022).

Eventually, according to the implementing Decree No 2017-639 of 26 April 2017, the emission factors are as follows:
- electricity for transport: 60.7 g $CO_2$-eq/kWh in 2019 and 59.9 g $CO_2$/kWh in 2020;
- off-road diesel with emission factor: 3.16 kg $CO_2$/litre;
- biodiesel B100: 1.21 kg $CO_2$-eq/litre.

Multimodal aspects of passenger transport services are considered by the methodology developed by SNCF. In this respect, SNCF's passengers travelling also on other transport modes, the methodological approach is as follows.
- For coaches the figures are calculated by the company providing the service, but if the actual data is not available, SNCF methodology is applied using emission factors provided by SNCF.
- For taxis, cars rented with driver and other transport on demand, the figures are calculated by the owner of the company, based on ADEME fuel consumption and $CO_2$-eq emissions factors.

[103] The distance travelled is taken from the kilometric databases for the rail lines.

[104] Line losses and all empty journeys are included in the calculations.

— For urban collective transport, the figures used in SNCF calculator are provided by RATP, the regional transport operator of Île-De-France. And SNCF provides information to RATP regarding figures for regional service Transilien[105].

Table 87 and Table 88, respectively, provide the overview of the emissions factors assumed for passengers travelling by SNCF trains (domestic and international) and by collective transport, road and air services. The tables show also how the emission factors have evolved over time.

**Table 87 - Emissions for SNCF passengers (g $CO_2$-eq/km)**

| Type of service | Type of train | 2016 | 2021 | 2022 |
|---|---|---|---|---|
| Domestic | Intercities | 10.80 | 5.29 | 6.73 |
| | TGV INOUI | N/A | 1.90 | 2.99 |
| | TGV OUIGO | 3.20 | 0.73 | 1.15 |
| | Transilien | 5.80 | 4.75 | 7.04 |
| | RER | 5.80 | 4.10 | 6.20 |
| | TER | 29.70 | 24.81 | 26.93 |
| International | Thalys | 11.60 | 6.68 | 7.32 |
| | Eurostar | 8.20 | 6.64 | 7.48 |
| | Lyria | 3.20 | 2.05 | 3.23 |
| | RENFE and SNCF in cooperation | 27.00 | 5.40 | 6.00 |
| | DB and SNCF in cooperation | 11.30 | 4.50 | 5.00 |
| | TGV INOUI Italia | N/A | 8.50 | 10.30 |

Source: SNCF (2016, 2021, 2022).

**Table 88 - Emissions for passengers travelling by other transport modes**

| Transport mode | 2016 | 2021 | 2022 |
|---|---|---|---|
| Metro | 3.8 | 2.5 | 3.8 |
| Tramway | 3.3 | 2.2 | 3.4 |
| Bus RATP | 96.5 | 98.0 | 104.0 |
| Bus other operators | N/A | 110.0 | 110.0 |
| Coach interurban | 171.0 | 146.0 | 146.0 |
| Car average | 162.0 | 111.0 | 111.0 |
| Car short distance | 148.0 | 134.0 | 134.0 |
| Car long distance | 90.0 | 75.0 | 75.0 |
| Domestic flight < 500 km | 168.0 | 167.0 | 167.0 |
| Domestic flight 500-1000 km | N/A | 126.0 | 126.0 |

Source: SNCF (2016[106], 2021[107], 2022).

## Barriers to GHG accounting adoptions

Between 2019 and 2021, French Energy Agency ADEME has set up a workgroup to calculate the carbon impact of vehicle manufacturing for inclusion in the transport emissions factors. SNCF has contributed to this workgroup. These factors are now available in ADEME's Base

105 See also dedicated page on SNCF website.

106 SNCF (2016). Greenhouse gases information for transport services, Social, Territorial and Environmental Commitment Department (version dated 2016, July 8th).

107 SNCF (2021). Greenhouse gases information for transport services, Social, Territorial and Environmental Commitment Department (version 2021).

Carbone in the 'All data' category. However, these emission factors are not taken into account in the regulations of Article L1431-3 of the Transport Code and are therefore not applicable in this context.

## Impacts: economic, social and environmental

The main impact identified regarding the application of SNCF calculator can be related to the environmental aspects. The activities undertaken over the past years to design and use the calculator suggest improved awareness at company level, when it comes to measures to increase the efficiency level to produce transport services, and ultimately its carbon footprint.

Firstly, based on the emissions factors provided in previous tables, Table 89 shows examples of $CO_2$-eq emissions for passengers travelling on certain routes by SNCF trains and alternative modes.

**Table 89 - Examples of $CO_2$-eq emissions for passengers travelling on certain routes by SNCF trains and alternative modes**

| Type of train | Origin-Destination | Train | | Alternative mode | | |
|---|---|---|---|---|---|---|
| | | Distance (km) | Emission (g $CO_2$-eq/km) | Mode | Distance (km) | Emission (g $CO_2$-eq/km) |
| TGV | Paris-Lyon | 563 | 1.7 | Car | 466 | 35.0 |
| | Paris-Lille | 258 | 0.8 | Car | 226 | 17.0 |
| | Bordeaux-Paris | 617 | 1.8 | Car | 587 | 44.0 |
| | Paris-Rennes | 374 | 1.1 | Car | 350 | 26.3 |
| | Marseille-Paris | 883 | 2.6 | Air | 627 | 88.4 |
| | Paris-Strasbourg | 503 | 1.5 | Car | 488 | 36.6 |
| | Paris-Nice | 978 | 2.9 | Air | 674 | 95.0 |
| | Paris-Toulouse | 713 | 2.1 | Air | 571 | 80.5 |
| | Lyon-Marseille | 381 | 1.1 | Car | 314 | 23.6 |
| | Lille-Lyon | 794 | 2.4 | Air | 558 | 78.7 |
| OUIGO | Nantes-Paris | 385 | 0.4 | Car | 386 | 29.0 |
| | Lyon-Marseille | 320 | 0.4 | Car | 314 | 23.6 |
| | Avignon-Marne La Vallee | 697 | 0.8 | Car | 702 | 52.7 |
| Lyria | Paris-Geneve | 692 | 2.2 | Air | 408 | 57.5 |
| Thalys | Paris-Bruxelles | 314 | 2.3 | Car | 312 | 44.0 |
| Intercites | Clermont Ferrand-Paris Bercy | 420 | 2.8 | Car | 425 | 31.9 |
| | Limoges-Paris | 400 | 2.7 | Car | 394 | 29.6 |
| | Bayonne-Toulose | 199 | 1.3 | Car | 300 | 22.5 |
| TER | Paris-Trouville Deauville | 281 | 7.6 | Car | 199 | 22.1 |
| | Grenoble-Lyon | 131 | 3.5 | Car | 113 | 12.5 |
| | Marseille-Nice | 218 | 5.9 | Car | 205 | 22.8 |
| | Geneve-Lyon | 129 | 3.5 | Car | 150 | 16.7 |
| | Arcachon-Bordeaux | 59 | 1.6 | Car | 72 | 8.0 |
| Transilien | Paris-Gare de Lyon-Juvisy | 20 | 0.1 | Car | 21 | 2.8 |
| | Paris-Montp-Versaille-Chantiers | 15 | 0.1 | Car | 26 | 3.5 |
| | Paris Nord-Ermont-Eaubonne | 14 | 0.1 | Car | 14 | 1.9 |
| | Paris St. Lazare-La Defense | 6 | 0.0 | Car | 8 | 1.1 |
| | Magenta-Chelles-Gournay | 18 | 0.1 | Car | 21 | 2.8 |

Source: SNCF (2022).

Secondly, taking into account the estimates elaborated using the calculator, SNCF has identified a number of measures to achieve energy savings, improve energy performance and consume new non-fossil energies. According to SNCF's financial annual report[108], the identified measures constitute an opportunity to develop the share of rail and sustainable mobility at the service of passengers and goods. The decarbonization trajectory of SNCF is also supplemented by technological innovations.

The measures identified by SNCF to improve the economic and environmental performance are summarised as follows:
- Train the train drivers to implement eco-driving saving. According to company's estimations eco-driving would allow to save up to 10% energy on a journey.
- During parking, an idle rolling stock consumes 10-30% of the total consumption, depending on the transport activities. SNCF envisages to save 5-25% of current parking consumption implementing 'eco-parking' device on the passenger transport activity on all rolling stock, both electric and diesel. For example, the expected gain for a TER train, the regional passenger transport, is around 48 kt $CO_2$-eq/year by 2025 (i.e. around 10% of $CO_2$-eq emissions from TER trains).
- Replacement of fossil fuels with bio-fuels. These include the tests carried out for the services operated between Paris and Granville in the second half of 2021. The analysis of the impacts of these operations is in progress. Furthermore, the ongoing deployment of biofuel (i.e. B100) is estimated to reduce GHG emissions from diesel trains by 60%.
- The design and introduction of lighter equipment associated with infrastructures (i.e. catenary system) and rolling stock with a lower environmental footprint.

### Implications for design of EU policy

The implications for design of EU policy can be summarised as follows:
- Include all transport activities and full life cycle emissions based on input data of Scope 3. This relies on the harmonisation level and requires guidance, as provided by ADAME for SNCF calculator. Access to information and data should be also facilitated, as shown by the access provided to ADAME Base Carbone.
- Calculate $CO_2$ equivalents, which are important for Scope 3.
- Minimise the use of default values.

## E.4 Tools and platforms

## E.4.1 Mobitool[109]

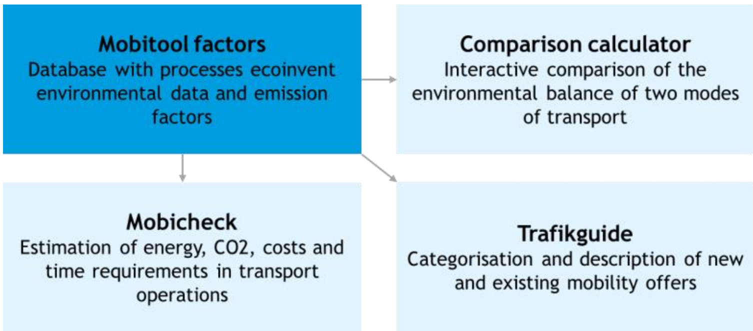
### Overview

The Swiss platform Mobitool was published in 2016. It provides free tools for managing mobility and environmental data. Mobitool provides factors for environmental and energy balances and consists of an interactive worksheet containing input values (i.e. Mobiltool factors) linked with three online applications, namely (i) a calculator tool, (ii) Mobicheck and (iii) Trafikguide. The platform brings together three tools that are dedicated to the

[108] See SNCF (2022). Rapport Financier Annuel Groupe SNCF.
[109] See also www.mobitool.ch.

mobility management process. Mobiltool factors and online application are described in the following paragraph. Figure 18 stylises the architecture of Mobitool's components.

**Figure 18 – Architecture of Mobitool's components**




Source: Mobitool website.

## GHG accounting: drivers, scope, choices in accounting methodology

### Mobiltool factors

The environmental indicator results of passenger and freight transport services are calculated with the most recent methods and compiled in the Mobiltool factors[110].
This interactive worksheet contains the environmental indicator results (e.g. according to the ecological scarcity method 2013, cumulative energy demand, greenhouse gas emissions) of approximately 150 different modes of transport. The tank-to-wheel and well-to-wheel cumulative energy demand and the greenhouse gas emissions are calculated according Standard EN 16258.

The parameters related to the load factor, fuel demand, vehicle weight, battery weight (for electric vehicles) and electricity mix strongly influence the environmental impacts of transport services and can be adjusted by the user to a specific situation.
The environmental indicator takes into account the following elements: direct operation of the vehicle, fuel or electricity supply, vehicle maintenance, vehicle construction and disposal, infrastructure construction and decommissioning. The energy label for passenger cars relies on primary energy factors and greenhouse gas emissions of fuel consumption and supply. Updated life cycle inventory data related to the fuel supply have been developed, including hydrogen used in the latest version of the energy label ordinance.

In Mobitool, emission factors have been developed by transport mode, based on the LCA methodology and elaborating the data from the Ecoinvent database. For case-by-case analysis, Mobitool applies a factor for scaling emissions and models. For example, a vehicle in Mobitool is defined as follows.

$$vehicle_{Mobitool} = vehicle_{Ecoinvent} \frac{vehicle\ weigth_{Mobitool}}{vehicle\ weigth_{Ecoinvent}}$$

And indirect emissions from electricity production are assumed in Mobitool as follows.

[110] See www.mobitool.ch/fr/outils/facteurs-mobitool-v2-1-25.html.

$$energy\ input_{Mobitool} = energy\ input_{Ecoinvent} \frac{average\ consumption_{Mobitool}}{average\ consumption_{Ecoinvent}}$$

A parallel method is adopted to establish the direct emissions and the emissions associated with maintenance and infrastructure.

According to STREAM (2021)[111], when compared with the similar calculator and information sources, the life-cycle emissions in Mobitool provide a clear breakdown into the contributions of infrastructure, vehicle production, maintenance and use. In addition, the figures for different vehicle categories are reported for CO2, NOx and PM emissions, which makes Mobitool factors a complete information source, also when it comes to the breakdown by type of pollutants.

Mobitool factors have been reviewed and enriched in 2016 and 2020 to maintain the information up-to-date. The next release of Mobitool factors has been announced by the end of 2022. Mobitool factors are used as soon as an assessment of energy or environmental efficiency is carried out in the field of mobility. They are considered as standard values for any ecological balance sheet or any environmental assessment of mobility in Switzerland.

## Online calculator

The online calculator directly compares the energy consumption and environmental emissions of two modes of transport (measured in tonnes of CO2e)[112]. Notably, by adjusting the input parameters, data sources and algorithms on a case-by-case basis (e.g. adjusting with respect to the rate of use, fuel consumption and vehicle weight), the online calculator allows to carry out comparisons of two transport modes resulting from a combination of approximately 150 different transport activities. The comparison of the transport modes is based on the abovementioned Mobitool factors[113]. Table 90 provides an example of the assumptions for passenger cars distinguishing by electric and petrol type.

**Table 90 - Examples of assumptions for petrol and electric cars**

| Item | Electric | Petrol |
|---|---:|---:|
| Battery life | N/A | 100,000 km |
| Average consumption | 7.5 litre/100 km | 20 kWh/100 km |
| Range | N/A | 165 km |
| Wear-and-tear emissions | 100% | 10% |
| Charging infrastructure | N/A | Not included |

Source: Frischknecht et al. (2016).

## Mobicheck

Mobicheck is the application designed to elaborate outputs of the environmental impact generated by transport activities at company level. The application gathers information regarding the company that wishes to carry out such estimations (i.e. sector, location area, scope of action and size) in order to obtain a first overall estimate of the emissions

[111] STREAM (2021), STREAM Freight Transport 2020 – February 2021.

[112] As part of a larger update project of the Swiss Federal Office of Energy, this tool will be completely revised and reprogrammed. Completion is scheduled for 2024.

[113] For freight transport, Mobitool makes no comparison between conventional and electric vehicles, except for rail.

produces. When it comes to the design of the application and initial information required, the entry level was deliberately kept very low by the designers. At first glance, the approach might result in relatively imprecise results, however, this has the advantage for non-professionals of obtaining a rapid estimation, which contributes to the implementation of subsequently ad hoc change processes.

The estimate provided by Mobicheck covers four types of transport activities as follows.

1. Business activities include all journeys made by employees to visit customers or partners, whether by plane, train or company car[114].
2. Commuter activities includes all journeys (i.e. round trips) made by employees between their home and place of work. According to previous analyses, for most companies, the majority of emissions and energy consumption is generated by commuter traffic.
3. Customer services includes all journeys (i.e. round trips) made by customers to reach the company's site. Customer services play an important role in a company's environmental balance sheet, especially when it comes to shopping centres and restaurants.
4. Transport of goods, distinguishing by transport mode.

Since transport situations can vary greatly between companies, the results obtained are checked for consistency. Namely, the parameters are adjusted ex-post to modify the initial modelling hypotheses and adapt them to the real situation. Mobicheck is based on Mobitool factors and modelling hypotheses.

### Trafikguide

Trafikguide has been designed to provide an overview with a systematised and updated collection of relevant transport services. It consists of a collection of more than 400 existing mobility offers, which are constantly developed and updated. The purpose of Trafikguide is manifold. First, foster promotion of modern forms of mobility. Second, accelerate the efficient and resource-saving mobility system of the future. Third, collect mobility offers and make them comparable.

### Barriers to GHG accounting adoptions

When it comes to the barriers to adoption of the tool, the main point of criticism is the incomplete transparency and traceability (Bauer, 2017)[115]. However, Bauer (2017) also observed that it could be largely eliminated giving access to the background inventory data used for the life cycle assessment calculations. Furthermore, Bauer (2017) suggested that the information used in Mobitool, from internal sources at the Swiss railway company SBB, should be based on traceable information.

[114] An interesting application can be found in Hölbling (2020) to estimate the carbon mobility of international scientific travel of Wegener Center. Hölbling S. (2020). Lower Carbon Mobility: Towards More Sustainable International Scientific Travel of Wegener Center and Beyond, Master Thesis, Wegener Center, Graz (Austria). A similar application can be found in Van der Goot Lab and Oates Lab (2020). Carbon Accounting of Research Activities in the School of Life Sciences, September 2020.

[115] Bauer (2017). Review – Mobitool v2.0, Datengrundlagen, 1 January 2017.

## Impacts: economic, social and environmental

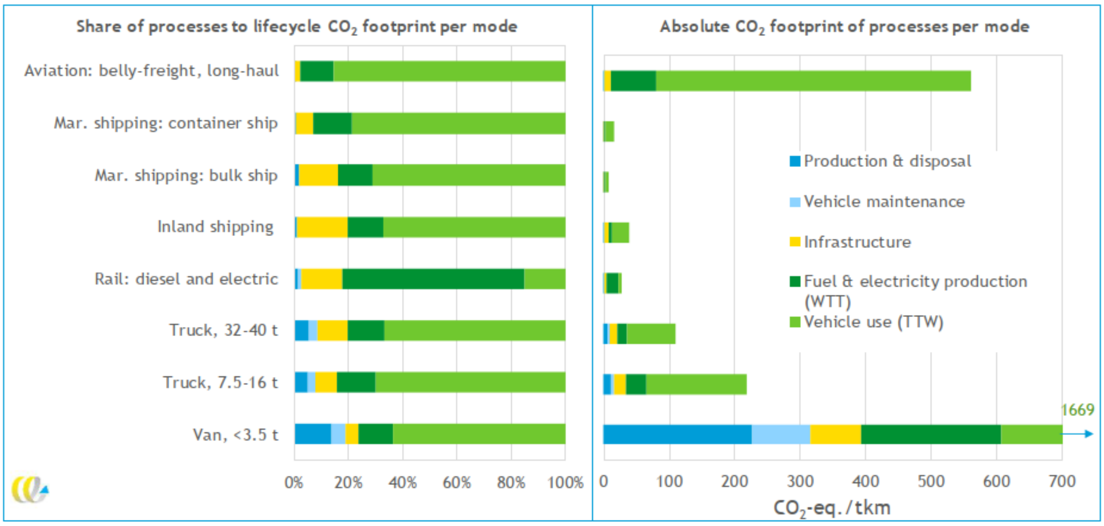
Based on the Mobitool data and Frischknecht et al. (2016)[116], the STREAM project (STREAM, 2021) calculated CO2 emissions associated with each phase of the life-cycle for key vehicle categories, in both percentage and absolute terms. According to calculations, in all cases the bulk of the CO2 emissions derive from the energy consumption for vehicle propulsion (i.e. tank-to-wheel and well-to-tank), with a minimum share of 80% in total life-cycle $CO_2$ emissions.

In absolute terms, the emissions due to vehicle production and maintenance and infrastructure are highest for road vehicles and aviation, owing mainly to the relatively low tonne-kilometre performance over aircraft and truck lifetime compared with rail and (inland and maritime) shipping. Infrastructure emissions are high for road transport because of tonne-kilometre performance, but also because of the extent of the road grid compared with the infrastructure networks for the other modes. While not applying across the board for aviation, short-haul flights (within Europe) do have relatively high infrastructure $CO_2$ emissions, since they make comparatively frequent use of the infrastructure relative to kilometres flown. With long-haul flights, this is obviously less true.

In relative terms, infrastructure emissions contribute more to rail and inland shipping than with the other modes, thanks to the low CO2 emissions due to energy consumption.
With aviation, production, disposal and maintenance make a negligible contribution to total life-cycle emissions, because of the far higher well-to-wheel emissions per tonne-kilometre.

The results obtained by the STREAM project, as regards the share of process in life-cycle $CO_2$ emissions for key vehicle categories are reported in Figure 19.

**Figure 19 - Share of processes in life-cycle $CO_2$ emissions for key vehicle categories**




Source: STREAM (2021) based on Frischknecht et al. (2017).

[116] Frischknecht, R., Messmer, A., Stolz, P. and Tuchschmid, M. (2016). Mobitool: Grundlagenbericht. Hintergrund, Methodik & Emissionfaktoren. Zürich: Mobitool.

Another interesting application of the factors developed in Mobitool can be found in the study carried out by Dang et al. (2021)[117]. The study examined the effects of on-demand mobility services on sustainability in terms of emissions and traffic volume. According to the simulations carried out by the authors, the implementation of on-demand mobility services was recommendable only as a supplement to public transport in both urban and rural regions since the positive effects in terms of CO2 emissions.

However, in urban areas, the authors found that there was a negative impact on the traffic volume in terms of additional vehicle-kilometre, since the bundled public transport demand is replaced by less bundled on-demand vehicles. In rural areas, the increase in vehicle-kilometre plays less of a role due to generally low demand. The negative effects per vehicle-kilometre are slightly higher in rural areas due to higher empty kilometres and lower bundling rates, but the negative effects per square kilometre in dense cities are much more serious. The authors concluded that the local authorities need to consider these effects according to the spatial context when implementing such services.

Finally, Hoerler et al. (2021)[118] further developed the application Mobicheck. Results found by the authors suggest that through an effective mobility management within the companies and administrations the mobility behaviour can be optimized (e.g. company carsharing, carpooling, safe pedestrian and bicycle paths, incentives for green mobility including electric vehicles or slow modes). This has the potential to reduce negative impacts of commuting and increase the satisfaction of the employees and stand out as an environmental-friendly company.

## Implications for design of EU policy

Mobitool is a comprehensive tool for comparing the environmental impact of different transport modes. Companies and individuals can use it for environmental checks and gain an insight into the environmental balance of the current mobility behaviour.

In order to ensure the scientific quality of Mobitool, its data basis is subject to an independent review. The environmental impacts of the transport modes are based on LCA, so they do not just include the operation of the vehicles, but also their production and disposal as well as the provision of the fuels. It is also worth observing that Mobitool introduced some simplifying assumptions in order to allow ease of use for non-expert users[119]. They are kept within acceptable ranges to produce reliable figures, although they may hardly have any effects on the results and distort the comparison between transport modes.

117 Dang L., von Arx W. and Frölicher J. (2021). The Impact of On-Demand Collective Transport Services on Sustainability: A Comparison of Various Service Options in a Rural and an Urban Area of Switzerland, Sustainability 2021, 13, 3091.

118 Hoerler R., Tomic U. and Del Duce A. (2021). Swiss mobility transformation to sustainability – recommendations on niche developments.

119 See also Cornet H. J. J. (2012). Sustainability screening tool for decision-making assistance in the field of urban mobility. Master thesis, Technische Universität München.

## E.4.2 CarbonCare[120]

### Overview

CarbonCare is a global emission calculator funded during a five-year research period and co-developed by the Swiss Federal Institute of Technology (ETH), co-financed by the Swiss Federal Department of the Environment, Transport, Energy and Communications (DETEC) and tested by the Swiss Federal Office of Civil Aviation (FOCA).

CarbonCare calculates emissions based on EN 16258 Standard and considers data from CE Delft's research study on transport emissions of all modes of transport (STREAM) and Clean Cargo Working Group (CCWG) initiative. All data are measured in collaboration with the industry and compared with the literature. The tool offers calculation and compensation, not only for all modes of transport, but also for activities related to warehousing, cooling, and transhipping of cargos.

### GHG accounting: drivers, scope, choices in accounting methodology

CarbonCare provides $CO_2$-eq[121] emissions for tank-to-wheel (TTW) and well-to-wheel (WTW) emissions as well as the pure $CO_2$ (TTW) emissions for information purposes.

CarbonCare developed a different approach with respect to EN 16258 Standard, when it comes to the allocation units. Similar to US's SmartWay programme, CarbonCare calculator considers an allocation based on $CO_2$ per tonne-kilometre, based on last year's historical data. Therefore, transport operators should measure their complete transported goods (i.e. the mass transported), the actual distances travelled and the consumed fuel on a yearly basis. The inputs provide a specific emission factor for a company[122] (i.e. transport service category, TSC) or a single vehicle (expressed in grams of $CO_2$ or $CO_2$-eq per tonne-kilometre). The specific TSC of a company is calculated as follows.

$$TSC = \frac{total\ fuel\ consumed\ (year)\ \cdot\ emission\ factor}{total\ mass\ transported\ (year)\ \cdot\ total\ distance\ performed\ (year)}$$

According to Wild (2021), the advantages of TSC formulation are manifold. Firstly, it allows to compare performances among competitors, which are challenged to improve their specific emission yearly.

Secondly, from the transport operations perspective, the TSC method allows to include empty trips and positioning. And it embeds any operational efficiencies which are related to the utilisation factors, seat load factors, cargo load factors, efficient use of vehicles, etc. On the basis of the factors used, operational improvements can be measured and quantified over time, which makes them accurate and based on the historical data gathered.

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120 Wild P. (2021). Recommendations for a future global $CO_2$ calculation standard for transport and logistics. Transportation Research Part D, 100 (2021) 103024. See also www.carboncare.org/en/index.html.

121 A quantity of GHG can be expressed as $CO_2$-eq by multiplying the amount of the GHG by its Global Warming Potential. For example, if 1 kg of methane is emitted, this can be expressed as 25 kg of $CO_2$-eq (i.e., 1 kg CH4 times 25 equals to 25 kg $CO_2$-eq). $CO_2$-eq measurement is useful for a number of reasons. It allows GHG to be expressed as a single number and different bundles of GHGs can be easily compared (in terms of their total global warming impact).

122 For example, for the fleet or group of vehicles with similar characteristics.

Third, on the technical side, modifications introduced over time at company level, like for example regarding changes of engines for vehicles' refurbishment, replacements of complete vehicles or changes in fuels for renewals (e.g. electrification, hydrogen, sustainable fuel, or bio-fuels) do not affect the calculation and still allow to carry out comparisons to past situations. Therefore, the method can properly reflect the specific capacity of the fleet used by the company. Moreover, given the yearly approach to measurement, any seasonal and meteorological variations occurring in the geographical context wherein the company operates are included (e.g. wind, temperatures, pressure systems, changing conditions of roads, different drivers and different vehicle operation system (VOS) patterns).

Finally, when it comes to the transparency of the methodology, the approach of TSC to calculation is suitable for customers, notably if the transport operator provides the specific emission factor and even smaller shippers/forwarders may calculate the emissions complementing the information on emissions with data from Google Maps (e.g. shortest distances) or with online Great Circle Distance calculators. Also, the formula may be used for ex-ante planning purposes and ex-post-delivery[123].

Table 91 provides the overview of the assumptions of the TSC formulation for each transport mode.

**Table 91 - Overview of the assumptions of the TSC formulation for each transport mode[124]**

| Transport mode | Distances | Underlying factors |
|---|---|---|
| AIR - aircraft/air cargo/air freight | Great circle distances plus 95 km according to EN 16258. RF Index is currently set to 1.0 according to CORE Project of University of Stockholm. | Data for different aircraft types.<br>– LF: 80% or cargo load factor 70%.<br>– LL: almost 0% since only a few technical flights required positioning. |
| ROAD - trucks/road freight | Great circle distances for delivery tours. In the logistics industry, point to point transports are extremely seldom. In addition, licensees may calculate shortest, real distances between two locations. The licensee may choose the options. | Data for various truck types (see calculator)<br>– LF: 80% for trucks 7 tonnes and smaller.<br>– LF: 75-80% for larger trucks.<br>In addition, licensees may choose the variable loading factors. |
| SEA - ships/ocean freight | Shortest routings based on our own specially developed distance calculator. Distance compared with international, well-known calculators and measured examples | Mainly based on CCWG (Clean Cargo Working Group) data. CCWG values corrected for one twenty-foot equivalent unit to 10.5 tonnes according to EN 16258. Data for cooling available.<br>Fleetwide utilisation factor of 74%; however, there are large differences for different routes varying between 60% and 84%. |

[123] Since such data are based on solid fundaments, only minor changes are expected between planning and effective operation.

[124] Abbreviations in the table are as follows: LF: load factor; LL: loaded legs; UT: utilisation factor.

| Transport mode | Distances | Underlying factors |
|---|---|---|
| | | Currents are compensated for over the timeframe. |
| IWW - barges/inland navigation/canals and water ways | Shortest routings based on specially developed distance calculator. Distance compared with international, well-known calculators. | Own measurements supplemented with newest STREAM research data. Applied UT of 53% for ships under 2,000 tonnes or 55% respectively. |
| RAIL - trains/railway cargo | Shortest routings based on specially developed distance calculator. Distance compared with international, well-known calculators. Routes split up into electrified and diesel train routes. | CarbonCare respects the masses for different railway systems. Further, we assess the diesel or electric traction for each route. The electrical consumption (well-to-wheel only) is calculated based on IEA national GRID values. |
| XSHIP - terminal/handling | | Our own transhipment values, developed for each mode of transport. At airports, there is a 10-hour warehousing period included which respects the national GRID values. Cooling is only calculated for airport transhipping. |
| COOL - transport/terminal/ cool storage/handling | | Cooling is only calculated for:<br>– Road transports and truck masses of 13 tonnes and higher;<br>– Sea transports;<br>– Air transports;<br>– Transhipping at airports. |

Source: CarbonCare.

As regards the pricing for the online calculator tool, CarbonCare offers licences for automated calculations of GHG. In addition to free calculations for individual cargo shipments, CarbonCare offers licences for shippers from trade and industry, as well as for forwarders and other logistics service providers. Depending on requirements, an offline (via FTP) or an online (via API) license are offered. CarbonCare includes an additional module for ‘Data Storage and Analytics’, which enables advanced calculations. Certification and compensation of GHG is possible with all options.

Table 92 presents the overview of annual prices (€$_{2022}$) of the licences to access to the use the calculator based on company turnover[125].

[125] For turnover up to € 500 million, the licence includes one million calculations. For turnover between € 500 million and € 10 billion, the calculator includes two million calculations.

**Table 92 - Overview of annual prices (€2022) of the license to access to the use of the calculator**[126]

| Turnover (€ million) | Licence | | | |
|---|---|---|---|---|
| | Free web | Basic | Business | Platform |
| < 5 | Free calculations with limit of five queries/day. Registration required in case of regular use. | 1,900 | 2,400 | Flat charge for up to one million calculation requests, plus surcharges for higher volumes. |
| < 25 | | 2,700 | 3,400 | |
| < 100 | | 4,000 | 5,400 | |
| < 500 | | 6,400 | 7,400 | |
| < 1,000 | | 9,400 | 9,400 | |
| < 10,000 | | 11,400 | 11,400 | |
| More than 10,000 | | 13,400 | 13,400 | |

Source: CarbonCare.

## Barriers to GHG accounting adoptions

CarbonCare measures cooling separately, and for transhipping it includes heating and electricity, but packaging and refrigerants are not calculated, although cooling is common in the supply chain and it requires additional energy. Therefore, it should also be assessed for transhipping together with electricity (e.g. for lighting and heating). Notably, for inland waterways and maritime transport it would be difficult to separate main energy consumption from the energy required for cooling. Energy for cleaning, maintenance and preparation of transport have not been included, because such allocation would dilute the comparison and promote misuse of calculations.

For rail transport, Chocholac et al. (2021)[127] observed that CarbonCare calculator can be used for passenger and general cargo. Because it does not allow to distinguish the freight transported by passenger cars, car bodies or containers, customized assessments cannot be readily implemented, like for example for the automotive industry.

CarbonCare also measures the emissions for transhipping between the chain elements for loading and unloading operations (e.g. unloading goods in a port from a vessel and loading the same parcels onto a train). Such emissions could be measured globally and allocated as fixed values (e.g. 5 kg of $CO_2$ for a transhipment from airplanes to trucks). However, as empirical measures from CarbonCare showed, such fixed values should be measured at regional level, because differences can be found between transhipment operations at airports located in Europe or Asia.

Moreover, fuel-based approach provides accurate results, since it is directly related to the emissions. However, the fuel-based approach needs to be clustered with respect to the activity, which means based on data gathered for the categories of vehicles that operate the services. On this basis, the calculation allows comparing the specific emission factor for different vehicle categories[128]. Furthermore, it is worth observing that depending on the technological evolution of the fleet over time, additional efforts to gather data for newer fuels might be necessary, like for example as regards gas-to-liquid, biodiesel or hydrogen.

[126] LF: load factor; LL: loaded legs; UT: utilisation factor.
[127] Chocholac, J., Hruska, R., Machalik, S., Sommerauerova, D. and Krupka, J. Customized Approach to Greenhouse Gas Emissions Calculations in Railway Freight, Transport. Applied Sciences 2021, 11, 9077.
[128] This approach has been developed in the 'Study on Transport Emissions of All Modes' (STREAM). See also STREAM (2016). Stream Freight transport 2016, Emissions of freight transport modes - Version 2. CE Delft, Delft, January, p. 2017.

## Impacts: economic, social and environmental

Impacts of transport operations have been estimated using CarbonCare calculator in view to raise awareness of the hidden environmental costs of construction, firstly with polymer versus steel district heating pipes, and then against copper plumbing pipes. According to Installer, an online journal heating, plumbing and renewable professionals, emission calculations have been carried out to assess the difference of transporting polymer versus traditional materials using industry averages[129]. The analysis used a typical journey in the UK, from London to Manchester (i.e. approximately 320 km or 200 miles). The objective of the application of CarbonCare calculator was to improve contractor's decision-making processes in the light of the decarbonisation targets.

Transport of construction material provides a good example, when it comes to the environmental impact, because selecting lighter and high-performance solutions shows the extent to which emissions can be reduced to achieve stringent sustainability targets. In the case of district heating pipework, for a sample of projects reviewed, the analysis using CarbonCare showed that transporting polymer pipes can cut carbon emissions by up to 67% against steel. Notably, for plumbing, transporting multilayer composite pipes can reduce carbon emissions from freight by up to 35%, which is a key saving taking into account 2050 net zero targets brought forward by the UK Government's Sixth Carbon Budget[130].

Furthermore, anecdotal information found carrying out additional desk research suggests that using this type of calculator might trigger behavioural changes also in the air transport sector, notably raising awareness to the need of transparency calculating the emissions. Well-to-wheel results in remarkably higher emission values compared to tank-to-wheel, however considering compensation, tank-to-wheel calculations providing CO2e emissions would encourage more carriers, forwarders, and shippers to monitor performance and plan the necessary measures to reduce the environmental impact[131].

## Implications for design of EU policy

Findings stemming from the design of CarbonCare $CO_2$-calculator for transport and logistics show that the industry would be in favour of a simple and transparent tool based on primary data to represent load factors, used energy and distances travelled. Moreover, primary data feeding the calculations should be gathered on annual basis (and updated on semi-annual frequency). When it comes to complementary activities to transport cargos from an origin to a destination (e.g. cooling, loading/unloading and warehousing)[132], the calculator should be designed either to provide estimates separately for these activities or by applying industry-specific mark-ups estimated at company level. Eventually, distances travelled should be treated according to great circle distances for all modes of transport.

[129] Installer (undated). New analysis to measure carbon emissions of transporting district heating and plumbing pipework.

[130] In 2021, the UK government set in law the aim of cutting emissions by 78% by 2035 compared to 1990 levels.

[131] For example, the Italian digital service provider CARGO START developed an interface with its airport-to-airport tracking solution StarTracking with the $CO_2$ emission calculator of CarbonCare.

[132] Emissions from warehousing and transhipping should be allocated based on mass.

### E.4.3 European Association for Forwarding, Transport, Logistics and Customs Services (CLECAT)

#### Overview

This case study discusses the methodology used and various drivers and barriers related to the calculation of GHG emissions within the transport and logistics sector of the EU and its further impact on the EU's policy design. For years, even though the transport sector is not regulated within the EU emission trading system (ETS), freight and logistics companies have recorded $CO_2$ emission values for products transported.

However, the method applied usually differs from sector to sector, and the reliability of its results is also questionable sometimes, making their evaluation difficult. Hence, to improve the accuracy, transparency and consistency in calculating energy consumption and GHGs, a new Standard was developed by European Committee for Standardisation (CEN) in 2012. This Standard showed how carriers, forwarders or logistics companies could calculate their energy consumption and GHGs (Schmied & Knörr, 2012).[133]

The Standard mentioned above, upon which the methodology to calculate the emissions in the transport sector, is EN 16258. It includes all passenger and goods transport modes, but has no legally binding character. Its application is therefore voluntary. In terms of the boundaries of the system, which defines what is essential for calculation and what needs to go into the equation, it includes the following:

- only transport services, no handling processes or offices;
- it includes transport services provided by sub-contractors;
- no manufacturing, maintenance or disposal of vehicles and transport infrastructure;
- no refrigerant losses.

#### GHG accounting methodology

For the GHG accounting methodology in the transport sector, as defined in EN 16258, the GHG emission values must be calculated as both the operation of the vehicle (tank-to-wheel, TTW) and as a total for operation and energy supply (well-to-wheel, WTW) values in kg $CO_2$-eq (energy consumption and greenhouse gas emissions) (Schmied & Knörr, 2012).

The calculation is as follows:

$$GT = F \cdot gT \text{ or } GW = F \cdot gW$$

Where:

- GT is the tank-to-wheels GHG emissions in kg $CO_2$ equivalents ($CO_2$-eq);
- F measured energy consumption (e.g. litre, kg or kWh);
- gT is the tank-to-wheels GHG emission factors from measured values in kg $CO_2$-eq;
- GW is the well-to-wheels GHG emissions in kg $CO_2$ equivalents ($CO_2$-eq);
- gW is the well-to-wheels GHG emission factors from measured values in kg $CO_2$-eq

The GHG emissions for tank-to-wheels and well-to-wheels are calculated similarly to energy consumption. A specific conversion factor is used to multiply the measured energy consumption for both values.

[133] Available at the following link.

The stakeholders which were interviewed for this case study indicated the following drivers and motivators for the transport sector to calculate and report GHG emissions:

- Without a demand from the market (i.e. customer request) or external pull, the logistics service providers will not calculate and account for emissions, since this forms an extra task within their business case.
- Calculating and reporting credible carbon emissions data helps set science-based climate targets.
- Helps to reduce emissions by implementing solutions as buyers or suppliers.
- Helps in collaboration and advocacy for sector-wide action and supportive policy.
- Improve operational efficiency and reduce associated costs.
- Improve customer service and value.
- Reduce exposure to climate and air quality-related risks and regulations.
- Contribute to the Paris Agreement and Sustainable Development Goals (SDGs).
- A stimulating factor in GHG accounting could be an emission trading system (ETS) for road transportation. With increasing ETS prices, companies would be more motivated to have insight in their emissions and fuel usage.

### Barriers to GHG accounting methodology

Stakeholders also pointed to the existence of multiple barriers to GHG accounting in the transport sector, including:

- Data reliability: whatever tool is being used, calculations on shipments should have similar outcomes. Harmonisation should focus on getting similar outcomes. Real emissions data is therefore preferable to default values. Tools that use general default values may yield outcomes that do not suit the particular context. Hence, primary data is the best input for accounting.
- Complexity of the transport network: supply chains can be highly complex. Sometimes it is not known who the ultimate cargo owner and who the client is, making it very difficult to track emissions along the entire transport route.
- The need not to disclose commercially sensitive information: companies are reluctant to share data related to distances (clients), fuel usage, efficiencies, and costs.
- The burden of calculating and accounting is harder for SMEs. Smaller firms may have IT systems for their shipments but no systems to calculate their emissions.

### Impacts: economic, social and environmental

Stakeholders reported that GHG accounting in the transport sector may have beneficial impacts insofar as clients may start demanding more insight into their emissions. There are also important impacts on cutting inefficiencies in fuel usage and costs. Stakeholders also reported, however, that any impacts largely depend on $CO_2$ pricing; and that achieving these impacts requires the use of primary data.

### Implications for EU policy design

The interview with the stakeholders on GHG accounting in the transport and logistics industry covered several issues related to the design of EU policy. The first one is the verification of results. While verification is desirable, stakeholders reported that certification may be too expensive. A ladder system, where certification starts being applying beyond a certain threshold - defined in terms of transport volume and firm size – is reportedly preferred.

There is also a focus on the development of an ISO Standard, which would be applied internationally, including all transport and passengers, in combination with a review of the CEN Standard on calculation and declaration of energy consumption and GHG emissions of transport services. Finally, stakeholders reported an interest in technical support measures—an example of which was the LEARN programme - providing training and raising awareness on GHG accounting tools.

# F Alternative applications of the common CountEmissions EU framework

## F.1 Introduction

The common CountEmissions EU framework will support companies in the transport sector to accelerate the uptake of GHG emissions accounting. This may help them to monitor carbon emissions of their transport and logistic activities, construct CSR (i.e. Corporate Social Responsibility) reports and setup roadmaps for emission reductions. Furthermore, it may provide them the opportunity to benchmark the GHG emissions intensity of their transport activities to those of their competitors (i.e. external benchmarking).

As discussed in Section 7.5.1, there are other potential applications of the GHG emission figures calculated conform the CountEmissions EU framework. The following alternative applications were identified in that section:
- ecolabelling of transport services;
- ecolabelling of final products;
- sustainable delivery services;
- permit to enter low- or zero-emission zones;
- sustainable financing;
- green public procurement;
- carbon pricing;
- self-organising logistics.

In this Annex we provide a more detailed description of these alternative applications or use cases (see Section F.2). Furthermore, we provide a comparative assessment of the use cases in order to identify which ones are expected to be the most effective (in terms of expected reduction of GHG emissions) and feasible (see Section F.3). Finally, in Section F.4 we discuss the minimum requirements that are set by these alternative use cases for the common CountEmissions EU framework.

## F.2 Overview of alternative use cases

In this section we provide an explanation of each alternative use case, discussing topics like the aim of the use case, how it works, what the role of GHG emission figures is, and which stakeholders are involved. In addition, we assess all individual use cases on criteria like the expected demand for the product/service delivered by the use case, expected GHG emission reduction potential, technical and political feasibility and stakeholder acceptance.

## F.2.1 Ecolabelling of transport services

**Table 93 - Ecolabelling of transport services**

| 1. | Ecolabelling of transport services |
|---|---|
| **Definition of use case** | |
| Aim | Inform stakeholders about the (relative) performance of transport operators. |
| How it works | Participating transport operators will report their emissions to the manager of the initiative. This manager processes the results of individual companies and rewards an eco label depending on their performance. A better GHG performance could result in a higher eco label. |
| Role of the GHG emission figures/account | The GHG emission figures form the basis for the eco labelling. A well-to-wheel approach is preferred in order to correctly account for the upstream emissions of biofuels and electricity. In order to compare GHG performance between companies, the results have to be calculated following similar calculation methods and aggregation levels. Also, it is important to distinguish the market in which transport operators are compared. For example, markets covering the transport of heavy goods cannot be compared with markets covering the transport of low weight (i.e. volume) goods. |
| Stakeholders involved | Some sort of governing body that awards the ecolabel (can be both a public or private entity). Additionally, participants are required, which can be shippers, carriers, logistic operators, freight forwarders among other parties involved with transport. |
| Potential benefits | The ecolabelling system has three main benefits. First, it offers transport operators an opportunity to compare their emission performance against competitors (i.e. external benchmarking). Secondly, it allows companies to report their emission performance to other stakeholders. Thirdly, it provides companies the option to distinguish themselves from their competitors. |
| Example of a practice application | Lean & Green is a greening programme which has started in the Netherlands around 2010 by the public initiative Connekt. Since then more than 500 companies from 14 European countries have participated in the program. In the program, participants promise to reduce $CO_2$ emissions. For different emission reduction levels and associated efforts, performance ratings (stars) are awarded. This stimulates companies which want to continue with GHG emissions as they are able to demonstrate their progress. Also, companies are anonymously compared against competitors active in the same market. More information on Lean & Green can be found in Annex C of the Annex report accompanying this report. |
| **Assessment of the use cases** | |
| (Expected) demand for the product/service delivered by the use case (by consumers, shippers, etc.) | The attention for sustainability is increasing. As a consequence more companies want to display their efforts. According to interviewees, this will lead to increased demand for ecolabelling. It is, however, important for ecolabelling services to remain relevant for frontrunners which will take new efforts to improve GHG efficiency. This can be done by adding new label levels or updating ecolabel thresholds periodically. As long as participation is voluntary, many companies will choose not to join. Therefore, the expected demand for this use is at best moderately. |

| 1. | Ecolabelling of transport services |
|---|---|
| (Expected) GHG emissions reduction potential | Ecolabelling offers participants a reason to accelerate GHG emission reduction. However, there are several other reasons for monitoring and reducing GHG emissions besides ecolabelling. Therefore we expect that the reduction potential which can be attributed towards ecolabelling is relatively limited.<br><br>To give an idea of the reduction potential of ecolabelling of transport services, we look at the GHG emission reduction achieved by the Lean & Green program. Companies participating in this programme have reduced over 700 ktonne $CO_2$ emissions since the start of Lean & Green, or about 0.7% of road transport emissions in the Netherlands. |
| Other (social) benefits | Ecolabelling may incentivise transport operators and users to choose for more sustainable options (e.g. modal shift to more sustainable modes, increased transport efficiency, etc.). Depending on the actual choices made, this may affect the level of other externalities (e.g. air pollutant emissions, noise, congestion) as well, although it is difficult to predict the size and sign of this effect. |
| Application cost for the owner/user of the use case | The application costs depend on the exact requirements of the ecolabelling initiative. In case the participants already calculates GHG efficiency following a methodology prescribed by the initiative, the application costs do not have to be high. However, if the ecolabelling follows a stepped approach, application costs to get top marks can be considerable. These costs can, however, be spread out over several years and as a results the annual costs are probably relatively low. |
| Technical feasibility | Current initiatives, like Green Award and TK'Blue, have shown that this use case is technically feasible. The main IT requirement is a secured system to exchange data. For transport companies, participation might also require upgrading their data collection. |
| Political and legal feasibility | Current initiatives have shown that this use case is politically/legally feasible. |
| Stakeholder acceptance | Stakeholders currently involved with GHG monitoring have a good acceptance of ecolabelling and hence voluntary ecolabelling is expected to be acceptable for stakeholders. Any form of mandatory ecolabelling will most likely lead to more resistance. |
| **Sources used for analysis** | |
| – Smart Freight Centre (SFC, 2019a), Global Logistics Emissions Council Framework for Logistics Emissions Accounting and Reporting;<br>– TK'Blue Agency (ongoing);<br>– Topsector Logistiek (2021), Richtlijn 18 – Benchmarken;<br>– Topsector Logistiek (2022), Lean & Green;<br>– Stakeholder interviews. | |

## F.2.2 Ecolabelling of final products

**Table 94 - Ecolabelling of final products**

| 2. | Ecolabelling of final products |
|---|---|
| **Definition of use case** | |
| Aim | Reporting (relative) GHG emissions over the entire life-cycle for final products. This allows consumers to consider the relative GHG emissions in their purchase decisions. |
| How it works | For each step in the value chain, GHG emissions are calculated and added up to create a picture of the entire GHG emissions of the final product. One of the sub steps creating emissions is transport. It is required that emissions are calculated and allocated following the same methodology in order to compare eco performance of final products. |
| Role of the GHG emission figures/account | The GHG emission figures of transport can be used as input for creating ecolabel of final products. Depending on the design of the ecolabel this can be aggregated figures at different levels, for example on route, type of goods or market. But in general, granularity at product levels is preferred. This does require that some type of allocation has to be applied for companies that transport a variety of goods, or transport goods in grouped form. Several interviewees have mentioned that a well-to-wheel approach is required to capture emissions of alternative fuels correctly. |
| Stakeholders involved | A governing body that awards the ecolabel (can be both a public or private entity). Besides this, participants are required, which can be shippers, carriers, logistic operators, freight forwarders among other parties involved with transport. The stakeholder providing transport operations is the logical party to lead the data gathering of transport emissions. Besides transport operators, other companies involved in the value chain have to be involved as well. The producent of the final product should be in the lead of the entire process. |
| Potential benefits | Ecolabelling has two main benefits. Firstly it offers final producers information about the emissions that occur in the supply chain. Secondly, it offers consumers the opportunity to buy products with the lowest GHG impact. This will offer producers the option to compete on something else than price and branding. |
| Example of a practice application | The EU Ecolabel is a practice application. EU Ecolabel certified products comply with strict criteria that guarantee a high quality and a lower environmental impact when compared to similar products on the market. Certified products and services are verified by third party, independent bodies. The labels consider a whole-of-life-cycle approach and strict limits on chemicals. |
| **Assessment of the use cases** | |
| (Expected) demand for the product/service delivered by the use case (by consumers, shippers, etc.) | The number of EU Ecolabel products is growing steadily in recent decades, with about 7% in the last year according to the European Commission. This example shows that demand for this type of ecolabels is increasing. According to the interviewees, a further increase of demand for eco-labelling is expected. |

| 2. | Ecolabelling of final products |
|---|---|
| (Expected) GHG emissions reduction potential | Yokessa & Marette, (2019) discusses the efficiency of Eco-labels. They show and discuss limitations in the form of complexity and the proliferation that hamper the efficiency in guiding consumers. For many consumers it is difficult to assess the value of the various amount of existing ecolabels as well as relatively performance between various types of goods. Economic literature underlines that an ecolabel is useful, but imperfect for providing information. Ecolabelling does not necessarily result in optimised buying behaviour from consumers.<br><br>Yokessa & Marette, (2019) argues that quantifying the influence of ecolabels on the environment is nearly impossible because of the complexity of environmental effects, heterogeneity of economic situations, and data availability. Therefore, currently no hard evidence is available on effects of ecolabels. Due to the lack of hard evidence we follow the economic theory which suggest a limited positive effect. |
| Other (social) benefits | As for the ecolabelling of transport services (see Section F.2.1), there may be impacts on other transport externalities as well. The size and sign of these impacts are, however, very uncertain and depends, among other things, on the design of the label. |
| Application cost for the owner/user of the use case | An ecolabel at shipment level requires information about GHG emissions at all steps of the value chain. Depending on the product this could involve a lot of various stakeholders. This would require a lot of data exchange between various partners, also outside of Europe. This could be very challenging and costly in case primary data is used. |
| Technical feasibility | The main difficulties are practical ones. How to exchange data, how to retrieve data down the value chain, how do you deal with companies that do not monitor carbon emissions. This requires uptake of IT infrastructure by the stakeholders in the supply chain. However, existing eco-labels shows that this is technically feasible. |
| Political and legal feasibility | There are many stakeholders involved in the production of the final product. Especially for companies situated outside the EU that are not willing to share information, it could be difficult to force them to provide the relevant data However, existing eco-labels shows that it is politically and legally feasible. |
| Stakeholder acceptance | This would vary depending on the stakeholder. Frontrunner companies will be willing to introduce an ecolabel. As a result they will request information about carbon emissions from companies in the value chain. These, for various reasons, might have less acceptance of GHG labelling at product level. For companies focussing on low price, there is probably less acceptance on ecolabeling as this increases final prices and thus reduces their competitiveness. |
| **Sources used for analysis** | |
| – EU Ecolabel (EU, ongoing);<br>– European Commission (ADEME, 2019), EU Ecolabel facts and figures;<br>– (Yokessa & Marette, 2019), A Review of Ecolabels and their Economic Impact;<br>– Stakeholder interviews. | |

## F.2.3 Sustainable delivery services

**Table 95 - Sustainable delivery services**

| 3. | Sustainable delivery services |
|---|---|
| Definition of use case | |
| Aim | The aim of using GHG emission data by sustainable delivery services is fourfold:<br>1. Show the receivers of the goods that the delivery company offers sustainable transport solutions.<br>2. Let receivers be in control with regard to the environmental impact of the delivery of their goods (e.g. fast delivery high $CO_2$ footprint, later delivery date, lower $CO_2$ footprint).<br>3. Meanwhile create awareness about the GHG impact of their preference.<br>4. Optimisation of transport operations in terms of environmental impact by the sustainable delivery service. |
| How it works | Based on the GHG emission figures, transport companies are able to calculate the impact of the different delivery services. GHG emissions of each individual delivery can be calculated and communicated. Companies can reduce the GHG emissions of their delivery services by optimising delivery routes and/or offer differentiated services based on their GHG impact. This can be realized by giving receivers the opportunity to choose between different timeslots for delivery which makes it possible to, for example, optimise routing or choose between different modes of transport. |
| Role of the GHG emission figures/account | The role of GHG emission figures is important as it helps to display towards transport users that a shipment is indeed sustainable. For this, an official calculation method is preferred as this helps to express objectivity of the results. For this purpose it is preferred to use primary data for calculations. In order to inform transport users beforehand, it is necessary to do ex-ante calculations. For a fair comparison between trips it is preferred to use a single method for allocation of shipments. Furthermore, the user needs to have confidence in the correctness of the figures. |
| Stakeholders involved | The central stakeholders in this use case are the delivery service providers (i.e. the transport company) and receivers, which can be both individuals as well as organisations. In addition, also the shipper (i.e. the sender of the goods and paying clients of the delivery service provider) have a stake in this as they can also have an influence on the delivery service. In some cases (primarily large shippers) the sender of the goods also executes the delivery. |
| Potential benefits | The most important benefit, from an environmental point of view, is that $CO_2$ emissions are reduced when more sustainable delivery services are being offered/ selected. Other benefits are increased awareness of consumers on the environmental impact of transport and the influence one can have in reducing this impact. Furthermore, companies offering the service create a sustainable image as well as that they can increase income (e.g. when a more sustainable option has a higher margin) or reduce costs (e.g. when routes are optimised). |
| Example of a practice application | Multiple companies already apply this in practise. Example are DHL Go Green, UPS My Choice and Bewust Bezorgd (a Dutch initiative to calculate $CO_2$ emissions of delivery options of online retailers). |

| 3. | Sustainable delivery services |
|---|---|
| | **Assessment of the use cases** |
| (Expected) demand for the product/service delivered by the use case (by consumers, shippers, etc.) | There is an increasing demand for sustainable products and services. Although customers might not be specifically asking for sustainable delivery services, companies are introducing such services to differentiate themselves and show that they are taken steps to reduce their footprint.<br><br>Research by Ignat & Chankov, (2020) shows that displaying environmental information of last-mile deliveries influences the decision behaviour of e-commerce consumers. In general, it makes them more likely to choose a more sustainable last-mile delivery. However, the acceptance of the trade-off in delivery speed varies per product type (Pereira Marcilio Nogueira et al., 2022). |
| (Expected) GHG emissions reduction potential | The Netherlands is among the European countries with the highest ecommerce activity (83% of the population buys online). Which makes them a front runner with regard to B2C e-commerce. In the Netherlands, delivery services of packages account for approximately 4% of the 3.6 Mtonne of $CO_2$ of city logistics in 2015 (Topsector Logistiek, 2017). Reducting the $CO_2$ emissions of e-commerce therefore is expected to have a limited impact on the total $CO_2$ emissions of transport (in the Netherlands, but maybe even more in other EU countries where the market share of e-commerce is often lower than in the Netherlands). |
| Other (social) benefits | If customers decide to go for sustainable delivery services this could result in better utilization of transport capacity due to more options to bundle cargo or usage of electric trucks or bikes. As a result less vehicles are on the road or the vehicles that are used generate less noise which creates a nicer environment to live in. |
| Application cost for the owner/user of the use case | Software to offer the service online and subsequently plan the deliveries also needs to be sourced or developed and implemented. On the other hand, increased transport efficiency and use of low- or zero-emission vehicles may result in lower energy costs for the delivery service. |
| Technical feasibility | Sustainable delivery services are already offered, there doesn't seem to be any technical limitations. |
| Political and legal feasibility | There are not political or legal restrictions, so from a political and legal point of view sustainable delivery services are feasible. |
| Stakeholder acceptance | This is a service that will be offered on a voluntary basis. Companies that offer the service see added value and hence from their side there will be no resistance. From a customer's point of view there is a large acceptance, especially since they are free to choose. |
| | **Sources used for analysis** |
| | – Ignat & Chankov, (2020);<br>– Pereira Marcilio Nogueira et al., (2022);<br>– Topsector Logistiek, (2017) Outlook City Logistics 2017;<br>– Stakeholder interviews. |

## F.2.4 Permit to enter low- or zero-emission zones

**Table 96 - Permit to enter low- or zero-emission zones**

| **4.** | **Permit to enter low- or zero-emission zones** |
|---|---|
| **Definition of use case** | |
| Aim | To create a healthier environment for the inhabitants and to contribute to reaching climate reduction targets, city councils may decide to introduce a low- or zero-emission zone for all or a selection of vehicles. |
| How it works | The low- or zero-emission zone is a predefined area in which vehicles that emit more than allowed are prohibited to enter the zone. If the vehicles do enter the zone they will be fined. Based on the licence plate of the vehicle it can be know what the characteristics of the vehicle are. Checks by the local enforcement agencies can be automated via camera's and related software or manually based on supplied permits.<br><br>The permission to enter a low- or zero-emission zone could also be given based on the total GHG emissions of a transport company. This can be relevant in cases where vehicles of a transport company use cleaner fuels, for example Hydrotreated Vegetable Oil (HVO), which can't be known based on the licence plate number and which need to be accounted for.<br><br>The focus of this instrument can be on GHG emissions, air pollution or both. Here we focus on zones which are focussed on (at least) GHG emissions. |
| Role of the GHG emission figures/account | Permits for low- or zero-emissions zones will, especially for air pollution, be based on the vehicles characteristics which will determine whether a vehicle is allowed in the zone or not. For carbon emissions it is however also important to incorporate indirect emissions from fuel production and biofuels. As certain alternative fuels (e.g. GTL or HVO) can be used in the same engines as diesel it is important to account GHG emissions at shipment level. This allows carriers to use biofuels specifically in low-emissions zones. |
| Stakeholders involved | The relevant stakeholders are the transport companies and local governments. The first to comply with the legislation and the second to develop, introduce and enforce the legislation. Although the legislation might also apply to citizen with vehicles, the focus of this case is on organisations (i.e. transport companies or organisations with own transport operations) which visit the low- or zero-emission zones. |
| Potential benefits | The main benefit of a low- or zero-emission zone is that within the zone emissions are substantially reduced. In addition, there is also an important spill-over effect as the vehicles are also used outside the zone. |
| Example of a practice application | Low-emission zones are already common practise in multiple countries, like the United Kingdom (London and Glasgow), Belgium (Antwerp and Brussels), France (Paris), Germany (Berlin and Munich), Spain (Barcelona and Madrid), Italy (Rome and Milan) and the Netherlands (Amsterdam, Rotterdam and Utrecht). Zero-emission zones are announced for over thirty cities in the Netherlands for freight transport entering the zone, which is in most cases the city centre. Also in China (near) zero-emission zones for freight transport are planned (i.e. Shenzen, Foshan and Luoyang). |

| 4. Permit to enter low- or zero-emission zones | |
|---|---|
| **Assessment of the use cases** | |
| (Expected) demand for the product/service delivered by the use case (by consumers, shippers, etc.) | The demand for this instrument is mainly driven from government and society to reduce emissions and increase livelihood within cities. Given the ambitious climate targets set by governments (including local ones), it may be expected that the use of low- or zero-emission zones will increase in the EU. It is, however, difficult to estimate the expected increase for this instrument in the next years. |
| (Expected) GHG emissions reduction potential | Current low-emissions zones are in general focussed at air pollutants. The thresholds are based on Euro classes from type approvals of vehicles. GHG emissions are not included in most emission zones. One of the reasons for this is that combustion engines can run on biofuels besides diesel and that it is difficult to account for differences in fuel types. Using GHG emission accounting the carbon emissions of specific shipments, e.g. for entry in low emissions zones, it is possible to show that vehicles have low GHG emissions as well. This allows for additional potential for low-emission zones by also including GHG emissions. The reduction potential depends on the size of the zone and the vehicle categories that need to comply to the regulation but in essence all city logistics can be affected and as such it has a large reduction potential. For example, CE Delft, (2016) estimated that $CO_2$ emissions from city logistics in the Netherlands was around 3.6 Mtonne per year (with a bandwidth of 2.7-4.5 Mtonne). The impact of the introduction of 30-40 zero-emission zones in the largest cities in the Netherlands is estimated to be around 1 Mtonne of $CO_2$ per year (PBL, 2021). On a city level De Bok et al., (2020) concluded based on a simulation study for Rotterdam that GHG emissions from transport operations can be reduced with 90% within the zero-emission zone. In the total Rotterdam area the GHG emissions were reduced by almost 10%. On a regional level the impact is very small. |
| Other (social) benefits | This kind of regulation will urge companies to rethink their operations. If they can't comply with the regulations, new concepts to supply the city will emerge which can result in less (e.g. through cargo bundling) or more traffic (e.g. through the use of light electric vehicle which have less loading capacity) on the road. |
| Application cost for the owner/user of the use case | Costs are made by governments to introduce and enforce the low- or zero-emission zones. For enforcement different solutions exist, the related costs also differ. Companies need to invest in low- or zero-emission vehicles, which tend to be more expensive than conventional ones (particularly in the short term). |
| Technical feasibility | This use case is technically feasible. |
| Political and legal feasibility | The political feasibility is heavily dependent on the local government. They decide on whether or not to introduce a low- or zero-emission zone. If there is willingness to introduce the zone, it is politically feasible. This also requires adjustments in legislation, but this is feasible (as has been shown in many real-life cases). |
| Stakeholder acceptance | Although companies understand the necessity for introducing policy measures to reduce emissions (like this one), the pace in which the zone is introduced and the time they have to comply would affect their acceptance for the instrument. In general, acceptance is expected to be low to medium especially since investments in zero-emission vehicles tend to be costly (at least on the short term). |
| **Sources used for analysis** | |
| – (CE Delft, 2016), De omvang van stadslogistiek;<br>– (De Bok et al., 2020), Simulation of the impacts of a zero-emission zone on freight delivery patterns in Rotterdam;<br>– (ICCT, 2021b), A global overview of zero-emission zones in cities and their development progress;<br>– (PBL, 2021), Klimaat- en Energieverkenning 2021. | |

## F.2.5 Sustainable financing

**Table 97 - Sustainable financing**

| 5. | Sustainable financing |
|---|---|
| | **Definition of use case** |
| Aim | Financial institutions increasingly use the (expected) carbon footprint of investment projects as criterion for financing those projects. |
| How it works | GHG emission figures for specific transport services may be useful information for financial institutions, e.g. for calculating the carbon footprint of transport or logistic infrastructure projects. |
| Role of the GHG emission figures/account | GHG emission figures of transport are used to estimate whether a project can be considered as a sustainable investment. This would require emissions calculated, ex ante, through an official methodology with verified results. |
| Stakeholders involved | These can be diverse. For transport related project the transport suppliers and financial institutions involved are included. For broader projects, also project managers, industry and other stakeholders can be involved. |
| Potential benefits | The GHG emission figures can help to mark investments under sustainable investment, such that they may apply for (favourable) financing conditions. |
| Example of a practice application | The European Taxonomy is a policy that offers a classification system, establishing a list of environmentally sustainable economic activities. The EU taxonomy provide companies, investors and policymakers with appropriate definitions for which economic activities can be considered environmentally sustainable. In this way, it should create security for investors, protect private investors from greenwashing, help companies to become more climate-friendly, mitigate market fragmentation and help shift investments where they are most needed. For more information on the European Taxonomy, see Annex D of the Annex report accompanying this study. |
| | **Assessment of the use cases** |
| (Expected) demand for the product/service delivered by the use case (by consumers, shippers, etc.) | With the increased focus on sustainability, the demand for sustainable financing will increase. In literature it has been argued that there is a clear need for sustainable financing in order to address market failures that can not be overcome with traditional financing.<br><br>With the EU Taxonomy, clear boundaries for sustainable investment will be set. The transport relevant technical screening data in the EU Taxonomy is currently mainly focussed on the sustainability on a vehicle level. This does not directly result in an increased demand for GHG figures. However, providing GHG emissions figures at the transport service level may provide the opportunity to modify the criteria set by the EU Taxonomy in order to make them more effective. |
| (Expected) GHG emissions reduction potential | One of the main issues with the climate transition is overcoming the high investment costs. Sustainable finance instruments are key to help solve this issue. Sustainable financing could therefore have a very large GHG emission reduction potential, although it is difficult to estimate the size of this potential. |
| Other (social) benefits | Sustainable financing helps to accelerate sustainable investments. This helps to easier achieve learning effects which reduces production costs. As a result of the lower production costs output can increase which further reduces production costs due to economies of scale. |
| Application cost for the owner/user of the use case | Sustainable finance instruments help sustainable investors to guarantee their sustainability and help to attract finance. In a way, this results in lower application costs. |
| Technical feasibility | The solution is feasible, though it is not clear how it will look in detail. |
| Political and legal feasibility | The Taxonomy proposal has been entered into force. This shows that there is political agreement on the relevance of sustainable financing. However, discussions on the |

| 5. Sustainable financing | |
|---|---|
| | details of what can be considered sustainable will probably remain due to differences in viewpoint. |
| Stakeholder acceptance | From financial institutions there is a demand for clear guidelines on investments which can be considered sustainable. The same applies for suppliers, as it helps them greatly to attract the required finances. |
| **Sources used for analysis** | |
| – (Boffo et al., 2020), ESG Investing: Environmental Pillar Scoring and Reporting;<br>– (Oman & Svartzman, 2021), What justifies sustainable finance measures? Financial-economic interactions and possible implications for policymakers;<br>– Stakeholder interviews. | |

## F.2.6 Green public procurement

**Table 98 - Green public procurement**

| 6. Green public procurement | |
|---|---|
| **Definition of use case** | |
| Aim | Governmental organisations can be a driving force behind the transition towards zero or low emission transport. Not only by legislation, but also by being a first mover by demanding that the transport services they procure do not exceed the maximum amount of GHG emissions which are required for the requested transport services.<br>If transport companies cannot comply with the demand, the companies do not qualify as supplier for the tendered service. |
| How it works | Governmental organisations tend to procure a large amount of services. Due to the size of the procured service or amount of assets (in case public services require their own vehicles to execute the service), governmental organisations are able to influence the operations of the service provider. Because when the assignment is large enough, transport companies will be able to adjust their fleet and/or operations to fulfil the demand and get the contract. |
| Role of the GHG emission figures/account | Currently, the Clean Vehicle Directive sets limits on the emissions per vehicle type (e.g. a certain percentage of the fleet needs to be zero-emission of may emit a maximum amount of 80 gr/km). The GHG emission figures per transport service can be of added value, as it will be much more detailed and it will incentive other types of reduction measures (e.g. increasing occupancy/loading rates). |
| Stakeholders involved | The main stakeholder is the procurement departments within governmental organisations, perhaps in combination with, for example on local level, the city council to set the agenda on how to deal with public procurement. In addition, the transport companies or vehicle manufacturers are important stakeholders since they need to be able to fulfil the demand. If the required standards are too challenging, the amount of companies that will be able and/or willing to fulfil the demand will be low, and hence the results of green public procurement will be more limited than anticipated. |
| Potential benefits | Reduction in emissions from transport services procured by governments. In addition, green procurement may create spill-over effects as the vehicles used for transport services ordered by the government might also be used for other customers. Finally, governments may set a good example, which may stimulate citizens or companies to invest in more sustainable transport options as well. |
| Example of a practice application | The driving force behind green procurement of transport services in the EU is the Clean Vehicle Directive, which sets national targets for the share of clean vehicles in the total number of vehicle procured by all types of governments. |

| 6. Green public procurement | |
|---|---|
| **Assessment of the use cases** | |
| (Expected) demand for the product/service delivered by the use case (by consumers, shippers, etc.) | The Clean Vehicle Directive provides targets per member state on the share of clean vehicle procured. This will push the demand for clean vehicles and as a consequence the governmental bodies will need to report on their progress. Reporting of GHG emissions can be instrumental in the actual outcome. |
| (Expected) GHG emissions reduction potential | Governments, on all levels, procure a large amount of services from third parties or finance public services like health care and schools. The impact assessment of the Clean Vehicle Directive indicates that a decrease of 17% of $CO_2$ emissions is possible on all vehicles procured and subsequently utilised by governments. By using targets defined in amounts of GHG emissions per transport services, this reduction potential could be even further increased. |
| Other (social) benefits | Higher shares of clean vehicles may also result in lower levels of air pollutant emissions. |
| Application cost for the owner/user of the use case | The application costs mainly consist of higher total cost of ownership of clean vehicles compared to standard vehicles. These costs will be mainly be borne by governments, as transport operators will largely pass these costs on. |
| Technical feasibility | This is technically feasible. |
| Political and legal feasibility | No political or legal support is needed to apply green procurement, this is already incorporated in the Clean Vehicle Directive. |
| Stakeholder acceptance | This is expected to be large. Society will probably not be against this way of working. This also holds for governments unless difficulties arise in procuring specific services as suppliers will not or cannot fulfil the demand. |
| **Sources used for analysis** | |
| – (EC, 2009b), Staff Working Document Impact Assessment of a Directive amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles;<br>– (Lindfors & Ammenberg, 2021), Using national environmental objectives in green public procurement: Method development and application on transport procurement in Sweden;<br>– Stakeholder interviews. | |

## F.2.7 Carbon pricing

**Table 99 - Carbon pricing**

| 7. Carbon pricing | |
|---|---|
| **Definition of use case** | |
| Aim | Reducing GHG emissions by effectively pricing carbon emissions. |
| How it works | Putting a price on carbon creates an incentive for reducing GHG emissions. In essence, the price put on carbon reflects the external costs of emitting carbon and places these costs back to the source. By doing so, it moves the responsibility of paying for the impact of climate change from the public to the GHG emission producer. It gives the producer the option of:<br>1. reducing its emissions to avoid paying a high price;<br>2. continue emitting but having to pay for its emissions.<br><br>Carbon pricing is most often applied upstream, i.e. at the point of fuel/energy production. It can, however, also implemented downstream, i.e. at the point of fuel/energy consumption, or somewhere in between. |
| Role of the GHG emission figures/account | GHG emission figures per transport service may be used as input for downstream carbon pricing schemes. As transport emissions contribute to the emissions of final products/services, information on these emissions is useful input for downstream carbon pricing schemes. |

| 7. | Carbon pricing |
|---|---|
| Stakeholders involved | A key stakeholder in implementing carbon pricing is some governing organisation. This is often a government, but also international organisations could manage a carbon price instrument. The other stakeholders are the parties that are charged. These can be transport operators but this could also be shippers or final producers. |
| Potential benefits | The primary benefit is that due to the additional costs the emitter has an incentive to reduce its emissions. |
| Example of a practice application | Pricing GHG emissions from transport indirectly or afterwards is important for the Carbon Border Adjustment Mechanism. This proposal from the EC aims to create a level playing field for EU producers subject to EU carbon pricing by levying carbon intensive products produced outside the EU. |
| **Assessment of the use cases** | |
| (Expected) demand for the product/service delivered by the use case (by consumers, shippers, etc.) | Carbon pricing is widely seen as an important $CO_2$ mitigation measure. However, most countries or regions do implement upstream carbon pricing schemes or emission trading schemes, for which no transport emission data at the service level is required. The demand for this specific type of carbon pricing is therefore expected to be low, even though it may have some advantages over an upstream scheme (e.g. it provides the option to simply exempting some sectors from the tax). |
| (Expected) GHG emissions reduction potential | Carbon pricing is considered an effective measure to mitigate $CO_2$ emissions. Its reduction potential, however, largely depends on the design and level of the pricing scheme. |
| Other (social) benefits | Carbon pricing incentivise all kinds of reduction measures (lowering transport demand, increasing loading rates, shifts to more sustainable modes, etc.) that also affect other transport externalities, like air pollutant emissions, noise emissions, congestion, etc. |
| Application cost for the owner/user of the use case | Implementing a downstream carbon pricing scheme will result in relatively high implementation costs (compared to an upstream pricing scheme), as the emissions at the level of end-users should be accounted. |
| Technical feasibility | Reliable and trusted accounting needs to be organised. Here some technical difficulties may occur. Collecting data for entire production chains is often technically difficult, especially for globalised supply chains. Also, the exchange of data can bring technical difficulties. |
| Political and legal feasibility | From a legal perspective carbon pricing is feasible, however getting political support is much more difficult. |
| Stakeholder acceptance | Stakeholder acceptance for a downstream carbon pricing scheme is probably low, particularly for consumers. Companies are probably more willing to accept such a scheme if there is a level playing field so that they won't have a competitive disadvantage compared to other companies. |
| **Sources used for analysis** | |
| – Aldy & Stavins, (2012), The promise and problems of pricing carbon: theory and experience;<br>– (IMF, 2021) Carbon Pricing: What Role for Border Carbon Adjustments?;<br>– (Oman & Svartzman, 2021), What justifies sustainable finance measures? Financial-economic interactions and possible implications for policymakers;<br>– (Van Essen et al., 2010), EU Transport GHG: Routes to 2050? - Economic instruments (paper 7);<br>– Stakeholder interviews. | |

## F.2.8 Self-organising logistics

**Table 100 - Self-organising logistics**

| 8. | Self-organising logistics |
|---|---|
| | **Definition of use case** |
| Aim | Self-organising logistics refers to the case where digital agents in the logistics chain (either companies, vehicles or loading units such as containers or packages) make autonomous decisions based on local intelligence and local data. Such systems can be programmed in a way that it also takes into account the emissions generated by the transport. |
| How it works | Algorithms or artificial intelligence can be developed or trained so that emissions, next to other conditions related to the delivery of the product of service, are taken into account. A weight can be given to the importance of emissions so that the algorithm will optimise on the emissions as much as possible. |
| Role of the GHG emission figures/account | Accurate GHG emission data of transport operations is needed to feed the system and base the decisions on. This requires information at shipment level. |
| Stakeholders involved | Shippers and transport operators are key in the decision to utilize the software/ implement the systems needed to realise self-organising logistics. In addition, the developers or platform operators of self-organising logistics systems/software might also play an important role as they can decide what kind of algorithms are included and how the decisions are made. This could be of importance when GHG emissions also come into play. |
| Potential benefits | Currently, it is difficult for transport planners to make an efficient planning. Often planners get support from planning software. However, information regarding GHG emissions is, if at all, included in a limited way. Adding this information to the planning tools is a first step towards transport solutions with less emissions.<br>The next step is including GHG emissions in advance software for the purpose of self-organising logistics. This results in a structural focus on emission reduction and decisions that are also based GHG emissions. |
| Example of a practice application | N/A |
| | **Assessment of the use cases** |
| (Expected) demand for the product/service delivered by the use case (by consumers, shippers, etc.) | Self-organising logistics is in its early stages and to some extent futuristic. However, there is an increasing demand to automate planning for which software is being developed. When sufficient reliable GHG emission data is available, it is expected that the demand for including this in decision making will increase. |
| (Expected) GHG emissions reduction potential | The incorporation of GHG emissions in decision making for transport planning needs to grow. Self-organising logistics will probably result in higher transport efficiency (e.g. higher occupancy rates and optimised routes) but the size of the impact is rather uncertain as evidence on the impact is still lacking. The uncertainty becomes larger due to the possible increase of transport demand due to increase in efficiency and/or transport capacity that is the results of self-organising logistics. This could partly counteract any emission reduction from transport efficiency (CE Delft and TNO, 2020). |
| Other (social) benefits | Companies are able to reduce costs as they can organise their operations more efficient. |
| Application cost for the owner/user of the use case | Transport operators need to investments in software, which still requires large investments. On the other side, they can reduce their operational costs as mentioned above. |
| Technical feasibility | The technical feasibility depends on the level of automation. Self-organising logistics to the full extent is not yet technical feasible as it requires a lot of data exchange |

| 8. | Self-organising logistics |
|---|---|
| | between multiple parties and new algorithms to make it work. Including GHG emissions as a decision variable in planning software is technically feasible. |
| Political and legal feasibility | Data sharing, security and privacy issues might need to be tackled to address the fears that might exist when data is used from different sources. However, the current technical solutions (i.e. cyber security systems, authorisation and authentication solutions, blockchain and federated data systems) provide sufficiently safe ways of working. Therefore, no political or legal restrictions are expected. |
| Stakeholder acceptance | Since the application of self-organising logistics is still voluntary, it is expected that the acceptance of companies using self-organising logistics is larger. Especially since they will only apply these systems when they expect to benefit from it. |
| Sources used for analysis | |
| – (CE Delft & TNO, 2020), The impact of emerging technologies on the transport system;<br>– (Kayikci, 2018), Sustainability impacts of digitisation in logistics;<br>– (TNO, 2020a), Central and decentral coordination of the logistics chain. | |

## F.3 Comparative assessment of alternative use cases

In the previous section we presented the qualitative assessment of the various alternative use cases on a set of criteria. Based on that assessment, we have conducted a comparative assessment of the various use cases. Therefore, we scored each use case on the relevant criteria on a five point scale (from '1: low' to '5: high'). The evidence presented in the previous section was used as basis for this scoring exercise. The results of the comparative assessment are shown in Table 101.

The highest potential in term of $CO_2$ reduction can be found in use cases that have a large reduction potential and high expected demand. Most promising use cases in that respect are sustainable financing and green public procurement. Additionally, these applications seems feasible from a technical, legal and political point of view. For sustainable delivery services the expected demand is also expected to be relatively high, but as its reduction potential is expected to be lower, this use case is considered less promising.  Finally, a downstream carbon pricing scheme has a lot of potential, but is very difficult to implement from a technical, legal and political point of view.

**Table 101 - Comparative analysis of alternative use cases**

| | Ecolabelling of transport services | Ecolabelling of final products | Sustainable delivery services | Permit to enter zero- or low- | Sustainable financing | Green public procurement | (Downstream) carbon pricing | Self-organising logistics |
|---|---|---|---|---|---|---|---|---|
| Expected Demand | 3 | 3 | 4 | 3 | 5 | 4 | 2 | 2 |
| Reduction potential | 2 | 2 | 3 | 3 | 5 | 4 | 5 | 2 |
| Application cost | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 |
| Technical feasibility | 5 | 4 | 5 | 5 | 4 | 5 | 2 | 1 |
| Political and legal feasibility | 5 | 4 | 5 | 3 | 4 | 5 | 2 | 3 |
| Stakeholder acceptance | 5 | 3 | 5 | 3 | 4 | 3 | 2 | 3 |

The overall conclusions of the comparative analysis as presented above are supported by the results of the targeted stakeholder survey. Green public procurement and sustainable financing were considered the most important future use cases by stakeholders: 22 out of 27 (82%) respondents found green public procurement (very) important, while for sustainable financing this was the case for 21 of the 27 respondents (78%). Also sustainable delivery (20 out of 27; or 74%)and ecolabelling of transport services (18 out of 27; or 67%) were considered to be (very) important future use cases by the stakeholders (18 out 24). Least important use case according to the stakeholders is a permit to enter zero- or low-emission zones (12 out of 27; or 44%).

## F.4 Minimum requirements for a common methodological framework

Based on the results of the previous steps, we defined (minimum) requirements that should (preferably) be met by the CountEmissions EU framework in order to effectively facilitate the implementation of these use cases. We have first done this for the most promising use cases and based on those requirements we tried to develop a set of general requirements.

The previous step has shown that the most promising alternative use cases are sustainable financing and green procurement. Besides these two, also sustainable delivery services is a promising option. Therefore, we took these three use cases into account in the assessment of minimum requirements for the CountEmissions EU framework.

In the assessment of minimum requirements, we again distinguish the various policy areas as done before in Annex C.

### F.4.1 Methodology

The results of the assessment for the requirements for the methodology are shown in Table **102**. Notice that the requirements are set quite stringent, meaning that they are selected in order to facilitate almost all implementations for the use cases, now as well as in the future. The results are discussed in more detail below the table.

**Table 102 - Minimum requirements of alternative use cases for the common methodology**

| | Sustainable delivery services | Sustainable financing (ESG financing) | Green public procurement |
|---|---|---|---|
| **Scope** | | | |
| Geographical scope | National | Global | Global |
| Type of emissions | All GHG emissions from combustion and refrigeration | | |
| Activity boundary | Well-to-wheel emissions + emissions from hub operations + emissions from construction and dismantling of energy infrastructure. | | |
| Intended user | Transport operators and organisers/users | | |
| Perspective | Ex ante and ex post | | |
| **Emission calculation methodology** | | | |
| Granularity in calculation method | Individual trip | Transport leg | Transport leg |
| **Allocation of emissions to transport services** | | | |
| Allocation parameters | GCD/SCF tonne or passenger-kilometre | | |
| Allocation granularity | Trip level | Leg level | Leg level |
| Allocation time aggregation | Annual base | | |

## Geographical *scope*

The minimum required scope of the use cases differs. Sustainable delivery services focusses on last mile deliveries which generally are not cross border. As a result a national scope would be sufficient. For the other use case a global scope may be required as these use cases may be implemented in an international (and global) context[134].

## Type of emissions

All alternative use cases require the collection of direct $CO_2$ emissions from propulsion as well as non-$CO_2$ GHG emissions from the combustion of fuels and originating from refrigeration. This is required to correctly include biofuels as well as the various forms of transport including temperature controlled transport.

As for the non-$CO_2$ emissions at high altitude for aviation and black carbon, it was made clear in Section A.1.1 that scientific evidence is currently too poor to include these emissions in the common methodology for CountEmissions EU. However, for some of the use cases they may be relevant when sufficient evidence on how to include them becomes available.

## Activity boundaries

For all use cases, the coverage of well-to-wheel emissions are relevant (amongst others to make comparisons between fossil fuelled, electric and biofueled transport possible). For the same reason the coverage of emissions from construction and dismantling of energy production infrastructure is relevant for all four use cases. Emissions from hub activities may be relevant for all use cases as well, depending on the specific situation where the use case is applied. Life-cycle emissions from vehicle construction and maintenance and infrastructure construction/maintenance may be useful for sustainable financing, but not necessary. For the other use cases, these activities are not required.

## Intended users

All four use cases can involve the participation of both transport operators/organisers and users. For example, green public procurement procedures can be targeting transport operators, but also shippers. Therefore, the emission accounting framework will have to support emission accounting for all types of entities for each of the use cases.

## Use p*e*rspective

All four use cases mainly require ex ante calculations, either based on historical data or default/modelled data. As the first method results in higher quality data, ex post calculations are relevant for all use cases as well. Therefore, both ex-ante and ex post data are relevant.

134 Although green public procurement will mainly have a national scope, it may also cover travelling by airplane and therefore a global scope is required fort his use case.

### Granularity in calculation method

The level at which GHG emissions have to be calculated differs between the use cases. Sustainable delivery services are vehicle and/or trip specific and therefore require emission calculation at the level of individual trips. For sustainable financing and green procurement there are many levels at which accounting could be relevant. Investments and procurement can be at project level which would require a less detailed level of emissions accounting, for example an average at operator level. However, for transport specific investments, like new efficient vehicles, more granularity can be required. Overall an accounting framework should support GHG calculations at various levels rather than enforcing a fixed level. Therefore, the minimum requirement from these use cases is that the framework supports calculations at TOC level, as based on that data emissions at less disaggregated levels can be calculated.

### Allocation parameters

Depending on the situation, different allocation parameters can be required for the various use cases. Energy efficiency, as measured per tonne or passenger-kilometre, is ideal to compare vehicles among each other. This could be helpful for investments in new vehicles or comparing the fleet in an offer. However, using SFD kilometres or GCD kilometres, allows for a better capture of the logistical performance and real world performance. This is especially helpful for comparing efficiency between companies or a correct allocation of emissions towards shipment addresses. Preferably the framework provides the flexibility to apply various allocation parameters, but as a minimum allocation based on GCD/SFD kilometres should be possible.

### Allocation granularity

Allocation granularity prescribes the level at which allocation of emissions towards individual shipments or passengers takes place. For sustainable delivery services, allocation on individual trip level is most relevant, as this is the level at which the service is offered. For sustainable financing and green public procurement, both the company level and TOC level may be relevant, depending on the specific situation. Company level may be sufficient where an overall picture of emissions is required, while for more detailed figures an allocation on TOC level is required. The minimum requirement for these use cases are therefore TOC level.

### Allocation time aggregation

For all use cases, time aggregation on an annual base is the preferred option to exclude the impacts from incidental impacts (e.g. weather impacts).

## F.4.2 Harmonised input data

For all use cases, the use of primary data to calculate GHG emissions is preferable. Modelled data or default data should only be used in case primary data is not available. Additionally, harmonised emission databases (energy emission factors and emission intensity factors) are relevant for all use cases.

### F.4.3 Harmonised output data

For sustainable delivery services, a harmonised format for the output data may increase the comparability of the results for different services. This may help consumers to compare different service providers. For the other use cases, the need for a harmonised output data is less urgent, as the results of GHG emissions accounting are particularly used on a case by case basis (and not compared between cases/companies).

### F.4.4 Sectoral implementation guidelines

Although the use of sectoral guidelines may facilitate the accounting of GHG emissions in each of the four use cases, they are not necessary for any of them. Therefore, no minimum requirement in this policy area is coming from the alternative use cases.

### F.4.5 Conformity

The need for verification differs between the use cases. Financial institutions offering sustainable financial arrangements will require that emissions accounts are verified. As public procurements are including very large investments, GHG emission figures used as input in these processes will definitely require verification. For both use cases, verification will be organised by the market in case no centralised system for verification is available.

For sustainable delivery services the use of verification is less obvious, particularly as the users of these services are mainly consumers, who have less power to require verification of the GHG emission figures. However, the companies offering this use case do have an incentive to organise verification of the figures themselves in order to increase their credibility. In this case, it is important that there are some conditions set for verifiers in order to guarantee that the verified figures are conform a common methodology. This will also increase comparability between figures from different service providers. Additionally, some sort of accreditation of verifiers may help to increase the credibility of the verified emission figures

### F.4.6 Complementary measures

Although the complementary measures may facilitate the accounting of GHG emissions in each of the four use cases, they are not necessary for any of them. Therefore, no minimum requirement in this policy area is coming from the alternative use cases.

### F.4.7 Applicability

None of the use cases require that the CountEmissions EU framework becomes mandatory, although it may facilitate the appliance of these use cases. Therefore, no minimum requirement on this policy area is set.

### F.4.8 Synthesis: general requirements

Based on the assessment above, Table 103 presents the minimum requirements from the alternative use cases for the CountEmissions EU framework.

**Table 103 - Summary minimum requirements for CountEmissions EU framework from alternative use case**

| Policy areas/elements | Minimum requirements |
|---|---|
| **Methodology** | |
| Geographical scope | Global |
| Type of emissions | All GHG emissions from combustion and refrigeration |

| **Policy areas/elements** | **Minimum requirements** |
|---|---|
| Activity boundaries | Tank-to-wheel, well-to-tank, hub emissions and emissions from energy infrastructure included |
| Intended user | Operators and users/organisers |
| Perspective | Ex-ante and ex-post |
| Granularity in calculation method | Various levels, but at least individual trips and TOC |
| Allocation parameters | Emissions per GCD/SFD kilometres |
| Allocation granularity | Various levels should be supported, but at least the level of TOCs and individual trip level. |
| Allocation time aggregation | Annual base |
| **Harmonised input data** | |
| Type of data | Primary data is preferred, but modelled data and default data is allowed in case primary data is not available. |
| **Conformity** | |
| | Some conditions for verification of data and calculations should be available in order to ensure that the figures are conform a common methodology (to increase comparability of GHG emission figures). Some kind of certification of verifiers will help to improve the credibility of the GHG emission figures. |

# G Stakeholder consultation report

## G.1 Introduction

This document contains the stakeholder consultation report for the Impact Assessment support study for an EU framework for harmonised measurement of transport and logistic emissions: ‘Count Your Transport Emissions – CountEmissions EU’ (hereafter, the ‘study’).

Consultation activities address the topics identified in the problem definition and additionally useful information on the experienced or expected impacts from similar emissions measurement and calculation efforts. Initial consultation activity focused on problem validation and identification of significant impacts based on possible interventions (e.g. early interviews). More recent consultation activity has focused on validating thinking on policy measures and the possible associated impacts (e.g. targeted questionnaires and stakeholder workshop). Later efforts focused on the assessment of impacts and case studies that can be presented to bolster the assessment of impacts (e.g. later interviews).

Although engagement has focused on the measurement of emissions and what a harmonised framework for measurement and calculation would look like, an exploration of possible future uses for the GHG emissions information (outputs) has also been included as part of all stakeholder engagement activities.

Stakeholders in the private sector are particularly interested in what the overall legislative ecosystem might look like in the future, for example: how the CountEmissions EU initiative would relate to the adopted Corporate Sustainability Reporting Directive (CSRD).[135] Large private sector (and publicly listed) companies are understandably driven by the (highly probable) future need to accurately report emissions to investors, customers and regulators.

This report presents the analysis of the outcomes originating from the stakeholder consultation activities that have been carried out throughout the support study. During the support study, a combination of targeted and non-targeted methods has been used to gather information from the relevant stakeholders.

In particular, we have analysed the outcomes of the following consultation activities.
- an on-line targeted survey-questionnaire, which collected 38 responses between 11 August and 31 October 2022;
- two of rounds of targeted interviews were held, of which:
  - the first round was organised as a round of exploratory interviews to better understand the problem from different user perspectives. We carried out four targeted interviews between 3 and 13 May 2022;

[135] Under Directive 2014/95/EU, large companies have to publish information related to: environmental matters; social matters and treatment of employees; respect for human rights; anti-corruption and bribery; diversity on company boards. On 21 April 2021, the Commission adopted a proposal for a Corporate Sustainability Reporting Directive (CSRD), which would amend the existing reporting requirements of the NFRD. The proposal extends the scope to all large companies and all companies listed on regulated markets (except listed micro-enterprises) requires the audit (assurance) of reported information introduces more detailed reporting requirements, and a requirement to report according to mandatory EU sustainability reporting standards requires companies to digitally ‘tag’ the reported information, so it is machine readable and feeds into the European single access point envisaged in the capital markets union action plan.

  - the second round focussed on gaining deeper insights and ask for clarification and fill gaps as needed as a follow-up to the targeted survey. We carried out 32 targeted interviews between 8 July and 6 December 2022.
- one short survey-questionnaire sent to four member states in substitution for targeted interviews sent on 28 November 2022;
- one online workshop, which was held on 27 October 2020 and included 41 representatives thought to represent the Stakeholder ecosystem;
- public consultations launched on the Commission's 'Have your say' web-portal to gather input and views from a broad range of stakeholder; the tools used are:
  - call for evidence opened between 19 November and 17 December 2021 and receiving 60 opinions in relation to the initiative;
  - open Public Consultation opened between 25 July and 20 October 2022 and receiving 184 responses to the questionnaire.

A non-random sampling method was used in the case of the survey-questionnaire to gather the information. Similarly, non-random sampling was used for the targeted interview programmes and the stakeholders workshop. We have purposefully preference engaged and knowledgeable stakeholders given the technical content of CountEmissions EU, but ensure equal representation from different stakeholder groups (e.g. individual shippers, freight service users, etc.). Follow-up methods, as well as promotion of the surveys, interview programmes and workshops were undertaken in order to stimulate interest, increase the response rate and the participation at the events organised by the team of experts.

By cross-referencing the input from the various consultation sources, e.g. targeted interviews, survey-questionnaires, etc., we ensure that the gathered information is relevant and representative for the relevant stakeholder ecosystem. We also gain insights on information gaps from one activity using information gathered in another. The triangulation activity is further explained in Section G.4.

The main focus of the stakeholder consultation report is to provide information on which stakeholder groups participated, their interests and whether all stakeholder groups have been reached. In addition, the stakeholder consultation report provides an assessment of the representativeness of stakeholders in which the methodologies are described.
The results of the consultation activities are compared and taken into consideration for the assessment of the impacts of the different policy measures and options provided in the draft final report.

## G.2 Synthesis of the report

The objectives of the consultation activities were the following:
- to collect information and opinions of stakeholders on the key problems and associated drivers, the definition of relevant policy objectives linked to those problems, and the identification and screening of policy measures that could be considered in this Impact Assessment;
- to gather information and opinions on likely impacts of the policy measures and options.

### G.2.1 Overview of consultation activities

The consultation strategy was developed from the start of the project and included as key stakeholders the following groups: citizens, companies, business associations, public authorities, NGOs, consumer organisations, academia, trade unions, environmental organisations. The consultation tools were placed in sequence to ensure appropriate feedback during the development of the respective stages of the Impact Assessment.

Consultation activities took place in 2021 and 2022, and specifically included:

1. **Feedback on the Call for Evidence:** as part of the initial feedback mechanism, interested parties had the possibility to provide feedback on the Call for Evidence published on the 'Have your say' webpage[136] on 19 November 2021 and open until 17 December 2021. In principle, the Call for Evidence collected feedback regarding the Commission's plans concerning the CountEmissions EU initiative, and general opinions on the issues related to accounting emissions in the transport sector.
2. **Open Public Consultation:** the Open Public Consultation (OPC) questionnaire was accessible on 'Have Your Say' webpage from 25 July to 20 October 2022. The OPC specifically inquired about the current situation and motivations for emissions accounting in transport, related problems and problem drivers, and measures to address these on the EU market.
3. **Targeted consultation:** two rounds of interviews were held:
   - exploratory interviews during the technical support study inception phase, aimed at tackling general issues from different user perspectives and targeting subsequent engagement with a broader group of stakeholders (Q2 2022);
   - in-depth interviews to plug information gaps and assess the expected impacts of policy measures (Q2, Q3 and Q4 2022).

   Two rounds of surveys were carried out:
   - a survey questionnaire to substantiate the problem analysis and to assess the impacts of policy measures (Q3 and Q4 2022);
   - a short follow-up survey questionnaire targeting selected member states (Q4 2022).
4. One **expert workshop** was held, focussing on the problem tree and proposed measures (on 27 October 2022).

## G.2.2 Stakeholder groups consulted

This section provides a short overview of the main types of stakeholders identified and targeted as part of the stakeholders' consultation.

Overall, the consultation activities attracted interest from various types of stakeholders, which resulted in a good participation level and numerous contributions received. The participation in all consultation activities is shown in Table 104.

[136] Count your transport emissions – 'CountEmissions EU' (europa.eu).

**Table 104 - Overview of stakeholder consultation results**

| Consultation activity | Number of stakeholders invited | Number of responses | Number of documents provided[137] |
|---|---|---|---|
| *'Have your say'* Call for Evidence | Not applicable | 64 | 60[138] |
| Open Public Consultation | Not applicable | After analysing the data, 188 non-duplicates, of which 184[139] contain answers to the questionnaire and not just a document (position paper) attached. SMEs are 100 of the responses. | 27[140] |
| Exploratory interviews | 4 | 4 | 0 |
| Targeted survey | 70 | After analysing and filtering the data, 38 questionnaires, of which 26 were fully completed. SMEs are 8 of the responses. | 22[141] |
| Targeted interviews | 44 | 32 | 0[142] |
| Short survey questionnaire | 4 | 1 | 3[143] |
| Stakeholder workshop | 43[144] | 33[145] | 0[146] |

It should be noted that given the concurrent engagement mechanisms, most stakeholders have chosen not to participate in all opportunities that were made available to them. For example, some stakeholders had contributed to the OPC or had undertaken targeted interviews and therefore did not feel the need to participate in the targeted survey.

137 Position papers or other contributions in addition to the responses to the questions.

138 The total number of written contributions was 64, but taking into account duplications, the number of unique written contributions that have been reviewed is equal to 60.

139 It is possible that 6 out of the 184 answers to the Open Public Consultation questionnaire are part of a coordinated campaign.

140 A total of 31 submissions were obtained, of which four were duplicate entries and were removed. From the remaining 27, 22 contain information related to the scope of this initiative, three contain information about related topics, and two do not contain information related to the scope of this initiative.

141 A total of 27 written contributions from 14 different stakeholders were received as part of this process in addition to the responses to the questionnaire, of which 4 are duplicates, and 1 more was already submitted as a contribution to the Open Public Consultation.

142 A number of written contributions were received from a limited number of stakeholders, but they are duplicates of other submissions that have been received in other stakeholder engagement tools.

143 The only Member State to respond provided two links to websites and one link to an online hosted document.

144 A total of 60 individual representatives were invited, representing 43 different stakeholder organisations.

145 In total there were 43 representatives attending the workshop, representing 33 different stakeholders.

146 One stakeholder sent a position paper as follow-up to the workshop, however it is a duplicate of documents received as attachments to the Open Public Consultation.

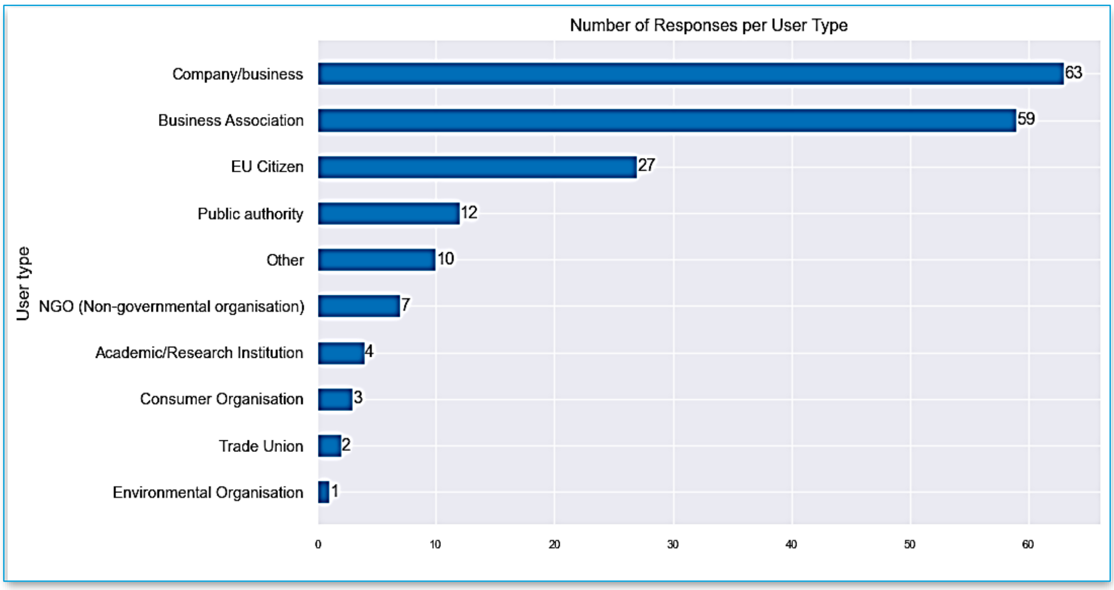
## Call for Evidence

60 unique contributions were received, with a large majority of respondents belonging to categories described as company/business organisations and business associations (25 and 24 out of 60, or 42% and 40%, respectively). With respect to the place of origin of the participating respondents, 24 out of 60 (or 40%) of the responses came from Belgium, where business associations usually establish head offices and act as umbrella organisations on behalf of associated national or industrial members. Other opinions derive mostly from western and northern EU member states. Two contributions were also submitted from non-EU countries (the UK and the US).

## Open Public Consultation

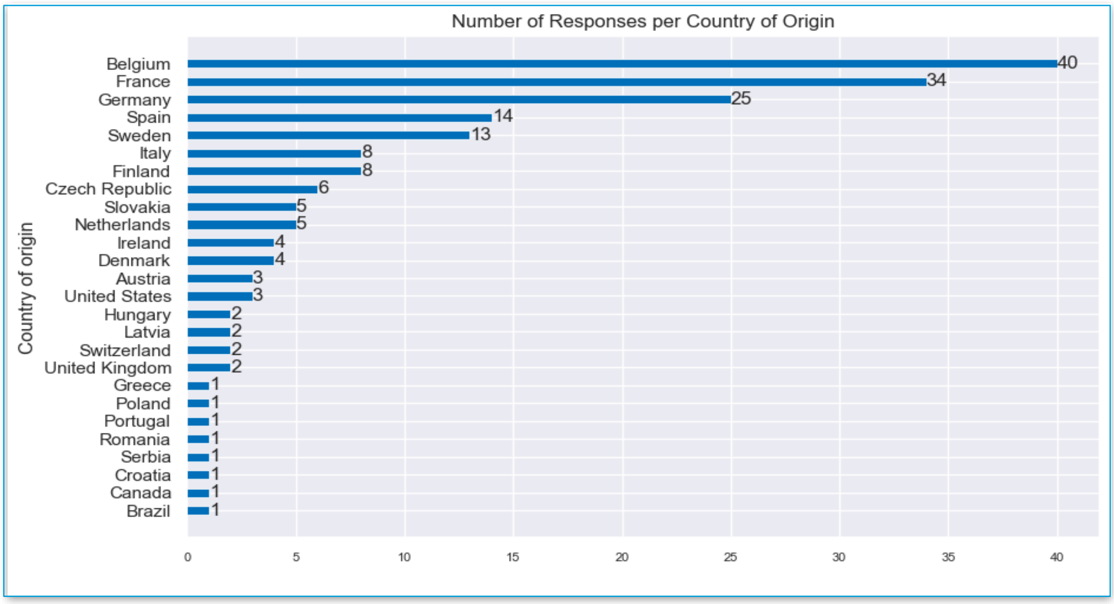
The OPC was open to the general public, with 184 stakeholders participating. The responses to the OPC were mostly populated by respondents representing company/business organisations and business associations, followed by individual citizens (34%, 32% and 15%, respectively).

**Figure 20 - Number of Open Public Consultation respondents by type of respondent**




In terms of the geographical representation, the respondents originated from across the EU, mostly from the western and northern member states, and in particular from Belgium. A number of responses were also submitted from non-EU countries, namely the US, Switzerland, the UK, Serbia, Canada and Brazil.

**Figure 21 - Participating stakeholders: countries of origin**




## Exploratory interviews

Four stakeholders were interviewed in exploratory interviews. The represented specifically: a passenger transport association, a shippers' association, a non-profit environmentally oriented organisation and a green transport programme.

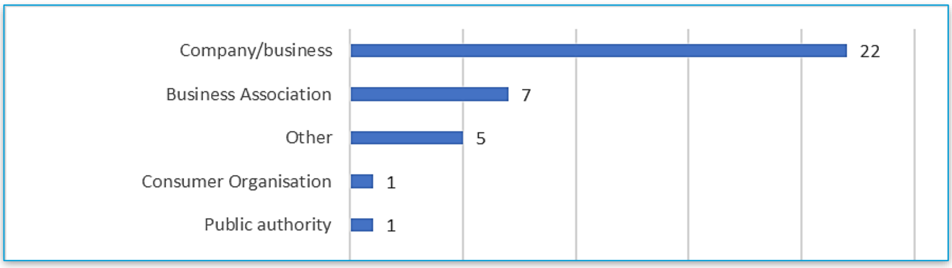
## Targeted interviews

32 stakeholders responded positively to the invitation to participate in targeted interviews, representing 12 individual companies, 9 transport associations, 4 public authorities, 2 consumer and passenger associations, 1 academia/research institution and 4 other types of stakeholders.

## Targeted survey

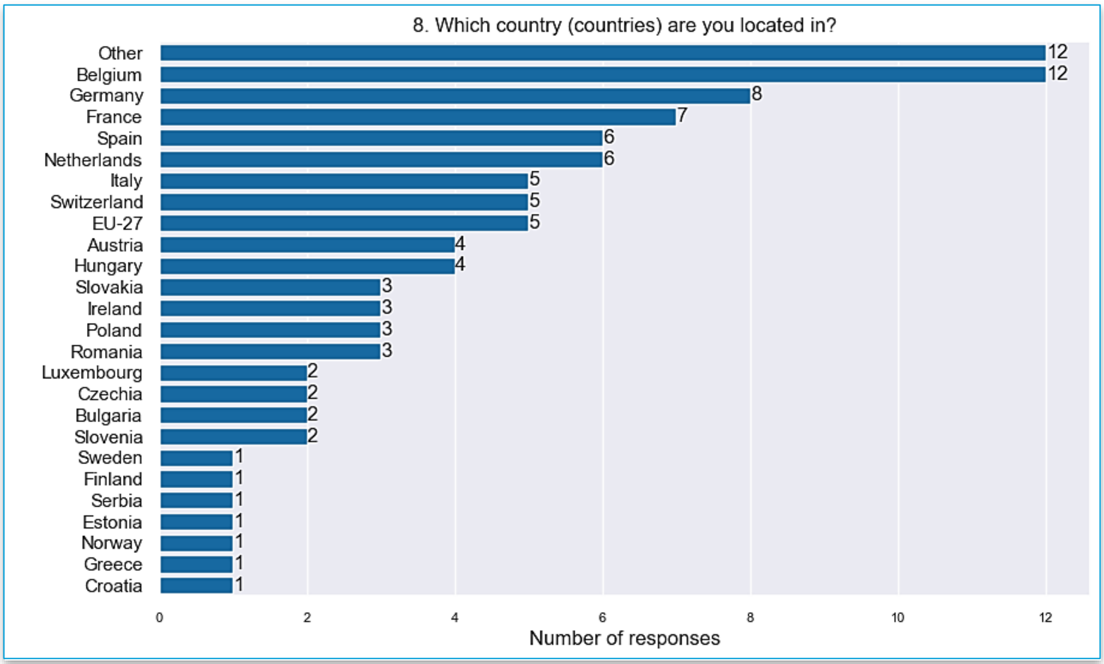
Questionnaires were sent to 70 addressees across the identified groups. Eventually 38 responses were collected from stakeholders, 26 of which had completed the survey in full.

**Figure 22 - Number of targeted survey respondents by type of respondent**




As shown in Figure 23, the majority of the respondents operate in EU-27 countries.

**Figure 23 – Participating stakeholders: countries of origin of respondents**




## Workshop

A workshop was organised upon direct invitation, with 43 participants representing 33 different stakeholders participating online: Airbus, Alliance for Logistics Innovation through Colaboration in Europe (ALICE), Aerospace, Security, and Defence Industries Association of Europe (ASD), Federation of German Industries (BDI), European Chemical Industry Council (CEFIC), Community of European Railway and Infrastructure Companies (CER), CLECAT (European Association for Forwarding, Transport, Logistics and Customs Services), Deutsche Bahn (DB), Deutsche Post DHL Group (DPDHL), Danish Transport and Logistics Association (DTL), European Union Aviation Safety Agency (EASA), European Environment Agency (EEA), Erste Group Services, European Freight and Logistics Leaders' Forum, European Shippers' Council, Federation of European Private Port Operators (FEPORT), Global Business Travel

Association (GBTA), HAROPA Port, International Air Transport Association (IATA), International Road Transport Union (IRU), ISO workgroup, Kaufland, Lidl/Schwarz group, Lufthansa, Nordic Logistics Association, Norwegian Truck Owners Association, Swedish Association of Road Transport Companies - Sveriges Akeriforetag, Topsector Logistiek, Transporeon, International Union of Wagon Keepers (UIP), Vendelbo Spedition, World Shipping Council, ZF group.

#### Short survey questionnaire

Short written questionnaires were sent to selected member states to complement the stakeholders' consultation analysis. Only one member state (France) provided a response to the questionnaire.

### G.2.3 Limitations of the stakeholder consultation

Some consultation activities (especially targeted) spread over the European summer period. This resulted in partial review of the original list of stakeholders. The stakeholders that were not available for the interview were in almost all cases replaced with similar organisations. The exception was the e-commerce sector, where despite repeated invites there was limited feedback, resulting in little direct representation in the interview process.

In addition, due to time constraints and limitations in the availability of the member states stakeholders to participate in the interviews, these were substituted with short written questionnaires sent to Denmark, Estonia, France, and Italy. Only one member state (France) provided a response to the questionnaire. However, other input from public authorities, including member states, was also collected though the general consultation tools.
Time constraints during the stakeholder workshop meant that not all policy measures were individually discussed with the same rigour. Stakeholders had a lot to say on the debate around input and output data, which led to the situation where other policy measures were only briefly discussed, sometimes as a group of measures only, instead of individual ones. While this reflects the issues that stakeholders consider the most important, it limited the quality of the input on the other aspects, not related to the data.

### G.2.4 Analysis of the key results of the stakeholder consultation

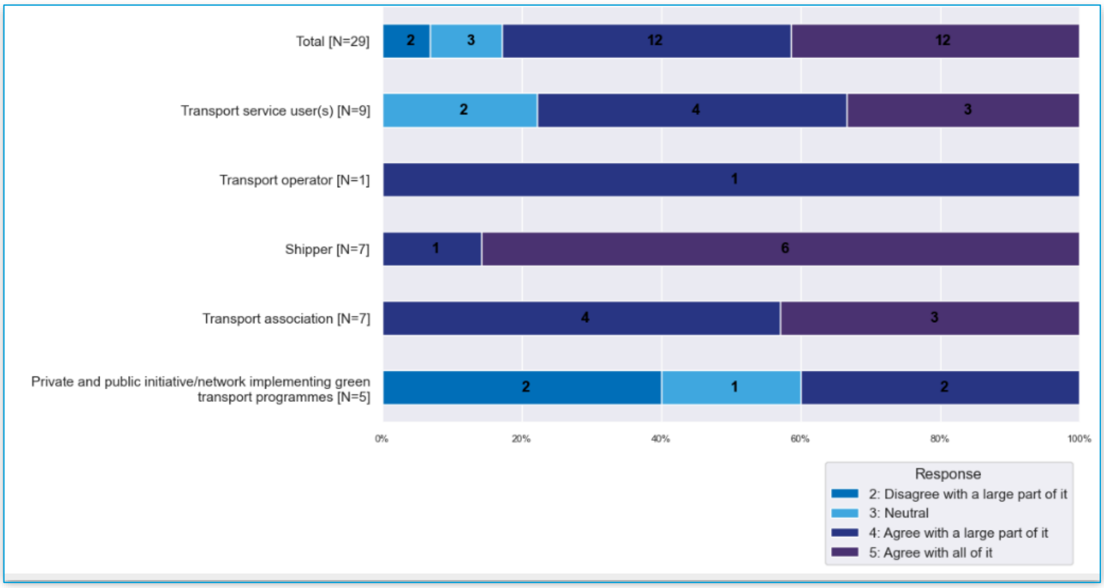
The remainder of this annex presents key findings from the analysis of stakeholder contributions to the consultation process.

#### Feedback received on the problem definition

This section provides an overall view of the stakeholders' inputs on the proposed definition of the problem and its underlying drivers.

Stakeholders responding to the various consultation activities confirmed the relevance of the initiative, to large extent agreed with the problems and objectives, and provided useful input for determining policy measures and options. Figure 24 shows the stakeholders' support for the overall problem diagram resulting from the targeted survey.

**Figure 24 - Extent to which the stakeholders agree with the overall problem diagram**

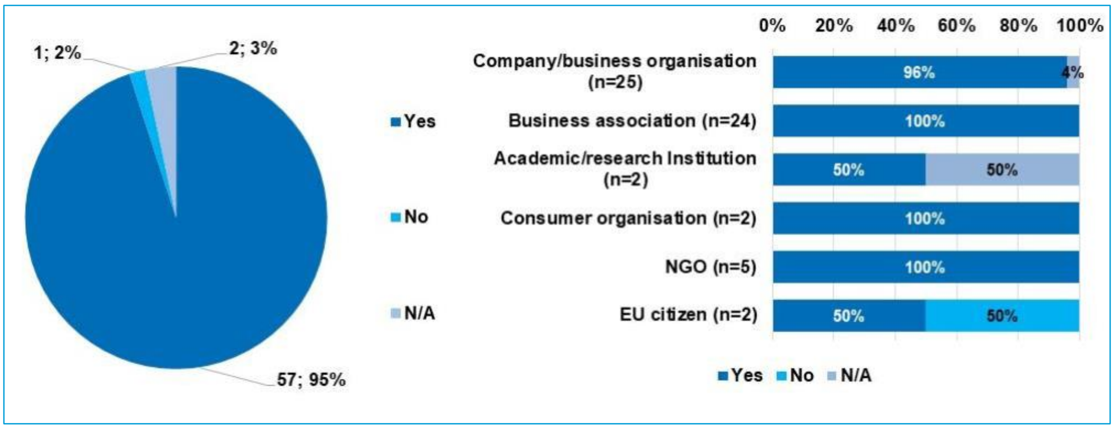



It should be acknowledged however, that the public consultation also revealed a clear need for shifting some elements in the initial problem definition, especially to recognise particular importance of input data while accounting emissions. Consequently, the problem tree was reshaped and updated.

## Current situation and motivations

The initiative received an overwhelming support from almost all stakeholders in the Call for Evidence (57 out of 60, or 95%) and the targeted survey (28 out of 31, or 90%). While the OPC did not explicitly include this type of question, the received responses indirectly point to a similar conclusion. This view was also notably expressed in the targeted interviews and was confirmed during the stakeholders' workshop.

**Figure 25 - Summary of the overall support of stakeholders for the initiative, expressed in the Call for Evidence**



Stakeholders generally recognised that a harmonised measurement and calculation framework is needed as emissions accounting becomes increasingly embedded in the broader policy ecosystem and the decision-making processes of transport services users. Better measurement of emissions is also considered by many as a way to establish and monitor specific sustainability targets.

In the Call for Evidence, targeted survey and interviews, stakeholders pointed to the on-going harmonisation efforts concerning emissions accounting in transport (such as ISO 14083, GLEC, Green Freight Europe, COFRET, CEN EN 16258), although they also admitted the lack of the necessary implementation regimes. This finding was also confirmed during the stakeholders' workshop.

The consultation also showed that emissions measurement and calculation is more mature and harmonised in the freight transport segment. However, as evidenced during the targeted interviews, passenger transport operators do acknowledge that emissions data is a factor that is increasingly looked into, especially during transport procurement processes. When asked about their motivation to measure emissions, the respondents to the targeted survey indicated without exception their environmental awareness and willingness to contribute to meeting emissions reduction targets (22 out of 22 consider it important or very important). Targeted interviews further suggested that emission accounting is also perceived as an element of risk management for private sector organisations. They are aware that emissions data would be increasingly important for preserving their competitiveness (or investor relations) and are therefore investing in systems to both measure or calculate emissions and communicate them effectively.

All consultation activities, however, consistently revealed that information on emissions is not yet a primary factor in decision-making for acquiring products and services. From the targeted survey, it is clear that price, time and reliability (quality) remain the primary motivators, with environmental aspects amongst the secondary considerations (12 out of 32, or 38%). SMEs are even less likely to consider the environmental dimension in their business practice than large companies (only one out of seven SMEs, or 14%). On the other hand, the targeted interviews and workshop showed that currently it is difficult to consider these aspects during the decision-making process, since information on emissions is hardly available at a point of sale, either for freight or passenger transport.

## Views on problems

### *Problem 1: Limited comparability of results of GHG emissions accounting in transport and logistics*

The vast majority of the consulted stakeholders see the lack of reliable and comparable information on GHG emissions data as a relevant issue. These findings were in principle confirmed by the results of the OPC, with 136 out of 169, or 80% respondents reiterating the prevalence of this problem and considering it significant or very significant. What is more, 103 out of 157 (66%) indicate it as a real concern for their professional or private activities. In addition, the respondents to the Call for Evidence point to substantial divergences in emission data calculation results and to the lack of comparability, which ultimately diminishes the usefulness of GHG measurement and calculation, when it comes to taking informed travel and transport decisions. The respondents, also emphasised that the status quo does not allow providing the end users with clear price signals and acknowledged that this situation hinders the effectiveness of GHG measurement and calculation as a policy measure to incentivise environmentally friendly transport and mobility choices.

Also, the stakeholders joining the workshop acknowledged large differences between emissions data calculated for transport services and shared in the transport chain, recognising the proliferation of methodological choices, and large variability in the input data.

Finally, 22 out of 31 respondents to the targeted survey pointed to better comparison of GHG emissions data as a key feature describing the added value of CountEmissions EU.

### *Problem 2: Limited uptake of emission accounting in usual business practice*

Respondents of the OPC agree that while obtaining information on GHG emissions of transport services is important or very important (145 out of 175, or 83%), and they are not given enough information when planning a journey or transport of goods (45 out of 56 organisations, or 80%; 61 out of 70 individuals, or 87%; and 60 out of 65 online customers, or 92%), which seems to confirm this problem. Respondents to the targeted survey also estimated the current uptake of emissions accounting as low or very low (26 out of 31, or 84%) and interviewees agreed, adding that while companies are starting to take up emissions accounting, this is not yet a commonplace, a notion that was also mentioned by the stakeholders that participated in the workshop.

On the other hand, the outcomes of various consultation activities show that many stakeholders already perform some form of emissions measurement and calculation. The results of the targeted survey suggest that 29 out of 37, or 78% measure emissions, but in most cases this is done only for certain activities, and not necessarily frequently. It is also not a common practice to measure, calculate or communicate transport emissions at the service or trip level (only by 9 out of 37, or 24% of the respondents), which is necessary to influence transport choices of operators and users.

These factors together confirm that emissions accounting in business practice is very limited at least in uptake, completeness, frequency, and precision. The targeted survey showed that the majority of respondents (30 out of 31) would adopt a harmonised emissions measurement framework if established at EU level.

## Feedback received on problem drivers

### *No set of common methodological principles to apply GHG emissions accounting*

The lack of a harmonised method appeared as a major problem driver across various consultation activities.

The respondents to the Call for Evidence recognised it as an important factor hampering the ability to accurately measure and compare the environmental impact of various transport activities. In this context, a number of contributions pointed to the harmonisation efforts being undertaken at various levels, however without having significantly improved the situation on the market.

In the OPC, 90% (157 out of 174) of the respondents replied that the existence of various GHG accounting methods and calculations leading to the provision of incomparable GHG emissions data poses a significant or very significant problem. When asked if this problem was affecting their private or professional activities, 69% (113 out of 163) replied affirmatively, while 20% (33 out of 163) considered this phenomenon to affect them only to a limited extent.

### *No set of harmonised input data to apply GHG emissions accounting*

In the initial problem definition presented to the stakeholders, this driver was integrated with another one addressing the lack of common methodological principles. However, based on the feedback from the stakeholders suggesting that the issues associated with input data (i.e. primary data and default values) need a more prominent place in the problem definition, 'No set of harmonised input data to apply GHG emissions accounting' was included in the problem tree as a separate problem driver.

In this context, looking at the results of the targeted survey, the vast majority of the respondents replied that the issue of various methodological principles and input data together, is either relevant or highly relevant (77%, 24 out of 31).

The Call for Evidence, the targeted interviews and especially the stakeholders' workshop clearly demonstrated that there is large variance in the accounting results depending on the input data used, even when using some already established methodologies. Especially debates at the workshop focussed on the importance of this problem driver.

### *Reluctance to share (sensitive) data*

The reluctance to share data that is necessary for emissions accounting and decision-making processes was strongly discussed during interviews, mainly with transport service providers and their associations. Reasons given included the need to preserve sensitive information on costs and operations, especially among SMEs. The contributions in the stakeholders' workshop, as well as the replies to the survey questionnaire (19 out of 31 respondents, or 61% rank it as relevant or highly relevant) and the questionnaire sent to member states further reiterated the importance of this driver in the problem definition. Specifically, France clearly indicated that CountEmissions EU should provide rules addressing the exchange of information on GHG emissions with an appropriate level of security and privacy.

### *Lack of trust concerning GHG emissions output data*

This driver was not initially provided in the first set of targeted interviews, targeted survey and the OPC, but it was included in the workshop discussion, because feedback obtained from stakeholders at previous stages of the consultation process pointed to the consistent lack of trust concerning GHG emissions output data as an important issue to be tackled. For instance, OPC respondents (145 out of 175, or 84%) acknowledged that access to reliable and accurate GHG emissions data is important or very important.

During the workshop, a number of stakeholders contributing to the discussion mentioned the need for more reliable emissions accounting results as a relevant factor. The lack of trust in reliability and comparability of the GHG emissions figures was commonly considered a reason for lower demand for such figures and hence lower uptake of GHG emissions accounting. In this context, the need for a credible and harmonised verification mechanism for the output shared or published has been constantly raised as an issue by many stakeholders.

### *Complexity and high costs of GHG emissions accounting*

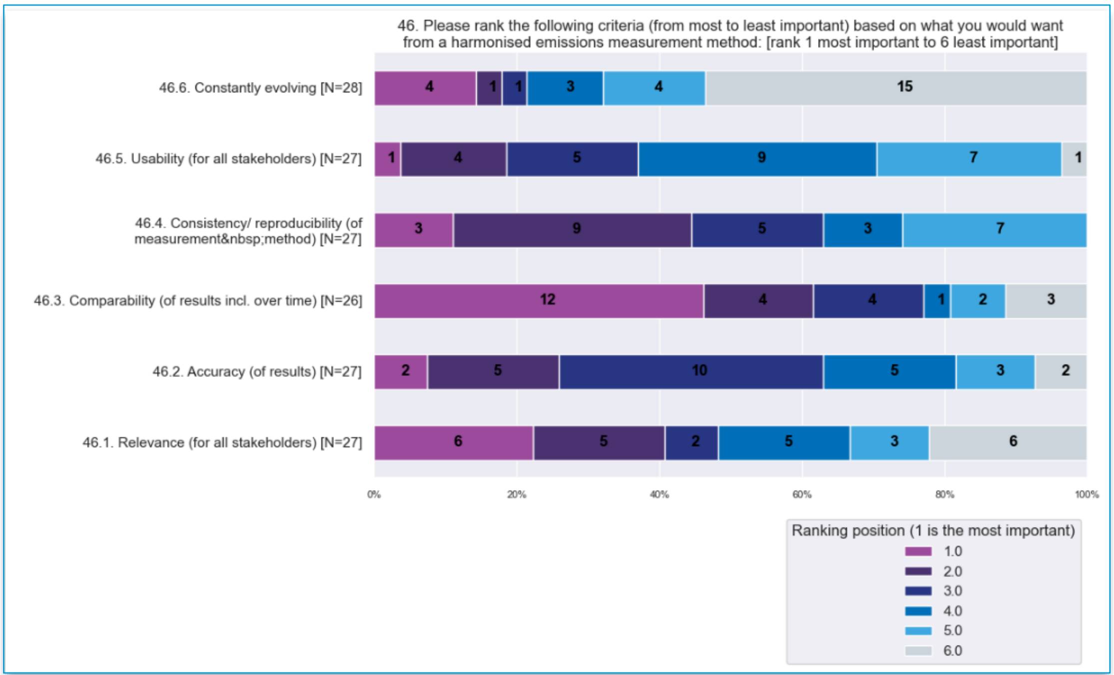
In general, stakeholders regarded complexity and high costs of GHG emissions accounting as strongly associated with calculation processes, and sharing of GHG emissions figures in the transport networks. The majority of the respondents (20 out of 31, or 64%) that replied to the targeted survey, consider this problem driver relevant or highly relevant. Respondents to the OPC also ranked this as the third most relevant driver, only after the limited availability of data within organisations and along the supply chain. These findings were also broadly confirmed by the stakeholders participating in the targeted interviews.

## Feedback received on possible solutions

### *General expectations from a harmonised emissions measurement framework*

When asked to rank specific criteria relevant for the harmonised GHG emissions measurement method (from 1: most important to 5: least important), respondents to the targeted survey pointed to the comparability of results over time as their first or second choice (16 out of 26, or 61%). This aspect was followed by the choices related to the consistency/reproducibility of the measurement method (12 out of 27, or 44%) and its relevance (11 out of 27, or 41%).

**Figure 26 - Summary of the views of stakeholders in regards to their ranking of importance of different criteria for a harmonised emissions measurement method**




The need for a consistent approach to measuring GHG emissions was also raised by the respondents to the OPC (167 out of 178, or 94%).

### *Interaction of the common emissions accounting method with currently existing methods*

Regarding the design of the initiative, there is strong support across all the consultation activities for an approach that considers already existing or emerging emissions accounting harmonisation efforts. In this regard, the response obtained from the member state questionnaire suggests that the success of the measure can be highly dependent on being based on well-established and robust methodologies, especially those with global scope, as otherwise it could open the way for a dispute.

According to the Call for Evidence, interviews, and workshop, it is also important that organisations are not subjected to diverging requirements, either across countries or regions, as that would greatly increase complexity of emissions accounting and the associated costs.

### *Inclusion of sector specificities in the common emissions accounting method*

The targeted survey (23 out of 28, or 82%), interviews and workshop revealed that the majority of stakeholders believe sector specific guidelines based on common rules to be necessary, with a possible role for each sector in collaboratively developing and implementing them in its respective networks. However, the interviews and workshop did show that some stakeholders also see these decentralised developments as a risk leading to uncontrolled divergences between the quantification processes in various sectors and resulting in producing inconsistent emissions output data. According to the discussion, this phenomenon may be mitigated by specific measures, such as a centralised approval of sectorial guidelines, or harmonised implementation rules applicable across the board. Moreover, during the workshop some parties mentioned that the uptake of primary input data could minimise the need for these guidelines in general.

### *Mandating the use of the common emissions accounting method*

According to the results obtained across the various consultation tools, there is a significant preference of stakeholders for an instrument including certain mandatory components. This may be especially demonstrated by the results of the targeted survey, where 26 out of 28 respondents (93%) indicated this preference, with the majority of them (17 out of 28, or 61%) suggesting mandatory calculation and reporting of emissions for at least some classes of organisations in the transport system. The survey also shows that the participating SMEs have a bigger propensity to prefer optional approaches, or, alternatively, derogations in the mandatory instrument (4 out of 7, or 57%, compared to 9 out of 28 or 32% overall). This could be due to disproportionate impact of the mandatory instrument on SMEs, a comment that appeared during interviews and workshops. Some transport associations that participated in the interviews in particular suggested large businesses should take on more of the early costs associated with CountEmissions EU, and then gradually involve the SMEs in their ecosystems to facilitate the knowledge and process transfer.

Unsurprisingly, the survey also revealed that stakeholders believe that the initiative will be more impactful if a mandatory instrument is used. Respondents felt that in this case positive effects for the transport system would substantially increase (respondents were asked to rank the magnitude of a number of potential impacts and the large majority foresaw an increase in positive impacts). However, they did not expect large emissions reductions from the accounting emissions alone (only 10 out of 23, or 43% foresaw emissions reductions), since CountEmissions EU should be seen rather as an enabler for more efficient transport options, and not a measure that can make the change directly. The insights from the interviews and the workshop broadly confirmed this finding.

### *Scoping and boundaries of the common emissions accounting method*

The stakeholders' consultation provided useful input to the analysis of various design alternatives when discussing methodological choices for CountEmissions EU[147].

[147] See Annex C for more technical details.

In principle, the Call for Evidence, survey and interviews clearly demonstrated that GHG ($CO_2$ equivalents) are the preferred emissions scope for the common method.
The interviews and the survey (16 out of 28, or 57%) also showed that the transport service level accounting is the one most favoured by the stakeholders (which is also the case for the member state questionnaire response), followed by the product-level approach. In all consultation activities, as already mentioned above, there was a strong preference for a methodology that would have a global scope, facilitating emissions accounting in the international transport chains.

In terms of the activity boundaries, the well-to-wheel (WTW) approach was the most preferred by stakeholders across various consultation activities. However, the full life-cycle assessment (LCA) was equally strongly supported in the OPC (i.e. 75 out of 164 respondents or 46% each), especially among citizens. In this context, there appears a division among beneficiaries of transport services (individuals and businesses not directly participating in transport activities) more inclined towards the LCA approach, and stakeholders that are a more integral part of the transport system expressing their favour towards the well-to-wheel. From the regulatory side, a response from France, benefitting from long experience in emissions accounting in transport, revealed a preference for the well-to-wheel boundaries as well.

### *Verification of the emissions data*

A dedicated system for verification of the emissions data and calculation processes featured prominently across all the consultation activities. In the targeted survey, for instance, out of 28 responses received, there was no opinion against the verification system to be implemented. This finding can be confirmed by the results of the OPC with 158 out of 178 (89%) respondents suggesting this measure should be tackled by CountEmissions EU. Also the participants of the stakeholders' workshop suggested a system where the emissions calculation methods and GHG data can be verified, expressing at the same time their strong preference towards using primary information.

On the other hand, the consulted stakeholders were not clear on how this verification system should be designed and which functionalities it should bear. In the OPC, an important share of answers (43 out of 178, or 24%) indicated that specific exemptions to the verification could be possible if it would prove to be too burdensome and costly.

### *Provision of the technical support tools and data sharing*

Stakeholders see the provision of technical support tools (such as calculators and specific software) as useful enablers to facilitate the uptake of the common emissions accounting methodology. Based on the targeted survey, 18 out of 28, or 64% of the respondents would likely or very likely use these tools in their business practice, a result that should be corroborated with the outcome of the OPC (123 out of 175, or 70% of the respondents pointed to the need for additional support tools under CountEmissions EU). This OPC finding is particularly strong among business associations (46 out of 57, or 81%) and NGOs (5 out of 6, or 83%). Comments in this regard highlighted that these tools could be most beneficial to lighten the administrative burden of SMEs.

On the other hand, there was no consensus on where these technical support tools should be developed or provided from. In particular, the respondents to the OPC and targeted survey were not clear on the potential role of the public and private sectors in developing and providing these tools to organisations that need/want to calculate their GHG emissions from transport services. Otherwise, stakeholders participating in the interviews and the workshop suggested that the private sector is better positioned to provide specific tools for businesses, while these should undergo some form of a public sector verification. The latter finding broadly aligns with the views expressed in the targeted survey (by 23 out of 28, or 82% of the respondents), that the technical support tools, regardless where they come from, should be certified by an independent entity.

In addition, during various consultation activities, stakeholders also raised the topic of sharing emissions data between various entities in the transport chain. According to these stakeholders, some actions would be necessary to ensure an appropriate level of security and confidentiality of these data (for instance by appointing neutral third parties or establishing/allowing for dedicated emissions data sharing platforms). During the workshop, an idea was also brought up for the EU to define clear rules on handling these data by businesses in a proper manner.

## G.3 Stakeholder consultation strategy

This chapter describes the preparation of the stakeholder consultation process, with focus on the stakeholder consultation strategy. The objective and scope of the stakeholder consultation is presented Section G.3.1. Section G.3.2 addresses the mapping of the stakeholders. Section G.3.3 provides information on the consultation methods and tools.

### G.3.1 Objective and scope

#### Objective of the stakeholder consultation

Consulting stakeholders is an important means of collecting evidence to support the impact assessment of the CountEmissions EU initiative. Listening to, documenting and analysing different stakeholder views based on their practical experience has improved the consultant team's understanding of the key issues and ultimately led to a more robust impact assessment support study. By consulting different categories of stakeholders involved in emissions measurement and calculation in the transport and logistics sector, we have validated the problem definition and gathered valuable information on the experienced or expected impacts from similar emissions measurement and calculation initiatives to inform the analysis of the problems, as well as the impacts originating from the implementation of the policy measures.

Initial consultation activity focused on problem validation and identification of significant impacts based on possible interventions. Later consultation activity focused on validating thinking on policy measures and the possible associated impacts.

#### Scope *of the stakeholder consultation*

Overall, the stakeholder consultation activities cover both the targeted consultation programme we have carried out, as part of the activities of Task 11 of the support study, and the public consultation activities launched by the Commission on this initiative.

The targeted consultation programme consisted of:
1. A survey-questionnaire round.
2. Two rounds of targeted interviews.
3. One round of a short survey-questionnaire.
4. One stakeholders workshop.

The outcomes of these consultation tools are described in detail in Section G.5.

The consultation activities launched by the Commission services consisted of the ‘Call for Evidence’ and the Open Public Consultation. Through both them, interested stakeholders provided feedback and opinions in form of responses to closed questions, comments to open questions and written contributions expressing positions on items relevant for the initiative. These outcomes of these consultation tools are described in detail in Section G.5.

### G.3.2 Mapping of stakeholders

The following stakeholder groups have participated in the consultation process:

- transport associations;
- consumer and passenger associations;
- individual transport companies;
- freight transport service users;
- individual logistics service providers;
- individual shippers;
- terminals, ports, and hubs;
- transport management system suppliers;
- public authorities;
- e-commerce platforms;
- standardisation bodies;
- private and public initiatives/networks implementing green transport programmes and labelling;
- research organisations;
- citizens.

The stakeholder consultation matrix is presented in Table 105 providing the overview of how the various stakeholder groups have been consulted through the different consultation tools.

**Table 105 - Stakeholder consultation matrix**

| Stakeholder group | | Support study targeted consultation programme | | | | Commission public consultation activities | |
|---|---|---|---|---|---|---|---|
| | Targeted survey-questionnaire | Exploratory interviews | Targeted interviews | Short survey-questionnaire | Stakeholders workshop | OPC | Call for evidence |
| Transport associations | √ | 2 | 9 | | √ | √ | √ |
| Consumer and passenger associations | √ | | 2 | | √ | √ | √ |
| Individual transport companies | √ | | 4 | | √ | √ | √ |
| Freight transport service users | √ | | 2 | | √ | √ | √ |
| Individual logistics service providers | √ | | 2 | | √ | √ | √ |
| Individual shippers | √ | | 3 | | √ | √ | √ |
| Terminals, ports, and hubs | √ | | | | √ | √ | √ |
| Transport management system suppliers | √ | | 1 | | √ | √ | √ |
| Public authorities | √ | | 4 | 4 | √ | √ | √ |
| E-commerce platforms | | | | | √ | √ | √ |

| Stakeholder group | | Support study targeted consultation programme | | | | Commission public consultation activities | |
|---|---|---|---|---|---|---|---|
| | **Targeted survey-questionnaire** | **Exploratory interviews** | **Targeted interviews** | **Short survey-questionnaire** | **Stakeholders workshop** | **OPC** | **Call for evidence** |
| Standardisation bodies | √ | | 1 | | √ | √ | √ |
| Private and public initiatives/networks implementing green transport programmes and labelling | √ | 2 | 3 | | √ | √ | √ |
| Research organisations | √ | | 1 | | √ | √ | √ |
| Citizens | | | | | | √ | √ |
| Total number of respondents | **38**[148] | **4** | **32** | **1** | **38** | **184**[149] | **60**[150] |

Source: Consortium.

## G.3.3 Consultation methods and tools

The consultation tools have been placed in sequence to facilitate effective interaction between the tools.

The desk research together with the exploratory interviews and the call for evidence provided an entry point to the key issues for stakeholders from different perspectives and allowed us to better target the content for other consultation activities, namely by establishing the basis for drafting the survey-questionnaire (e.g. revealing a concern about the addition of new measurements and calculation processes that did not account for existing one).

The results of the survey-questionnaire in turn provided a sound basis for better understanding the position of stakeholders and stakeholder groups, which has been used as input for the latter half of the targeted interview programme, which also allowed us to discuss missing data and look for other evidence (e.g. possible impacts of policy measures, including behavioural changes). The results from the survey-questionnaire and the targeted interviews have been used to further elaborate on the proposed policy measures and options and assessment of the direct impacts. The stakeholders workshop allowed the validation of the problem definition and proposed policy measures. The way the consultation tools have been implemented is presented in Chapter G.4.

Table 106 presents an overview of the consultation tools applied, also including the scope and the timing.

148 In total, the stakeholders provided 45 responses. Out of those 45 responses, many have been found incomplete (i.e., only introductory questions answered) or duplicates (i.e., multiple entries under the same name and/or organisation). After cleaning the data, we ended up with a sample of 38 responses, of which 26 reached the end of their bespoke set of questions.

149 In total, the stakeholders provided 189 responses. Out of those 189 responses, some have been found incomplete (i.e., only uploaded a position paper) or duplicates (i.e., multiple entries under the same name and/or organisation). After cleaning the data, we ended up with a sample of 184 responses.

150 In total, the stakeholders provided 64 responses. Out of those 64 responses, some have been found incomplete or duplicates. After cleaning the data, we ended up with a sample of 60 responses.

**Table 106 - Consultation tools, scope, and timing**

<table>
<tr><th>Tool</th><th>Scope of the tool</th><th>Timing</th></tr>
<tr><td>Exploratory interviews</td><td>1. Better understand the problem from different user perspectives.<br>2. Aid in targeting subsequent engagement with a broader group of stakeholders.</td><td>3 - 13 May</td></tr>
<tr><td>Targeted survey-questionnaire</td><td>3. Current situation and motivations for emissions measurement and calculation.<br>4. Validation of objectives and problem definition (problems and problem drivers).<br>5. Emissions measurement and calculation framework design and policy measures.<br>6. Potential impacts of the policy measures.<br>7. Applications of emissions measurement and calculation.</td><td>11 August - 31 October 2022</td></tr>
<tr><td>Targeted interviews</td><td rowspan="2">8. Current situation and motivations for emissions measurement and calculation.<br>9. Validation of problem definition (problems and problem drivers), assess their importance and find any missing ones.<br>10. Emissions measurement and calculation framework design and policy measures.<br>11. Gathering evidence on potential impacts of the policy measures.<br>12. Other external developments in emissions measurement and calculation.<br>13. Alternative applications of emissions measurement and calculation.</td><td>8 July - 6 December 2022</td></tr>
<tr><td>Short survey-questionnaire (in substitution of some targeted interviews)</td><td>28 November 2022</td></tr>
<tr><td>Stakeholders workshop</td><td>14. Gathering opinions and feedback to validate the problem definition and the initial set of policy measures and policy options.</td><td>27 October 2022</td></tr>
<tr><td>Call for Evidence</td><td>15. Opinions of the public on emissions measurement and calculation in the transport sector.</td><td>19 November - 17 December 2021</td></tr>
<tr><td>Open Public Consultation</td><td>16. Current situation and motivations for emissions measurement and calculation.<br>17. Main problems for emissions measurement and calculation.<br>18. Measures to address the problems.</td><td>25 July - 20 October 2022</td></tr>
</table>

Source: Consortium.

## G.4 Conducting the consultation process

This chapter describes how the stakeholders have been consulted. Section G.4.1 presents the communication towards stakeholders. Section G.4.2 deals with the way the consultation process has been carried out, with an overview per stakeholder tool. Section G.4.3 indicates how results were analysed and the limitations of the process.

### G.4.1 Communication on the project and consultation process

For the targeted consultation programme we have established the communication process, since the early stages of the support study, to make the stakeholders aware of the upcoming consultation activities related to this initiative. Given the detailed nature of the file, stakeholders that have been involved in the consultation process have received detailed information on the specific engagement activity in advance, including background documents to introduce the main items and questions for discussion. The stakeholders invited to participate in the survey-questionnaire(s), targeted interview and workshop received an introductory and invitation message. As follow-up activity, and in order to increase the rate of responsiveness, periodic reminders were sent out to ensure commitment. In a small number of cases we also received suggestions from stakeholders to consult another stakeholder, or we were explicitly requested by an organisation (via the Commission) that they be directly involved.

The main form of communication used with stakeholders has been email, and to support the stakeholder consultation process and communication we have made sure to follow-up specific requests of the stakeholders seeking clarifications on the consultation tools and announcing belated responses with respect to our preferred deadlines to gather the inputs.

As regards the public consultations launched by the Commission and its feedback opportunities, the intention to launch the initiative on CountEmissions EU was communicated on the web-portal ‘Have your Say’ on 19 November 2021. Both the Call for Evidence and the Open Public Consultation received a relatively large number of responses indicating interested stakeholder used them as the primary method of input.

Towards the end of the evidence collection process, we received comments from stakeholders indicating they had provided what they could (through various consultation mechanisms) and that they didn’t see a lot of value in providing further information at this stage. This gives an indication that highly relevant stakeholders have found/been made aware of more than enough mechanisms to provide valuable input.

### G.4.2 Implementing the consultation

This section presents information on the way the consultation tools, as presented in Section G.3, have been implemented. In Table 107, we provide detailed description of the number of stakeholders invited to provide feedback to each consultation activity we launched, the number of positive responses obtained and the number of documents provided.

**Table 107 - Overview of stakeholder consultation results**

| Consultation activity | Number of stakeholders invited | Number of responses | Number of documents provided |
|---|---|---|---|
| Exploratory interviews | 4 | 4 | 0 |
| Targeted survey questionnaire | 70 | After analysing and filtering the data, 38 questionnaires, of which 26 fully completed | 22[151] |
| Targeted interviews | 44 | 32 | 0[152] |
| Short survey questionnaire | 4 | 1 | 3[153] |
| Stakeholder workshop | 60[154] | 41 | 0[155] |
| 'Have your say' call for evidence | Not applicable | 64 | 60[156] |
| Open Public Consultation | Not applicable | After analysing and filtering the data, 188, of which 184[157] contain answers to the questionnaire and not just a document attached. | 27[158] |

Source: Consortium.

It should be noted that given the concurrent engagement mechanisms, most stakeholders have chosen not to participate in all opportunities that are made available to them. For example: some stakeholders had already made an effort to contribute fully to the OPC or had undertaken targeted interviews and therefore did not feel the need to participate in the targeted questionnaire. In any case we are confident key stakeholders have had adequate chance for input, and the consultation through the stakeholders workshop allowed for validation.

## Exploratory interviews

Exploratory interviews were conducted with:

- the International Association of Public Transport (UITP);
- European Shippers' Council (ESC);
- Smart Freight Centre;
- Lean & Green.

151 A total of 27 written contributions from 14 different stakeholders were received as part of this process in addition to the responses to the questionnaire, of which four are duplicates, and one more was already submitted as a contribution to the Open Public Consultation.

152 A number of written contributions were received from a limited number of stakeholders, but they are duplicates from other submissions we have received in other stakeholder engagement tools.

153 French authorities provided two links to websites and one link to an online hosted document.

154 Number of individual contacts invited. Multiple individual contacts have been reached out for one entity.

155 One stakeholder sent a position paper as follow-up for the workshop, however it is a duplicate from documents received as attachments to the Open Public Consultation.

156 The total number of written contributions received is equal to 64, but taking into account duplications within the same group and between different groups, the number of unique written contributions that we have reviewed is equal to 60.

157 It is possible that 6 out of the 184 answers to the Open Public Consultation questionnaire are part of a coordinated campaign.

158 A total of 31 submissions were obtained, of which 4 were duplicate entries and were removed. From the remaining 27, 22 contain information related to the Scope of this initiative, 3 contain information about related topics, and 2 do not contain information related to the Scope of this initiative.

These interviews provided an entry point into the key issues for stakeholders from different perspectives. They allowed us to better target the content for subsequent engagement with a broader stakeholder group.

## Targeted survey-questionnaire

Targeted questionnaires were sent to 70 stakeholders (organisations) across the identified stakeholder groups. The questionnaire collected 38 responses of which 26 stakeholders had completed the survey in full. 10 respondents come from an organisation that identify as an SME according to the EU definition. The majority of the EU-27 countries are represented by respondents. In addition many organisations operate in the UK, Asia or the US.[159]
The majority of responses (23 of 37) specifying the geographic focus of operations are 'Globally (urban and regional)'. The most represented NACE economic sectors are unsurprisingly 'Transport and Storage solutions' (7 of 14) and 'Manufacturing' (5 of 14). Transport modes are approximately equally represented, with a slightly lower set of responses representing inland waterway transport.
Outputs from the targeted questionnaire can be found at Section G.5.3.

## Targeted interviews

Targeted interviews have been undertaken with 32 participants:

1. International Road Union (IRU).
2. Community of European Railway and Infrastructure Companies (CER).
3. European Barge Union (EBU).
4. European Association for Forwarding, Transport, Logistics and Customs Services (CLECAT).
5. European Community Shipowners' Association (ECSA).
6. International Union for Road-Rail Combined Transport (UIRR).
7. International Air Transport Association (IATA).
8. Association of European Vehicle Logistics (ECG).
9. Airlines for Europe (A4E).
10. The European Consumer Organisation (BEUC).
11. Global Business Travel Association (GBTA).
12. Connexxion (Transdev).
13. MAERSK.
14. Ewals Cargo Care.
15. Cruise Lines International Association.
16. DPD Group.
17. European Chemical Industry Council (CEFIC).
18. European Automobile Manufacturers Association (ACEA).
19. EU TravelTech.
20. DOW.
21. Rolls-Royce.
22. Alstom Group.
23. Transporeon.
24. French Environment and Energy Management Agency (ADEME).
25. International Maritime Organisation (IMO).
26. European Environment Agency (EEA).
27. Joint Research Centre (JRC).
28. ISO 14083 Workgroup.
29. EPA Smartways.

[159] 34% of total responses to 'Which country (countries) are you located in?' are specified as 'other'.

30. Connekt.
31. GreenRouter.
32. Network for Transport Measures.

The interviews follow a similar structure to the targeted questionnaire:
- current situation on GHG emissions measurement and calculation in transport and logistics;
- problems which prevent the harmonisation and uptake of GHG measurement and calculation in transport and logistics;
- design of the CountEmissions EU initiative;
- impacts;
- external developments;
- alternative applications of harmonised GHG emissions figures.

### Short survey-questionnaire

Due to time constraints and limitations in the availability of the member state stakeholders to participate in interviews, their interviews were substituted with short written questionnaires. Only one member state (France) provided a response to the questionnaire.

### Stakeholders workshop

The stakeholder workshop was held online with the participation of 41 representatives from the following organisations:
1. Airbus.
2. European Aerospace, Security and Defence industries (ASD Europe).
3. ADP Group.
4. HAROPA Port.
5. Deutsche Bahn.
6. Global Business Travel Association (GBTA).
7. European Association for Forwarding, Transport, Logistics and Customs Services (CLECAT).
8. European Union Aviation Safety Agency (EASA).
9. Community of European Railway and Infrastructure Companies (CER).
10. Swedish Association of Road Transport Companies (SVERIGES ÅKERIFÖRETAG).
11. Topsector Logistiek.
12. World Shipping Council (WSC).
13. SZ Group.
14. Federation of German Industries (BDI).
15. Lufthansa.
16. Deutsche Post DHL Group.
17. Schwarz Group.
18. Transporeon.
19. Alliance for Logistics Innovation Through Collaboration in Europe (ALICE).
20. International Air Transport Association (IATA).
21. Norwegian Truck Owners Association (Norges Lastebileier-Forbund).
22. HAROPA Port.
23. European Environment Agency (EEA).
24. Nordic Logistics Association.
25. International Union of Wagon Keepers (UIP).
26. ISO 14083 Workgroup.
27. European Chemical Industry Council (CEFIC).

28. Federation of European Private Port Operators (FEPORT).
29. Erste Group Services.

For the preparation of the workshop, an overview of the status of the study and the initiative was provided. Policy measures were presented for the stakeholders to consider. The stakeholders were able to provide input by participating in the discussion in verbal form or written form using the chat function, as well as by voting in the online Mentimeter tool (real-time survey).

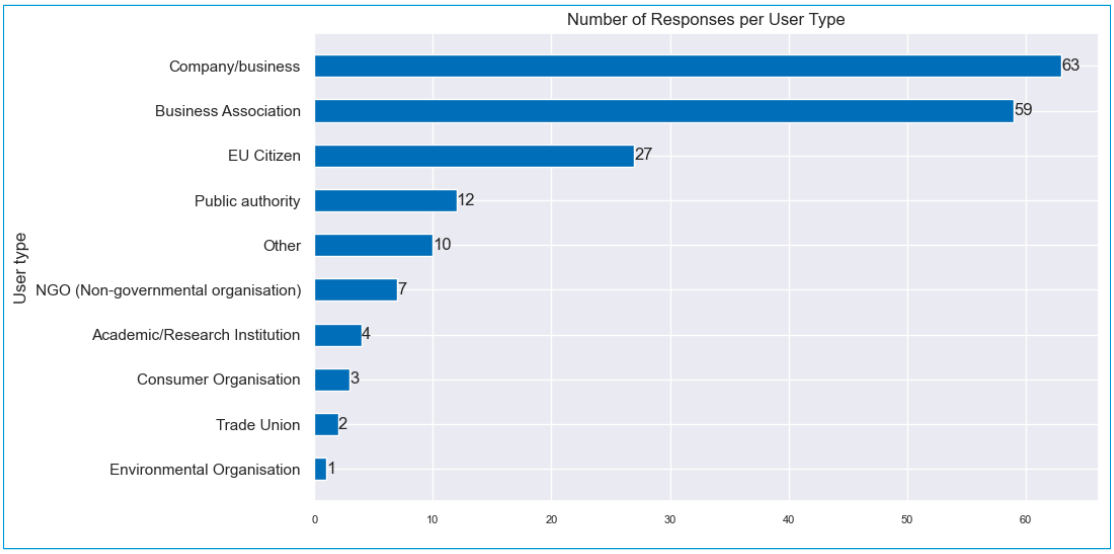
## Call for evidence

The call for evidence launched by the Commission received 60 opinions from stakeholders expressing interest for this subject. The large majority of the respondents belong to categories related to company/business organisation and business association (i.e. 25 and 24, respectively). With respect to the geographical scope of the respondents, 24 out of 60 responses originated from Belgium, where business associations usually establish head offices and act as umbrella organisations on behalf of the associated national members. Other 21 opinions have originated at the member state level and eventually two from non-EU countries (i.e. the UK and US). As far as the geographical scope is concerned, it is also worth noting that opinions have not been expressed from stakeholders of eastern and southern European countries.

## Open Public Consultation

Open public consultation has run concurrently to targeted efforts. In contrast to targeted efforts, results have largely represented inputs from EU Citizens, as they represent the third largest group of respondents (see Figure 27).

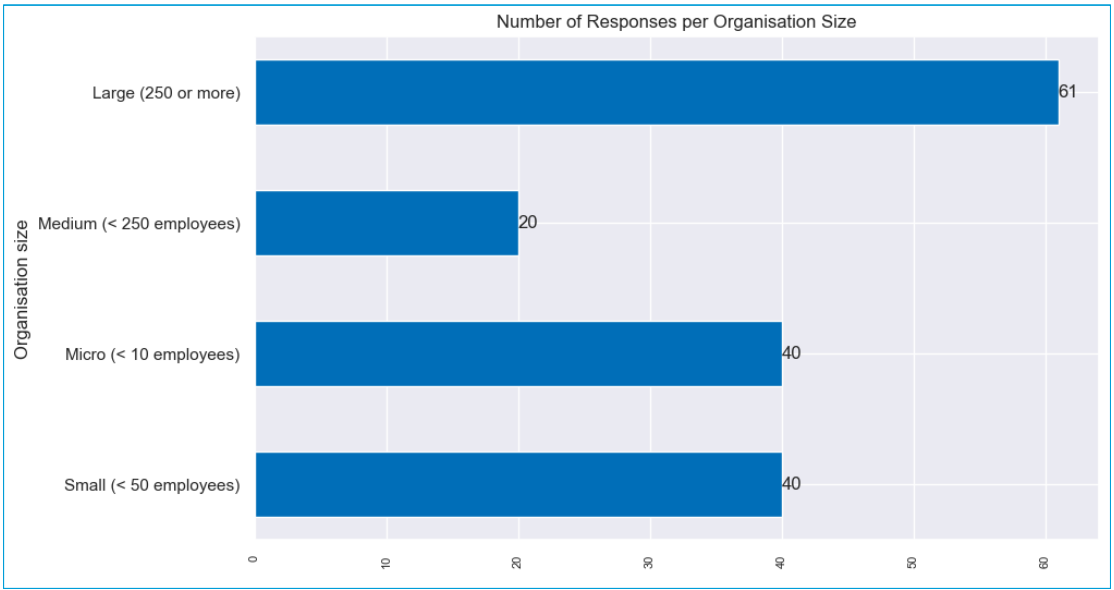
**Figure 27 – Number of Open Public Consultation respondents by type of respondent**




Source: Consortium, based on Open Public Consultation results.

When responses were on behalf of organisations, the proportion of large organisations (61 from 161; or 38%) was less than SMEs as shown in Figure 28.

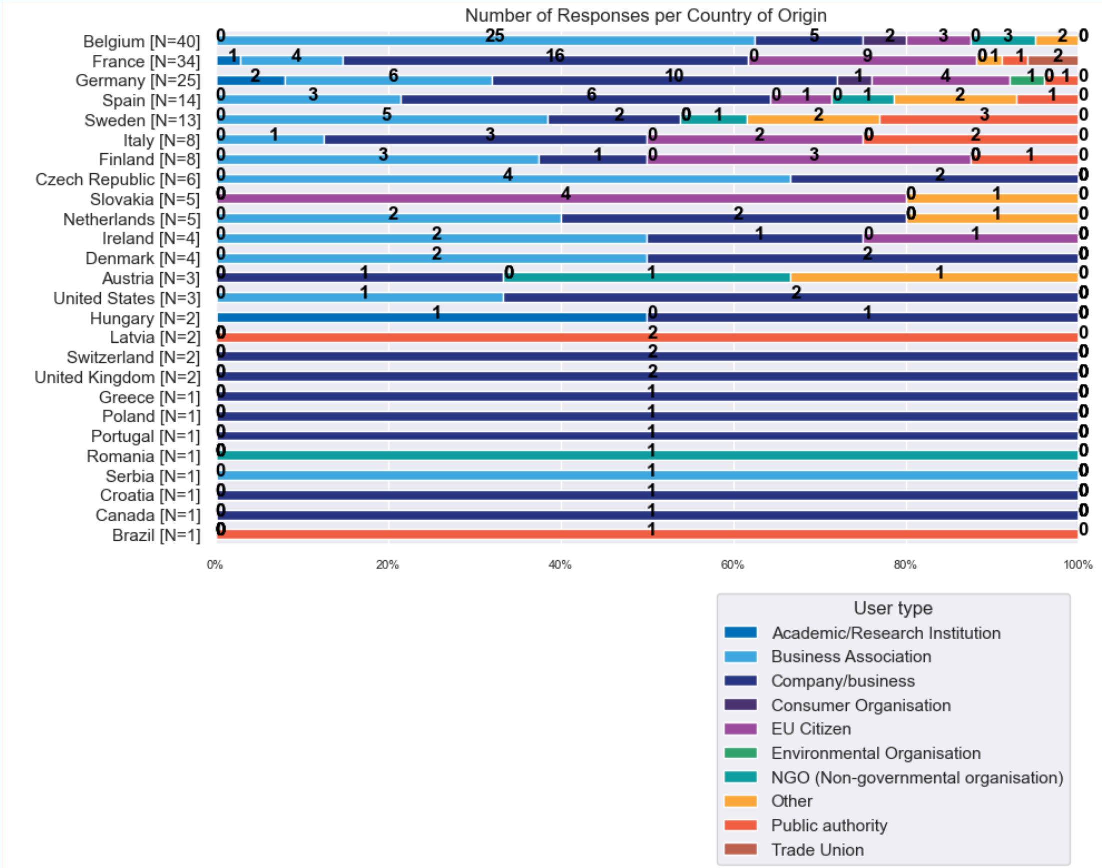
**Figure 28 – Number of Open Public Consultation respondents by organisation size**




Source: Consortium, based on Open Public Consultation results.

Responses came from across the EU, although not from all member states. A large number of responses (40 from 184; or 22%) were received from Belgium, in large part due to business associations/representative organisations being headquartered in Belgium (see Figure 29).

**Figure 29 – Number of Open Public Consultation respondents by country of origin and stakeholder type**




Source: Consortium, based on Open Public Consultation results.

It is possible that a coordinated campaign targeting the Open Public Consultation took place. Three pairs of identical responses (for a total of six responses that were also similar to each other) were found. These came from companies and business associations linked to the energy sector, but were not considered to influence aggregate results dramatically.

## G.4.3 Analysing content of the consultation

In order to distinguish between views of different stakeholder groups, the breakdown by stakeholder categories, as presented in the stakeholder consultation matrix (Table 105), has been maintained as best as possible for all consultation activities. The respondents of the survey-questionnaires and the Open Public Consultation were asked to indicate the stakeholder group they represented. This harmonised approach has facilitated the comparison of results per stakeholder group, as derived from different consultation tools.

Similarly, the sections for the targeted survey-questionnaire and the interviews were also kept in a similar fashion, to aid comparability.

The outputs of the survey-questionnaires and the OPC provided a sound basis to

- validate the problems analysis;
- project the likely evolution of the problems in the absence of the initiative;
- validate the identified policy measures;
- elaborate a qualitative assessment of the direct impacts.

The targeted interviews programme and the workshops fill information gaps and complement the data to elaborate the quantitative assessment of the direct impacts.

The closed questions of the survey-questionnaires and OPC were placed in figures, facilitating a quick overview of the results. This has been complemented by an assessment of the divergence of scores per stakeholder group. Responses of open questions and the reviews of the written contributions have been grouped thematically, facilitating a more qualitative assessment. Also here, the analysis has been carried out distinguishing by stakeholder group.

## G.5 Results of the consultation process

### G.5.1 Call for evidence

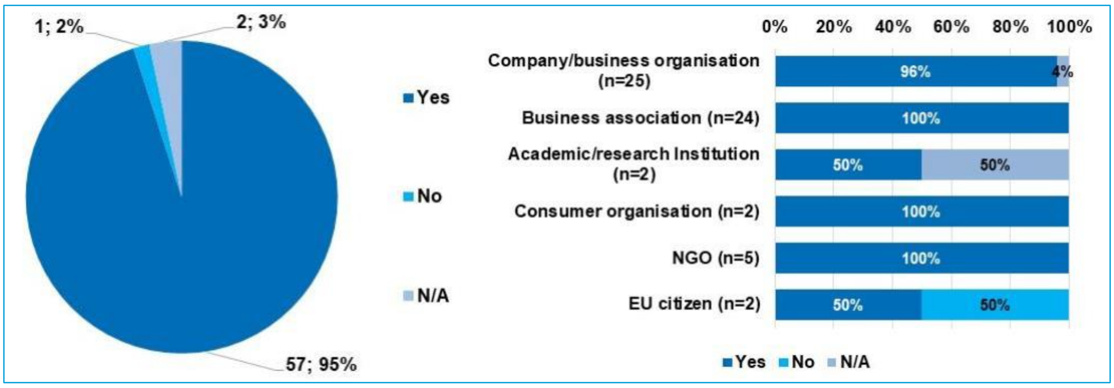
The position papers submitted in the call for evidence were issued by stakeholder groups operating in both sectors of the economy related and not related to transport and logistics. The diversity of responses gave an early indication of the scale and complexity of the issues associated with CountEmissions EU; and the importance of the problems to be addressed.

#### Current situation and motivations

In general, regardless of the sector of the economy, the stakeholder view recognises that there is no globally harmonised calculation methodology for transport GHG emissions in place. This is recognised by the responding group as a situation which hampers the ability to measure and report the environmental impact of human activities. In particular transport and logistics sector stakeholders identified specific aspects for consideration as part of the assessment of the impacts. Our interpretation of the position papers supplied by stakeholders during the call for evidence follows.

Respondents support the need for a CountEmissions EU type initiative to a very large extent (57 from 60; or 95%). **Figure 30** summarises the overall view of the stakeholders (on the left-hand side) and distinguishing by category of stakeholder with respect to the level of support expressed to the initiative (on the right-hand side).

**Figure 30 – Summary of the overall view of the stakeholders (left-hand side) and distinguishing by category of stakeholder (right-hand side)**

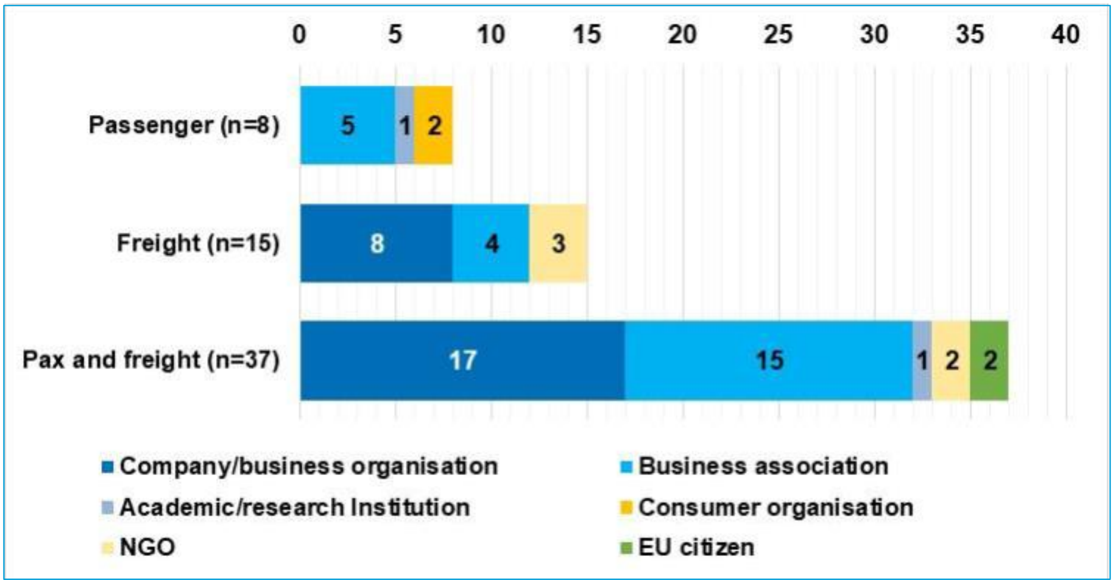



Source: Consortium, based on call for evidence submissions.

When it comes to the analysis of the transport modes addressed in the opinions provided, the stakeholders focussed their views on both passenger and freight transport for the majority of the cases (i.e. 37 out if 60; or 62%). For the other responses provided, 15 (25%) think that it is only relevant for freight and 8 (13%) for only passenger transport, respectively. Furthermore, the analysis of the opinions shows that the majority of the responses have considered the impacts of the initiative of the Commission on all transport modes and to lesser extent on a specific transport mode. This provides an indication of the level of awareness of the respondents that the existing problems for measurement of transport and logistics emissions are not specific for a single transport mode, but rather they currently involve the broadest modal spectrum.

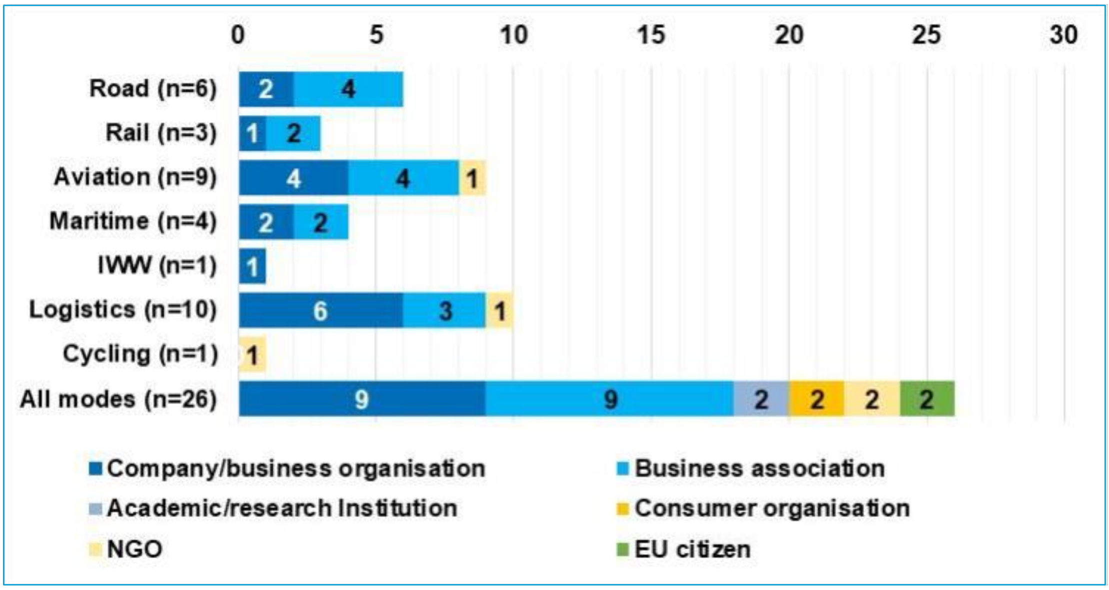
Figure 31 shows the summary of the views of the stakeholders distinguishing by passenger and freight modes. Figure 32 illustrates whether the views address all transport modes or a specific transport mode.

**Figure 31 - Summary of the views of the stakeholders distinguishing by passenger and freight modes**




Source: Consortium, based on call for evidence submissions.

**Figure 32 - Summary of the views of the stakeholders with respect to all transport modes or a specific transport mode**




Source: Consortium, based on call for evidence submissions.

## Analysis of the problems and their drivers

According to the opinions provided, the main problem that the initiative aims to address is the information failure that prevents companies, customers and passengers from monitoring and comparing easily and accurately various transport service options with respect to their emissions of GHG. This situation may lead to suboptimal choices by both the business sector and at the individual level. As also noted in the previous study on a standardised carbon footprint methodology in support of the development of an EU strategy for freight transport logistics (CE Delft et al., 2014), in most cases decision-makers take their decisions based on other factors, such as price, speed and quality, giving low priority to environmental issues (CE Delft, 2018).

Also, the analysis of the opinions (and accompanying written contributions) largely confirms that the market failure to be addressed in this impact assessment support study can be expressed as two problems. The call for evidence already shaped the links between problem drivers and these problems.

### *Towards P1: Limited comparability of results from GHG emissions accounting in transport and logistics.*

The respondents to the call for evidence often pointed out in their views that the lack of common methodological principles being applied to transport GHG emissions accounting (PD1) has led to substantial divergences in emission data calculation results and to a lack of comparability, which ultimately has diminished the usefulness of GHG emissions measurement and calculation (PD3), in particular when it comes to taking informed travel and logistics decisions. Also, the respondents emphasised that the status quo does not equip end-users with clear price signals and acknowledged that this situation hinders the effectiveness of GHG emissions measurement and calculation as policy measure to incentivise environmentally friendly transport and mobility choices.

The respondents felt that there were ongoing efforts to address the existing fragmentation of methodological approaches both within industry (e.g. EN16528[160], ISO 14025, ISO 14083, ISO 14040, ISO 14044, ISO 14064, ISO 14067) and at national level (e.g. in France[161] and the UK). Despite ongoing efforts, however, respondents suggest that the tools developed have limited precision and unclear methodological underpinning; still leaving room for interpretations of certain categories of emissions and not taking into account relevant factors.

Thirteen opinions reported that the scope of emissions measurement and calculation needs to be extended to 1) the lifecycle of the vehicles and construction phase of the infrastructure and 2) to a door-to-door assessment of the impact related to transport and logistic activities. Specifically, for six respondents, this means that the scope of the measurement and calculation has to take into account all types of GHG emissions, i.e. including carbon dioxide ($CO_2$), nitrous oxide ($N_2O$) and methane ($CH_4$).

Finally, the respondents pointed out that a common methodological approach for GHG emissions calculation should allow to achieve a fairer administrative burden with respect to the one originating from the current different approaches.

### *Towards P2: Limited uptake of emissions accounting in usual business practice*

The second problem (P2) refers to the limited uptake of emissions measurement and calculation in everyday business practice and stakeholders in the call for evidence recognised it is still limited. The view was that transport operators are neither interested in publishing their carbon footprint data nor in disclosing the information for business activities. They do, however, acknowledge the need to better understand their own emissions. This was also among the findings of a previous stakeholders consultation (CE Delft et al., 2014), according to which only a minority of the final users expressed interest for this information, if offered by transport operators.

To some extent, this second problem can be linked to the one previously discussed in relation to the lack of a common methodological approach, a situation that has created uncertainty for potentially interested stakeholders when it comes to identifying and applying ‘the right’ methodology. In this regard, eight respondents to the call for evidence generally remarked that the uptake of the emission measurement and calculation methodology could improve if it was based on good and reliable data, easily accessible and exchangeable.

[160] The European Committee for Standardization (CEN) Standard EN 16258 ‘Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers)’ (CEN, 2012) is a European Standard for the calculation and declaration of energy consumption and emissions of transport services and has been published in January 2013.

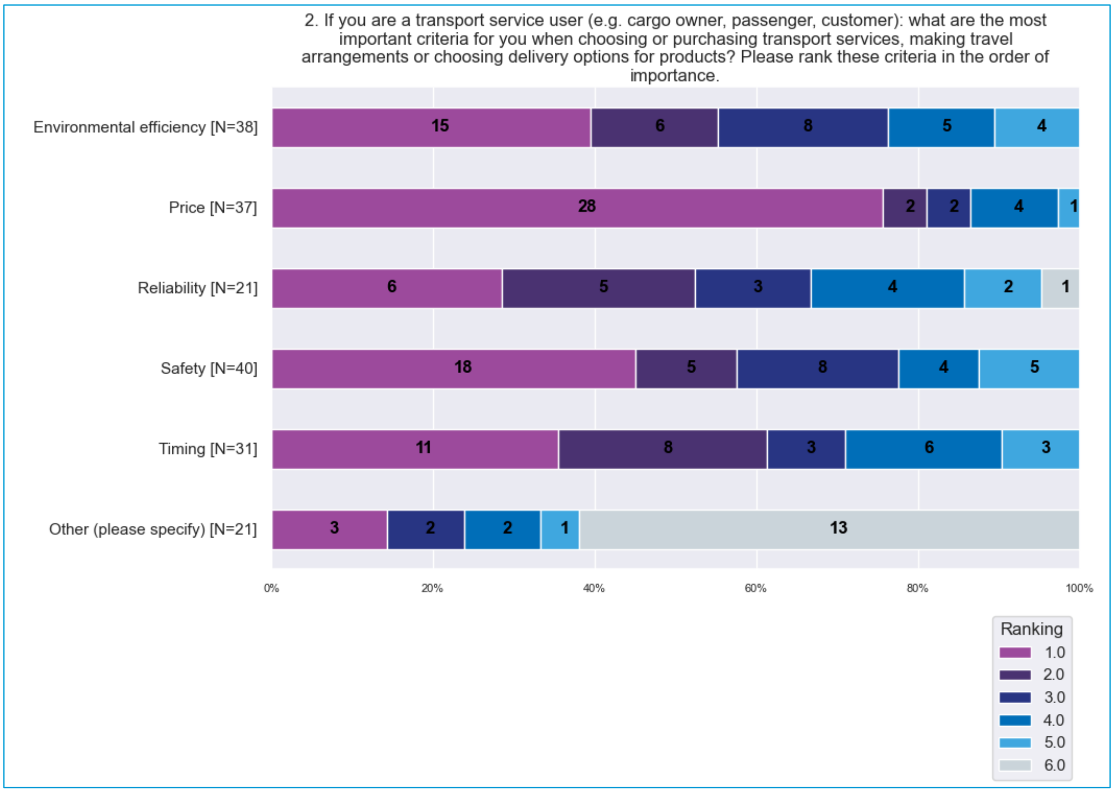
[161] In France for example, operators are obliged to report the GHG emissions of each transport service. According to Decree no. 2011-1336 of 24 October 2011 (entered into force in 2013), the methods are specified for implementing Article L1431-3 (see also ‘Grenelle II’ Law).

## A.4.1 Open public consultation

### Analysis of the problems and their drivers

It is clear from the available responses that while emissions are important to decision makers (transport service users, cargo owners, etc.)[162]; and they value access to reliable and accurate information, they are not often provided with the emissions information they feel they need to make informed decisions. Price is clearly the most important criteria for respondents using transport services, while environmental efficiency, safety and timing (often closely related to cost/price) are secondary criteria.

**Figure 33 - Summary of the views of stakeholders in regards to the most important criteria to choose transport services**

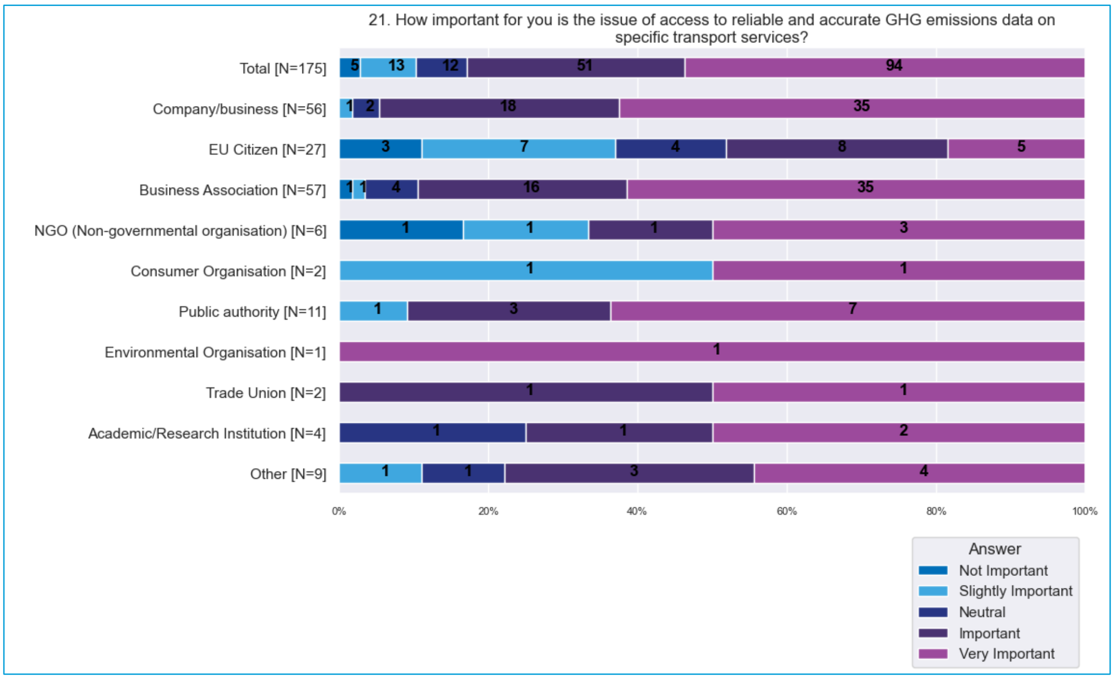



Source: Consortium, based on Open Public Consultation.

Only five respondents (from 175; or 3%) to the open consultation find accessible and reliable GHG emissions data on transport services to be unimportant. And of these five, three were is the category of 'EU Citizen'. The category of 'EU Citizen' had the largest spread of responses between finding reliable GHG emissions data on transport services to be unimportant and finding reliable GHG emissions data on transport services to be very important. Businesses, business associations and public authorities overwhelmingly found access to reliable GHG emissions data on transport services to be important or very important (in excess of 90% of respondents from these categories).

162 Respondents have indicated a willingness to trade off for example comfort with emissions.

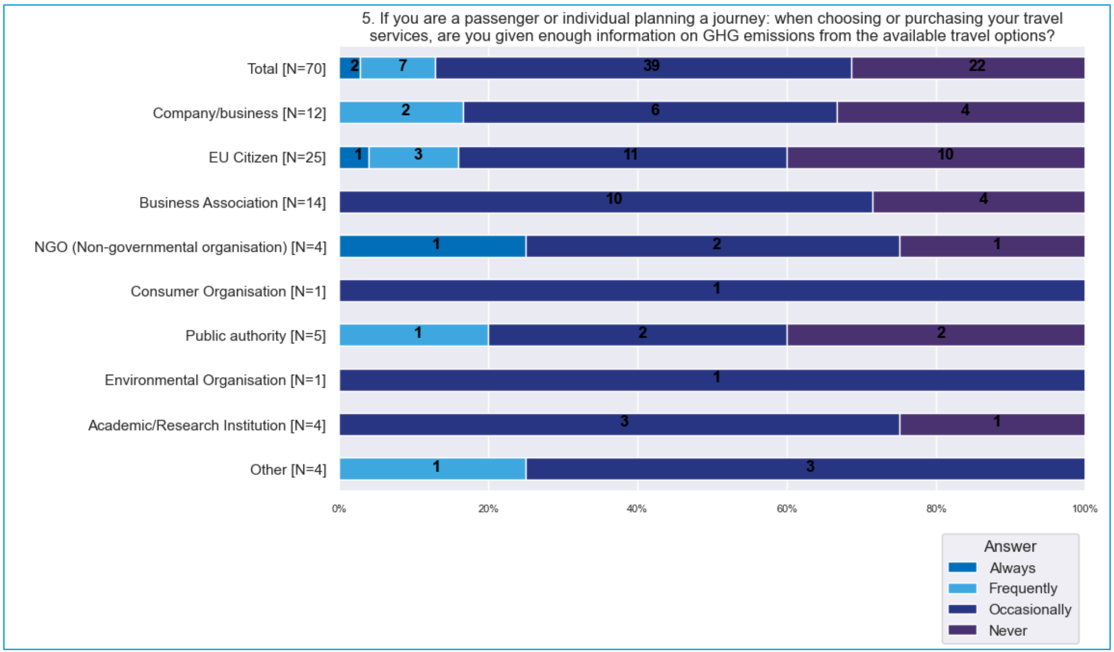
**Figure 34 - Summary of the views of stakeholders in regards to the importance of accessible and reliable GHG emissions data on transport services**




Source: Consortium, based on Open Public Consultation.

Although almost all respondents (145 from 175; or 83%) find reliable GHG emissions data on transport services to be important, they also feel they are not currently given enough reliable information at critical times. For example: passengers (amongst others) find GHG emissions information important, but are not often given the right information while planning a journey.

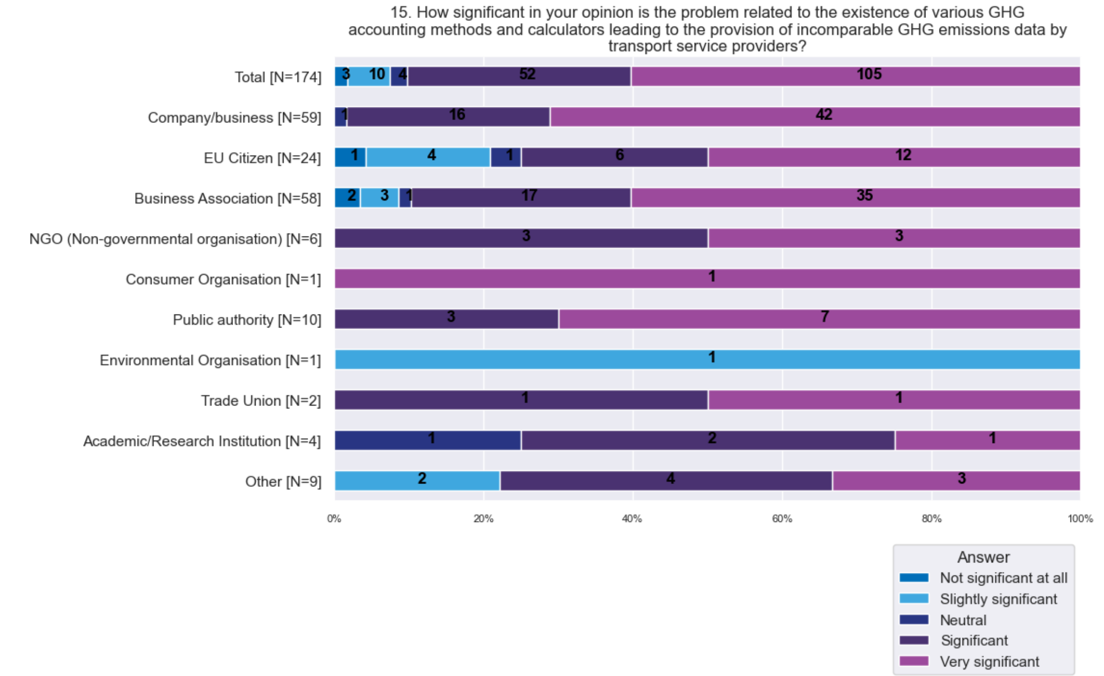
**Figure 35 – Summary of the views of stakeholders in regards to sufficiency of GHG emissions information**




Source: Consortium, based on Open Public Consultation.

It is also clear that respondents find the fragmentation of emissions measurement and calculation methods to be a serious challenge for comparability from an emissions perspective. The responses to the question on the significance of the fragmentation problem (Q15) mirror the responses to the question on the importance of reliable GHG emissions information (Q21). Almost all stakeholders (157 from 174; or 90%) find the fragmented emissions measurement and calculation in the transport sector to be at least significant.

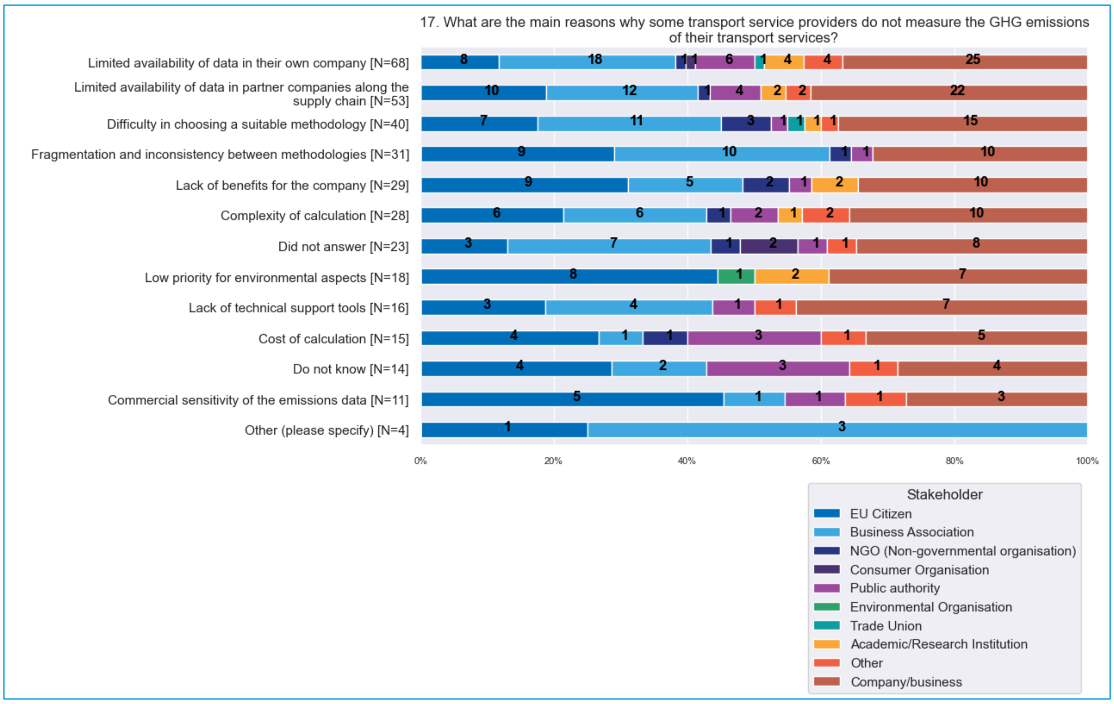
**Figure 36 p- Summary of the views of stakeholders in regards to the relationship between the fragmented emissions measurement and calculation space and the problem**




Source: Consortium, based on Open Public Consultation.

It is not surprising then that the lack of reliable data availability (top two answers listed with 68 and 53 responses) for transport service providers is one of the key reasons given for not measuring GHG emissions, followed by problems associated with which methodology to use (third most common answer with 40 responses). Input data and understandable/ consistent methodologies emerge across the stakeholder group as the key issues leading to transport service providers not calculating emissions. This suggests providing guidance and consistency in these areas would increase the number of service providers wanting to calculate their transport related emissions, however, it is unclear from the question what proportion of service providers might be encouraged to do so.

**Figure 37 - Summary of the views of stakeholders in regards to the reasons to not measure GHG emissions**

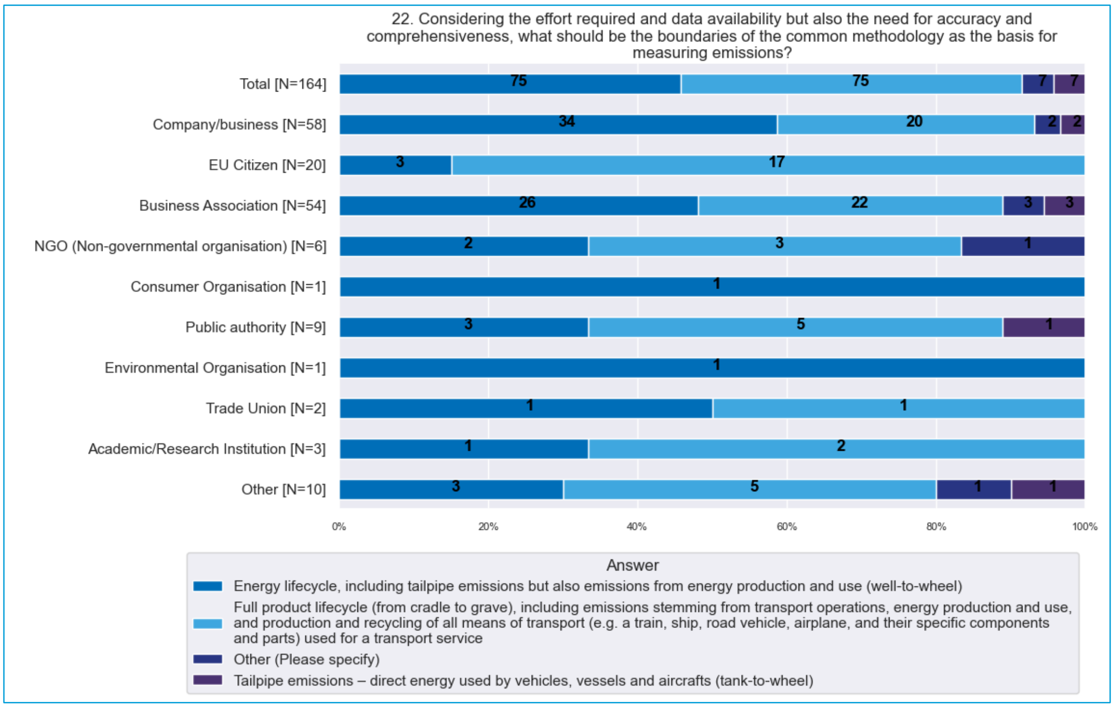



Source: Consortium, based on Open Public Consultation.

## Policy measures

Respondents considered well to wheel/wake and full life-cycle to be the best scope of emission options for CountEmissions EU in similar proportions (75 of 164 for both; or 46%), with full life-cycle being more strongly preferred than well to wheel/wake for citizens (17 of 20; or 85%).

**Figure 38 - Summary of the views of stakeholders in regards to the boundaries of the common methodology**

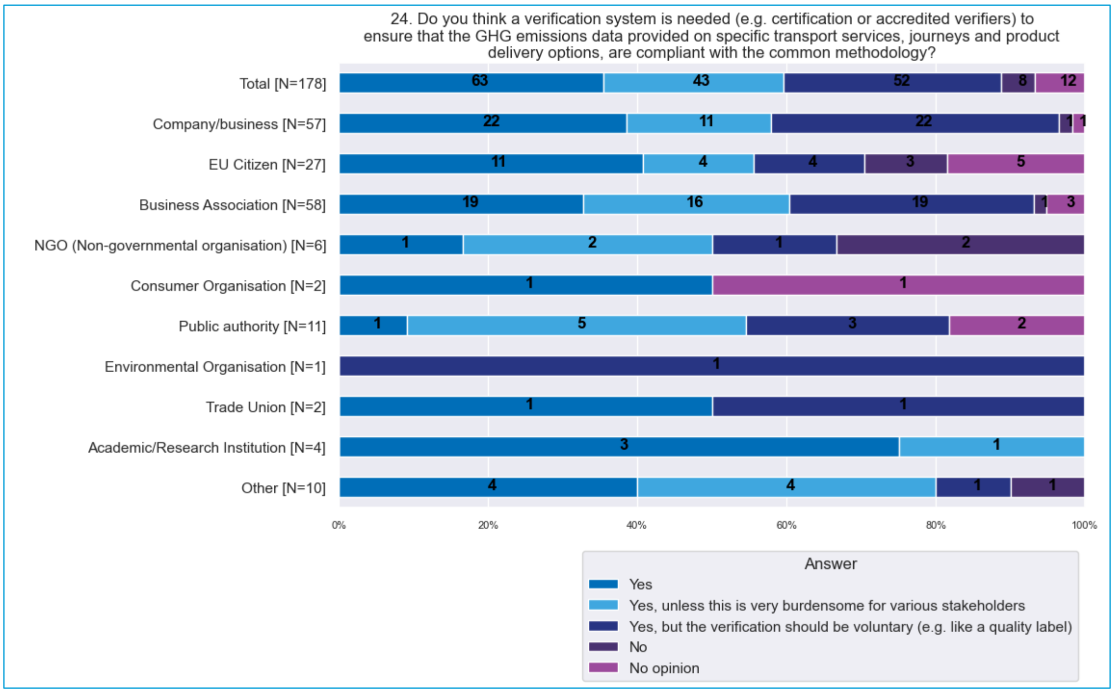



Source: Consortium, based on Open Public Consultation.

The majority of respondents (158 from 178; or 89%) suggested some form of verification system was needed for CountEmissions EU to be effective. Respondents from companies and businesses, however are more likely to consider that verification should be voluntary with 39% compared to 29% (N=178) from the total respondents, while all respondents from academic and research institutions (4 from 4) believe that there should be some form of mandatory verification. In general, (43 from 178) 24% of respondents also believe that exemptions to verification could be possible if it would be too burdensome.

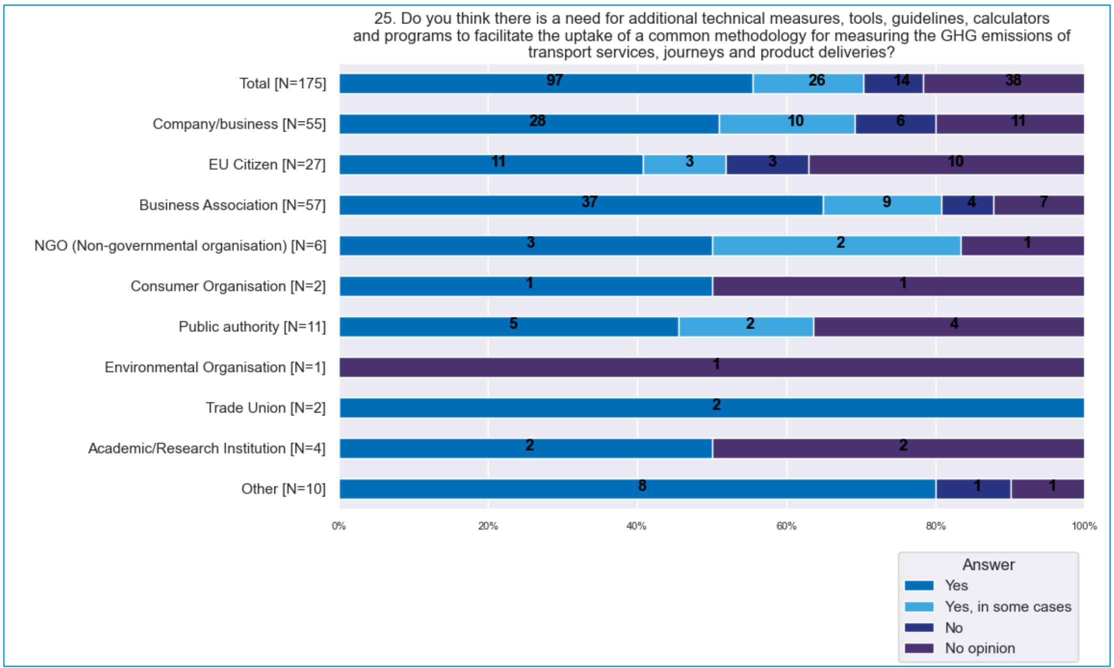
The majority of respondents (123 from 175; or 70%) also believes that there is additional need for support of some kind (tools, guidelines, calculators and programs), a trend that is particularly strong among business associations (81% of 57 respondents in the category) and NGOs (83% of 6 respondents in the category), but weaker for citizen (52% of 27 respondents in the category) and academic and research institutions (50% of 4 respondents in the category).

**Figure 39 - Summary of the views of stakeholders in regards to the verification systems**




Source: Consortium, based on Open Public Consultation.

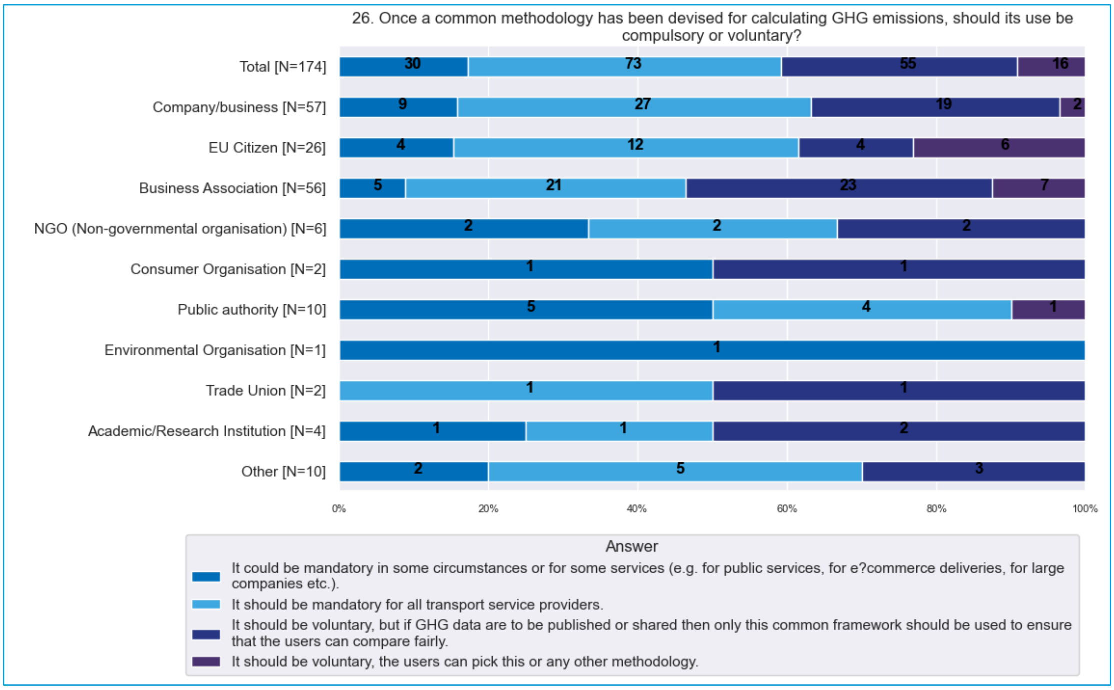
**Figure 40 - Summary of the views of stakeholders in regards to support tools**




Source: Consortium, based on Open Public Consultation.

The choice of mandatory or voluntary instrument is relatively evenly split, with a slight preference towards mandatory instruments (103 of 174; or 59%) with the exception of business associations that slightly favour voluntary instruments (30 from 56 respondents in the category; or 54%). It must be said that during the stakeholder workshop it was clear that participants had not fully grasped the application of 'voluntary' and 'mandatory' instruments in the context of CountEmissions EU.

**Figure 41 - Summary of the views of stakeholders in regards to the compulsory or voluntary measurement and calculation**

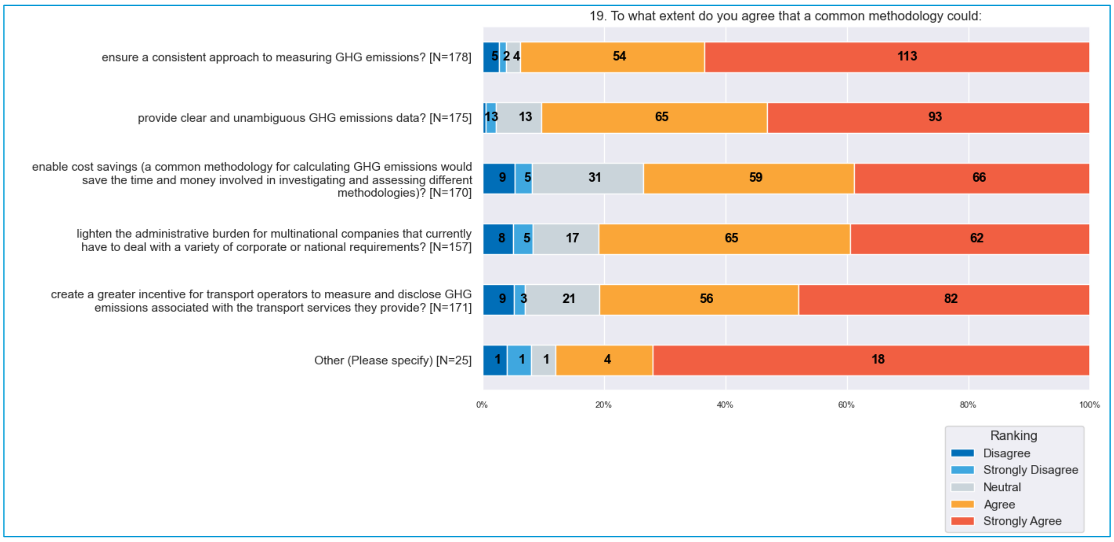



Source: Consortium, based on Open Public Consultation.

## Assessment of the impacts

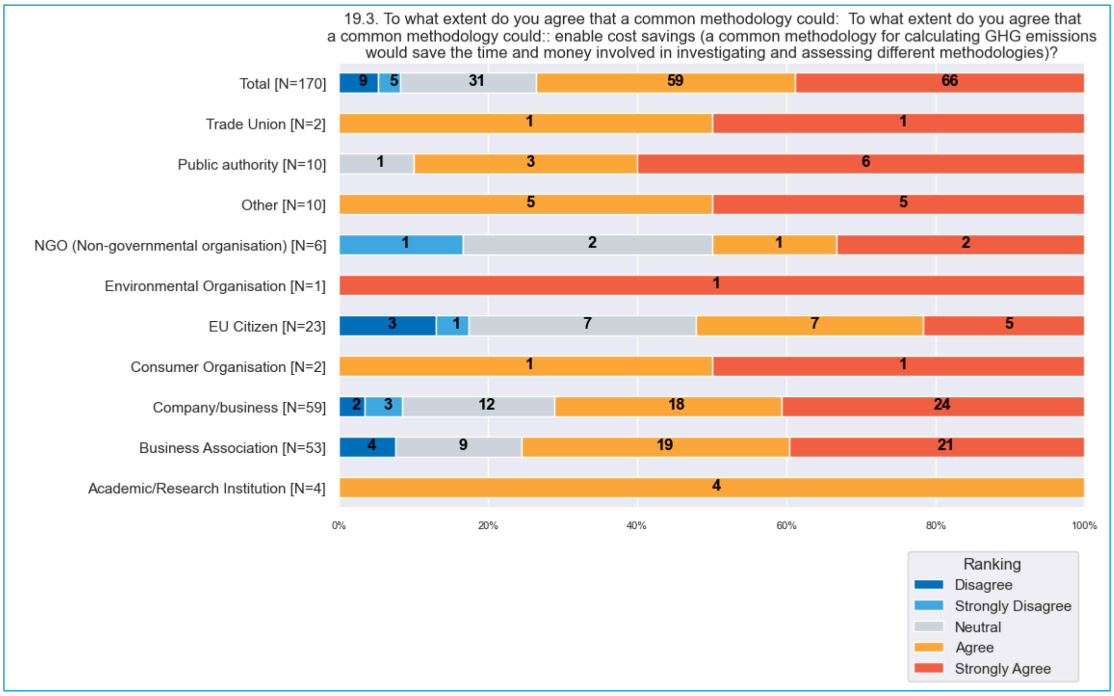
Respondents generally agree with the impacts identified in the questions and agree with the aims put forward in the questions. However, respondents are slightly less likely to agree that the harmonised method would enable costs savings (125 from 170; or 74% agree to some degree). In this regard, citizens (52%) and NGOs (50%) are the least likely to agree. Notably, companies and business associations, which together represent a large part of respondents (112 of 170; or 66%), set the trend for these responses.

**Figure 42 - Summary of the views of stakeholders in regards to the impacts of a common methodology**




Source: Consortium, based on Open Public Consultation.

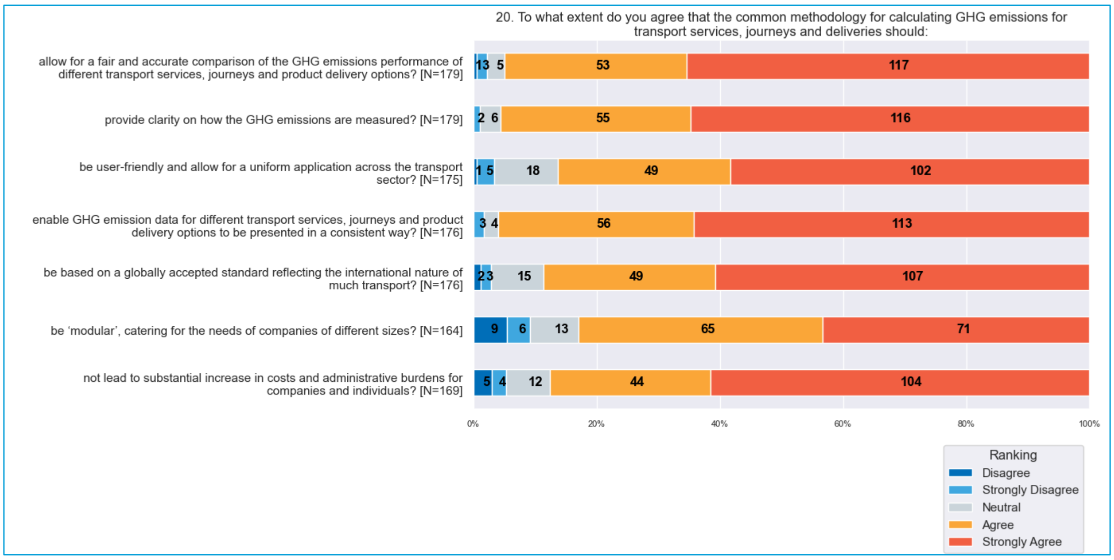
**Figure 43 - Summary of the views of stakeholders in regards to the impacts of a common methodology on enabling cost savings, broken down by stakeholder type**




Source: Consortium, based on Open Public Consultation.

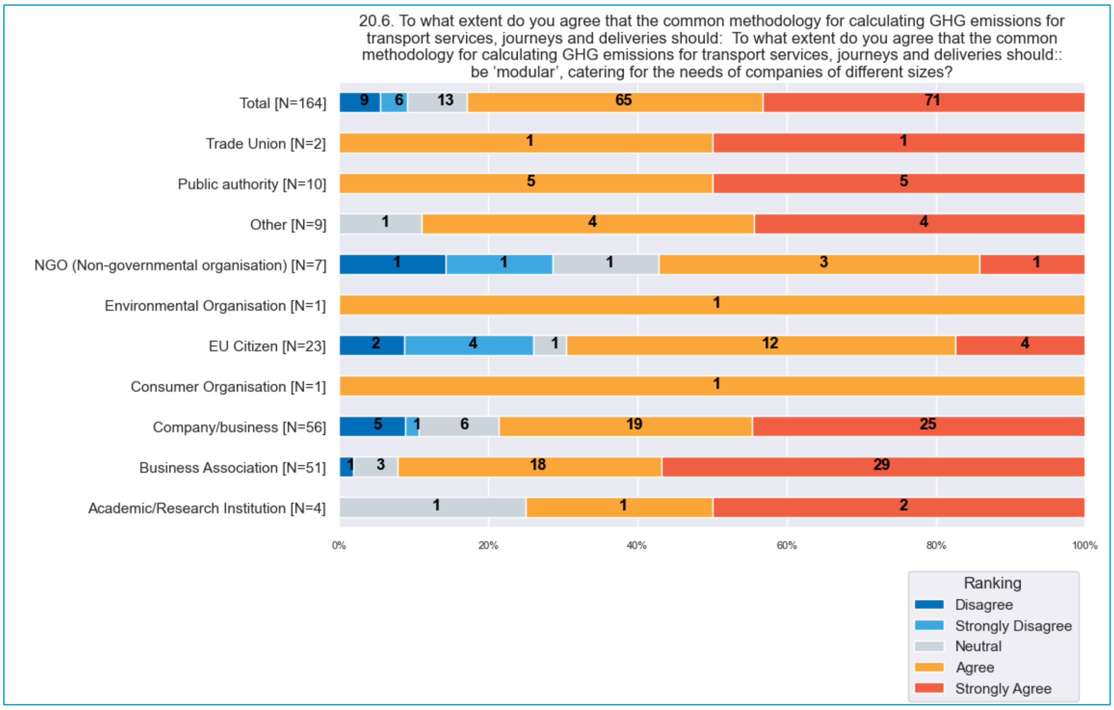
While the majority of respondents agree that the methodology needs to have the requirements outlined in the questionnaire, respondents are also slightly less likely to agree with the methodology needing to cater for the needs of companies of different sizes, where citizens and NGOs are again less likely to agree (i.e. 70 and 57% agree, respectively). This could be in conflict, for example, with exempting from verification if too burdensome (see section above on policy measures), or imply that some respondents have a preference for a method that applies to companies of all sizes but verification is done more strictly for bigger companies.

**Figure 44 - Summary of the views of stakeholders in regards to the requirements for a common methodology**




Source: Consortium, based on Open Public Consultation.

**Figure 45 - Summary of the views of stakeholders in regards to the requirements of a common methodology in catering for the needs of companies of different sizes, broken down by stakeholder type**




Source: Consortium, based on Open Public Consultation.

### G.5.2 Exploratory interviews

#### Current situation and motivations

From the exploratory interviews it is clear that the freight community in Europe is ahead of the passenger transport community in establishing the basis (and indeed support) for that harmonisation of measurement in the transport ecosystem. The conventional wisdom that measurement of emissions for passengers is easier than for freight is challenged, with public transport buses being used as an example of the complexity at the individual passenger level (given the variation in operating conditions and vehicle technologies across the fleet).

#### Analysis of the problems and their drivers

The need (and possible benefits) for a harmonised measurement and calculation framework for transport emissions is clear for all stakeholders and centred on trustworthiness and comparability for supply chains and transport users.

#### Policy measures

The exploratory interviews showed that all stakeholder groups shared a concern about the addition of new measurement and calculation processes or requirements that did not take into consideration all of the hard work that had already been done.

#### Assessment of the impacts

One of the key points is that the Commission should be acutely aware that ‘harmonisation’ – if not thought through very carefully – could result in a backwards step for those organisations actively involved in current emissions measurement and calculation efforts.

The scope of emissions and the role of SMEs are reinforced as key issues for the impact assessment. A renewed focus on (sectoral) guidelines and the role of calculation tools (we group these as ‘technical support measures’) is suggested.

#### External developments affecting the uptake of GHG emissions measurement *and calculation*

The stakeholders brought up examples of the work that had already been done to begin to harmonise measurement and calculation, which are: efforts by the International Organization for Standardization (ISO) on Standard 14083, GLEC, Green Freight Europe, COFRET, work by the European Committee for Standardization (CEN) for example EN 16258.

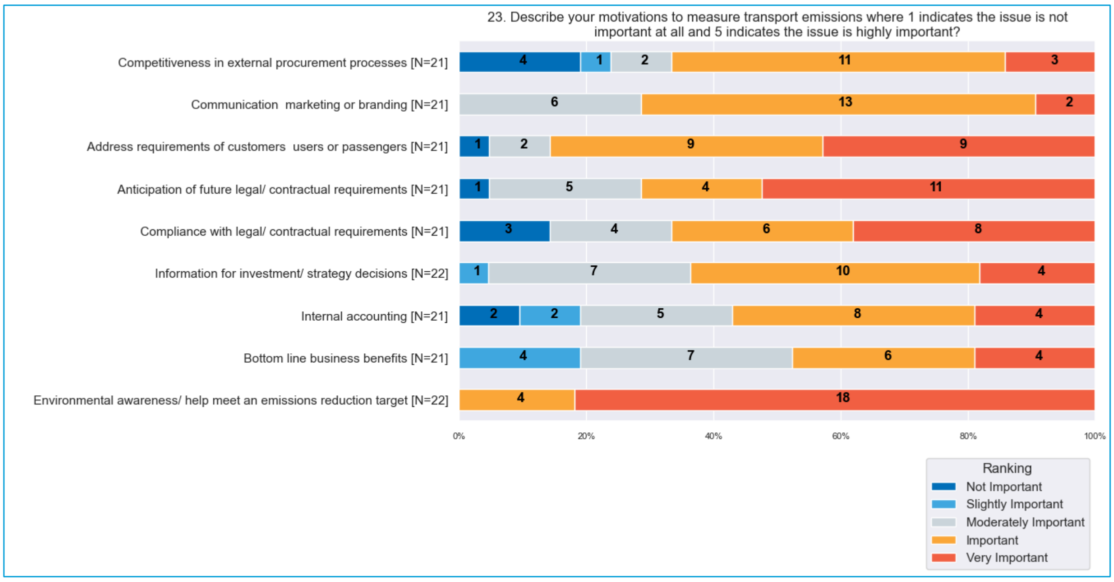
### G.5.3 Survey questionnaire

The survey questionnaire was broken down into a number of thematic sections to facilitate both the answering process for stakeholders, and the analysis from our part.

## Current situation and motivations

The vast majority of responding organisations (29 of 37) already measure their transport emissions in some way. Of these, around half acknowledge that they do not currently include all relevant activities. GLEC and GHG Protocol accounted for the majority of methodologies currently in use, however PEF and sector specific methods (built on GLEC) are also mentioned. Around half of respondents use these methods to calculate emissions ex post only (13 of 26; or 50%) with the other half using them to calculate emissions both ex post and ex ante (12 of 26; or 46%). It is worth nothing that all SMEs that responded (N=3) engage in both ex ante and ex post assessment. The majority of respondents (22 of 26; or 85%) apply these methods at the organisation level, with significantly less focussing on the service or product level. Of those that chose to respond (N=9), most organisations felt that their current methods added value and are complex to use. The LEARN Project found the majority of the companies have an intrinsic motivation for computing the carbon footprint of their (logistics) activities.[163] The participants thought that a better understanding of where and why the GHG emissions are taking place and input for the optimisation of logistics processes with respect to GHG emission reductions is particularly important. Respondents to the current survey are without exception motivated by environmental awareness and meeting emissions reduction targets. Communication, marketing and branding is also a strong motivation. The least important motivation for respondents is generating bottom line business benefits.

**Figure 46 - Summary of the views of stakeholders in regards to the motivations to measure emissions**




Source: Consortium, based on targeted survey-questionnaire.

A majority of respondents (12 of 21; or 57%) indicated they had a small or large team of people within their organisation dedicated to measuring or calculating transport emissions. Three (3) of the large organisations indicated they spend over € 500.000 annually in non-labour costs in order to measure or calculate their emissions. The main sources for these non-labour costs were software licencing (for calculation tools) and data access/ management. Ten (10 of 21; or 48%) respondents also engage third party services

[163] See here for the deliverable on 'testing results': www.nucms.nl/tpl/learn/upload/D%204.4%20Testing%20results%20-%20FINAL.pdf

(accountants or auditors) as part of their process. A majority of respondents (15 of 22; or 68%) already share their transport emissions externally.

The vast majority of respondents (30 of 31; or 97%) indicated they would adopt a harmonised emissions measurement framework if it is established for the EU. They are also clear that they did not want an additional framework to be established, but instead one that aligns with current efforts (e.g. ISO 14083). 84% (N=26) of respondents indicated that they thought GHG emissions measurement in the EU transport sector is currently niche or low (under 50%), but respondents also expected take up of GHG emissions measurement in the EU market to be medium or high (above 50%) by 2030.

## Analysis of the problems and their drivers

The vast majority (28 of 31; or 90%) respondents agree the European Commission should pursue the current policy objective of the CountEmissions EU initiative.[164] Respondents are positive about the specific objectives and the problem statement (represented by the draft problem tree). A majority (24 of 29; or 83%) of respondents agree either totally or with a large part of the way the problem is stated, although some private and public initiatives/ networks implementing green transport programmes (2 of 5; or 40%) disagree with a large part of it. The problem drivers are mostly assessed by respondents as relevant or highly relevant, with the driver stated as: 'Lack of demand for GHG emissions figures from shippers or customers' receiving the least favourable assessment – 52% (N=31) of respondents found it to be moderately relevant or lower. Some stakeholders commented that the lack of demand for GHG emissions is an outdated view based on data collected before current initiatives (for example ISO 14083 development) are in place. There are also comments indicating data collection and exchange is more important to emissions measurement and calculation than is currently represented.

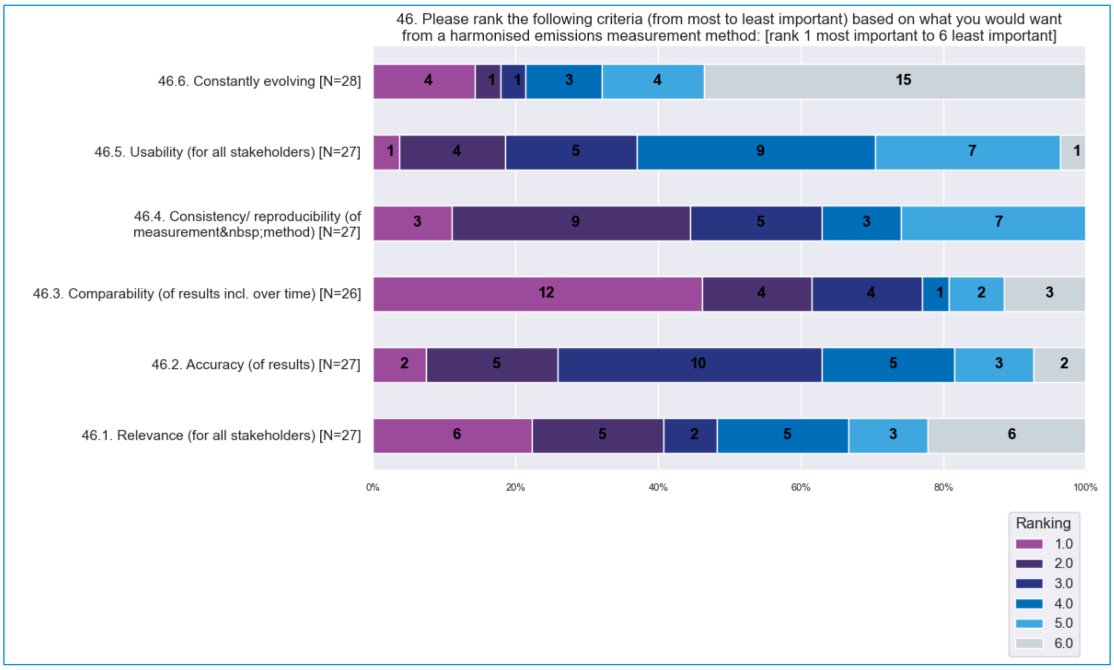
Better comparison and coordination amongst member states are identified as key areas for EU added value resulting from the CountEmissions EU initiative. Stakeholders recognise that added value will be achieved through subsequent reporting requirements that might be better facilitated by harmonised calculation or measurement of transport GHG emissions.

## Policy measures

Respondents are asked to rank criteria for good harmonised transport GHG emissions measurement method. Comparability is ranked as the most important criteria by 46% (N=26) of respondents. Reproducibility is also very important with 44% ranking it first or second most important criteria (N=27).

[164] 'To incentivise the reduction of emissions from transport and logistics, through establishing a level playing field for GHG emissions measurement and calculation in transport and logistics sectors; and facilitating behavioural change.'

**Figure 47 - Summary of the views of stakeholders in regards to the importance of different criteria for a harmonised emissions measurement method**




Source: Consortium, based on targeted survey-questionnaire.

A global geographic scope is preferred by 71% (N=25) of respondents. Calculation at the service level is preferred by 57% (N=28) of respondents, although some respondents pointed out that all organisational, service and product levels should be addressed explicitly by any harmonised method. An overwhelming 93% (N=28) of respondents suggested any harmonised method should specify either well to wheel/wake (54%); or full life-cycle boundaries (39%), although it is worth noting that respondents identifying as transport service users are more likely to prefer full product life-cycle boundaries with 56% (N=9). Both ex post and ex ante analysis should be possible using the harmonised framework according to 74% (N=27) of respondents. An 82% (N=28) of respondents suggested sector specific guidelines should be included in the framework, with 43% (N=23) suggesting sector specific bodies should be responsible for development and 30% preferring the European Commission (or indeed agencies) take responsibility, although it is worth noting that shippers might not see the need for sector specific guidelines (only 1 of 4 respondents expressed a preference for it).

When it comes to the type of emissions respondents think should be included in the harmonised framework, remarks overwhelmingly suggest starting with GHG emissions and then expanding to other emission types (for example particulate matter). The main challenge identified is that scientific evidence for calculating emissions other than GHG emissions is not yet mature enough.

A mandatory policy instrument of some kind is preferred by 93% (N=28) of respondents with the majority (i.e. 17 out of 28) suggesting calculation and reporting should be mandatory for at least some classes of organisation in the transport system, with SMEs having a stronger preference of 57% (N=7) for the obligation to be applicable only for some organisations, possibly based on size, compared with 32% (N=28) of the total. Respondents see the provision of technical support tools as particularly important, but there is no consensus on where these technical support tools should be developed or provided from (i.e. who should be responsible for them). In particular respondents are not clear on the potential role for the public and private sectors in developing an providing technical support tools to organisations who need/want to calculate their transport GHG emissions. What 82% (N=28) of respondents agree on is that these technical support tools – wherever they come from – should be certified by an independent entity.

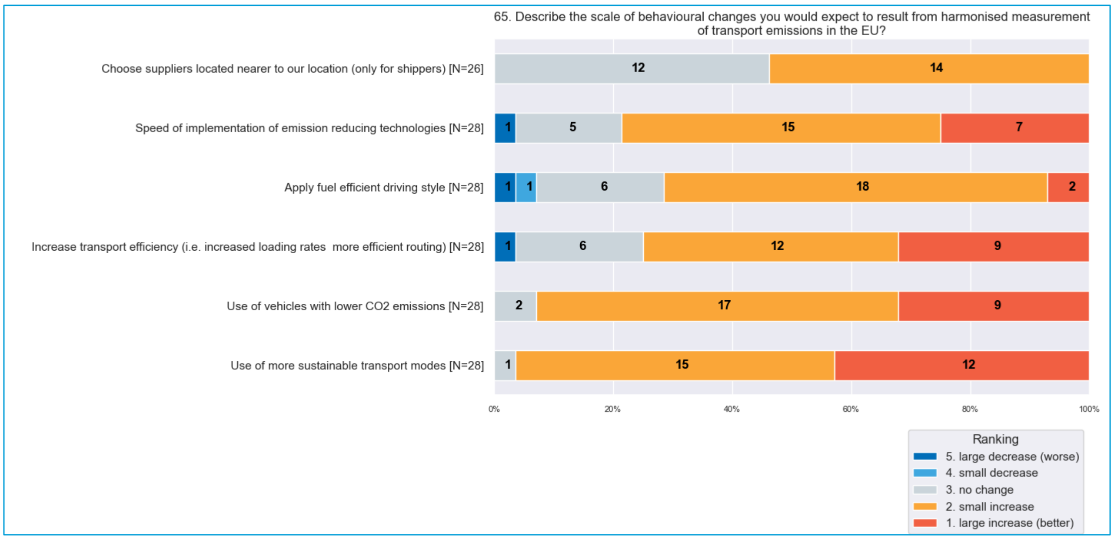
Respondents see the need for some kind of verification system (0 from 28 responses suggested no verification system should be implemented) although they are not clear on what it should look like. There are notably suggestions for a step by step approach to development of a mature verification system, as opposed to an all-in from day one approach.

Unsurprisingly low costs for measuring and calculating transport emissions are preferred by all respondents – somewhere well under 3% of total annual expenditure. Suggestions for keeping costs low include: building on existing methods; keeping the method simple; providing the required data and data management processes (in the public sector); automating the calculation using digital methods.

## Assessment of the impacts

Respondents are asked to describe the scale of behavioural changes you would expect to result from harmonised measurement of transport emissions in the EU. Mode shift to more sustainable options and use of lower emissions vehicles are considered the most likely and largest magnitude behaviour changes that will result from a harmonised transport GHG emissions framework.

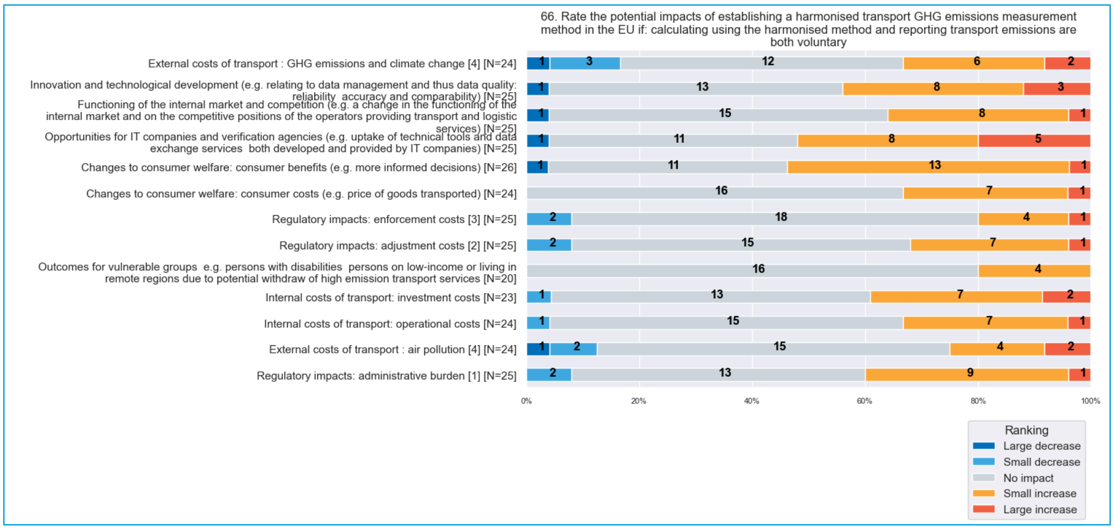
**Figure 48 - Summary of the views of stakeholders in regards to the behavioural changes expected to result from harmonised measurement of transport emissions in the EU**




Source: Consortium, based on targeted survey-questionnaire.

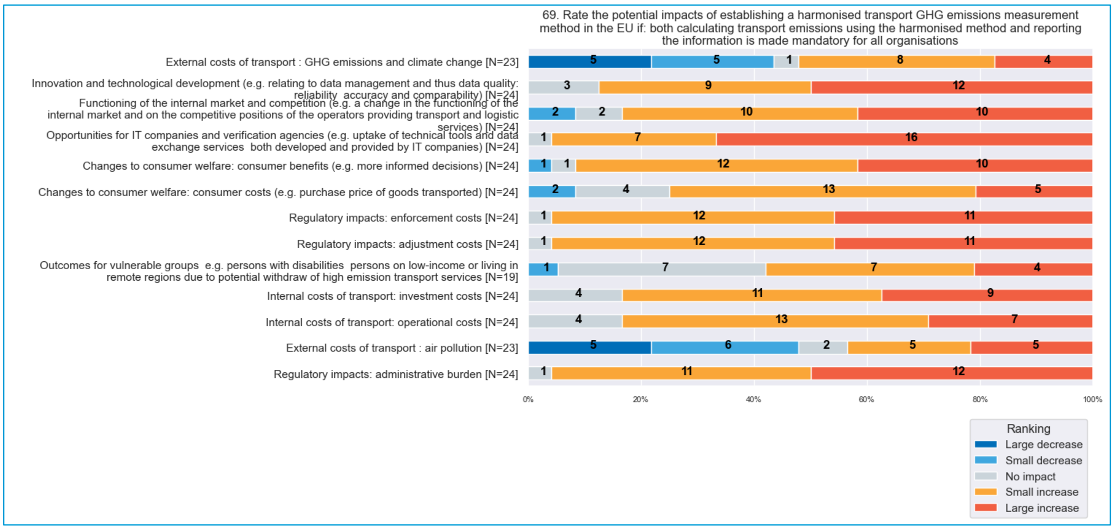
In general respondents considered impacts would increase in magnitude for frameworks with mandatory instruments compared with voluntary instruments. In particular respondents felt the external effects of transport would dramatically decrease with mandatory measurement or calculation and reporting according to an EU framework. Opportunities for innovation and for technology companies to sell products/services into the market are considered relatively high under any instrument choice. Regulatory impacts (administrative burden; adjustment costs; enforcement costs) are considered to increase in magnitude with the introduction of mandatory instruments.

**Figure 49 - Summary of the views of stakeholders in regards to the impacts of both the method and the reporting being voluntary**




Source: Consortium, based on targeted survey-questionnaire.

**Figure 50 - Summary of the views of stakeholders in regards to the impacts of the method and reporting being mandatory but not needing to report externally**




Source: Consortium, based on targeted survey-questionnaire.

Respondents seem unsure about the precise emissions reduction that could be expected from harmonised measurement in the EU. Some comments suggest that a large reduction should not be expected from harmonised measurement and calculation alone.
SMEs should be considered carefully according to participants. In particular the implementation costs and administrative burden they are subjected to by the framework.

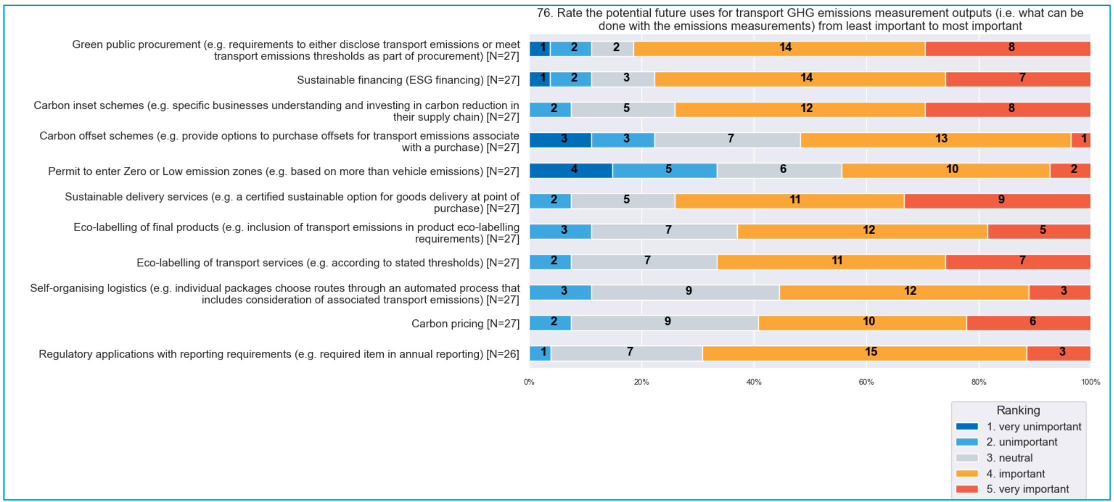
Some respondents suggest the cost per employee of measuring/calculating emissions – or the lack of resources to do so – will be particular challenges for SMEs.

Respondents did not suggest any additional impacts for consideration that are relevant to the current scope of CountEmissions EU. They did, however, reiterate a collective focus on making use of what already exists and minimising the cost associated with any measurement or calculation method. Labelling, carbon pricing and targeting decision makers are mentioned as key mechanisms for the information produced.

### External developments affecting the uptake of GHG emissions measurement and calculation

Green public procurement is seen as a key use for emissions information measured or calculated in a harmonised way. Certified sustainable delivery services are also thought to be a high priority use for the information.

**Figure 51 - Summary of the views of stakeholders in regards to the importance of potential future uses of emissions measurements**




Source: Consortium, based on targeted survey-questionnaire.

### Alternative applications of harmonised GHG emissions figures

Suggestions to look more closely at Eco-labelling initiatives; Lean & Green; and FRET 21 (France national scheme) were noted and are included in further analysis.

## G.5.4 Targeted interviews

### Current situation and motivations

Several interviews showed that some companies are already taking up emissions accounting, especially in Europe. This is possibly motivated by factors including national regulatory pressure, pressure from investors that consider emissions a financial risk, marketing purposes, and customers. One vehicle manufacturer claimed when pressure came from customers, it is felt most strongly through customers in the public sector.

## Analysis of the problems and their drivers

The stakeholders interviewed in general agreed with the problems and consequences defined. According to two operators of private green freight programmes and one transport association comparability of GHG emission figures have been improved significantly over the last years, particularly due to the development of the GLEC framework. However, many of the other stakeholders mentioned that there is still a large variance in the results of GHG emissions measurement and calculation initiatives. A supplier of transport management systems indicates that a variance of up to 77% are noticed in practice, due to differences in methodologies and input data used. Particularly the different quality levels of input data is seen by most stakeholders as an important reason for the large variance in GHG emission figures calculated. As for the limited uptake of GHG emissions measurement and calculation in business practice, this problem is acknowledged by the vast majority of the stakeholders interviewed.

As mentioned above, the vast majority of the stakeholders agreed with the problem driver **'No common methodological principles to apply GHG emissions measurement and calculation'.** Harmonisation of these principles is generally seen as essential to improve the level playing field for GHG emission figures of transport services. This driver exists at the European level, but is even more important at the international level, as indicated by some globally operating stakeholders. As mentioned earlier, some stakeholders point out that a certain extent of harmonisation of methodologies have taken place over the last years, particularly for freight transport (by the development of the GLEC framework).

There is general agreement among stakeholders that the fact that there is **no set of harmonised input data** significantly contributes to the limited comparability of GHG emission figures produced for transport and logistics operations. Stakeholders recognise the added value of using primary data instead of default (or modelled) data, as using default values will not show the results of innovations and does not (accurately) reflect the differences in GHG emissions performances of companies on the same corridor and mode. But as pointed out by several stakeholders with all kinds of backgrounds, primary data is often not used for GHG emissions measurement and calculation. A supplier of transport management systems mentioned that it is often not beneficial for companies to use primary data, as using default data results in lower GHG emissions figures than using actual data. Furthermore, it was mentioned that there is often no real incentive to make use of primary data. For example, according to a transport operator, clients only want a GHG emission figure and are not interested in how it is calculated. For cases where default data are used, they are often considered to be outdated, used in the wrong context or not detailed enough. For example, one stakeholder from the aviation sector mentioned that frequently default values based on old aircraft types are used, while an operator of a private freight greening programme indicated that emission intensity factors of DEFRA are often used for cases outside the UK where they are not applicable.

The **reluctance to share sensitive data** is also seen by many stakeholders as an important driver for the problems addressed by the CountEmissions initiative. However, according to one of the consumer and passenger federations, this driver is mainly relevant for freight transport and not for passenger transport. For freight transport, stakeholders indicated that operators are afraid that sharing of primary data will be used as a tool for shippers to demand lower transport prices. Sensitive data to be shared are fuel costs and actual distances, but also load factors. As indicated by both one of the transport associations and a researcher, operators often offer transport prices based on two runs, assuming an empty return trip. However, by sharing load factor data it becomes clear that there is a backhaul, offering the client arguments to bargain for lower prices. From the interviews, it did not become clear whether this driver is more important for large or small operators. On the one hand, as mentioned by an interviewed standardisation body, small companies have less bargaining power (in price negotiations) and therefore they will be more reluctant to share such sensitive data. On the other hand, as mentioned by a supplier of transport management systems, large companies have in general more issues with transparency.

According to the majority of stakeholder groups, **lack of trust concerning GHG emissions output data** is a relevant problem driver. The lack of trust in reliability and comparability of the GHG emissions figures is a reason for less demand for such figures and hence lower uptake of GHG emissions measurement and calculation.

**The (perceived) complexity and high costs of GHG emissions measurement and calculation** is mentioned by the vast majority of interviewed stakeholders as an important problem driver. This driver is seen as most relevant for small companies, as these are considered not having the time and resources to apply GHG emissions measurement and calculation. This conclusion is challenged by a supplier of transport management systems, who mentioned that GHG emissions measurement and calculation becomes easier the less vehicles and transport legs are involved, which may imply that complexity (and costs) for smaller transport operators is relatively lower. The multi-layer structure of the transport and logistics sector involving numerous actors (operators, shippers, forwarders, subcontractors, etc.) is indeed seen by many stakeholders (with different backgrounds) as an important factor complicating the collection/sharing of all required data to account for emissions. In addition, it was mentioned by one of the transport associations that because of the (perceived) low benefits of measurement and calculation, costs are often considered as too high. This finding was confirmed by one of the interviewed freight transport service users, who stated that transport users will not ask for GHG emissions figures as it has a significant impact on the transport price, because of the fact that there are no/few observable benefits. The other way around (as mentioned by one of the operators of private freight greening programs), operators are not incentivised to apply GHG emissions measurement and calculation as they cannot increase their transport prices (to cover the costs of measurement and calculation). Finally, it was argued by operators of freight greening programs that calculation tools are often not adapted to business practice, demanding for input data that is not easily available for users of the tool. As a consequence, companies consider the application of these calculation tools, and of GHG emissions measurement and calculation in general, as complex processes.

The **lack of demand for GHG emission figures from customers/passengers** is recognised by a large number of stakeholders as a barrier for the uptake of GHG emissions measurement and calculation by the market. Both representatives of transport operators and users mentioned that due to this lack of demand, a business incentive to account for emissions is currently often missing. This is also shown by the fact that GHG performance of mobility options is often not integrated in business operations, like procurement processes by shippers, as was mentioned by one of the operators of a freight greening programme. However, representatives from a consumer and passenger federation and from a freight greening programme suggested that while this may have been the case a few years ago, this is changing rapidly. This view is partially shared by some of the transport associations, who think that demand for reliable and accurate GHG emission figures will increase in the (near) future.

## Policy measures

The development of a harmonised framework for GHG emissions measurement and calculation in transport and logistics is supported by a vast majority of the stakeholders interviewed. Particularly representatives of individual transport operators and users claim that such a framework will contribute to an equal level playing field, allowing customers to compare two transport services on their environmental performance. At the same time, a broad range of stakeholders (with different backgrounds) also emphasise the importance of aligning the CountEmissions EU framework with other initiatives in this field (like EU MRV, CORSIA, EU ETS, national schemes) in order to lower the administrative burden for companies. For the same reason a representative from a consumer and passenger federation suggested that the framework should allow a range of methodologies. Although such an approach will lead to less harmonisation, it will also results in lower administrative costs for companies. Related to this suggestion, both a transport association and a freight transport service user mentioned the option to leave room within the framework for sector-specific standards/methodologies. According to them, this is the only way to cover specificities for sectors in a decent way.

As for the **harmonised methodological framework** several elements were discussed with the stakeholders:

- **Geographical scope:** the majority of the stakeholders interviewed prefer a global scope for the methodology, particularly in order to cover international transport in a good way. Two associations representing land-based transport suggest a European scope, probably as this is in line with the scope of the transport segment they represent. Also a public authority prefers an EU scope, as a methodology with a global scope is considered too complex at this stage.
- **Type of emissions:** according to most stakeholders, the CountEmissions EU initiative should cover all GHG emissions, i.e. $CO_2$-equivalents. There were two stakeholders, from the maritime and aviation sector, who would like to limit the scope to $CO_2$ emissions, in line with the schemes currently used in those sectors (i.e. EU MRV and CORSIA). Both stakeholders do, however, mention that an extension to non-$CO_2$ GHG emissions could be considered in the future. Coverage of air pollutant emissions is only supported by two stakeholders (a transport association and an individual transport operator).
- **Emission boundaries**: the vast majority of stakeholders suggest that the harmonised methodology should cover well-to-wheel (WTW) emissions, as this would facilitate the comparison between modes and different types of fuels. Again, two representatives from the aviation and maritime sector, prefer a narrower scope: tank-to-wheel emissions. Covering all life-cycle emissions (also the ones related to the vehicle and infrastructure) is considered too complex by the stakeholders for now. Three more research oriented stakeholders and one transport association do, however, suggest that an extension to life-cycle emissions could be considered later.
- **Activity boundary**: the inclusion of emissions from hub-related activities is actively supported by three transport associations and three more research oriented stakeholders, while one transport association discards this option as it complicates the methodology. Several options to lower the complexity of the inclusion of hub-related emissions are given by the stakeholders. One transport association suggests to use a rating scheme, where only an A, B or C rating is given to hub operations. Another option is provided by a researcher, who suggests to make use of a cut-off point: if emissions from hub-related activities contribute less than X% to the total emissions, these do not have to be accounted for.
- **Minimum level of granularity of emissions measurement and calculation:** emissions calculations at the service level was most often called as preferred option by the stakeholders interviewed, followed by shipment level. An operator of a freight greening programme mentioned that the methodology should be flexible on different levels of granularity, as the preferred level depends on purpose of measurement and calculation, type of transport mode, etc. As calculation at the service level requires disaggregated data, results at the other levels of granularity can be provided as well. Only one

stakeholder (public authority) mentioned that measurement and calculation at the company level should be sufficient.

- **Allocation parameter**: one of the operators of a freight greening programme points out that using tonne-kilometres as allocation parameter may result in wrong conclusions[165] and instead great circle distance or shortest feasible distance tonne-kilometres are more appropriate parameters.
- **Measurement unit volume-based transport**: by one of the operators of a freight greening programme and a parcel shipping company it was mentioned that for volume-based transport another measurement unit than tonnes (or tonne-kilometres) may be used (e.g. pallets, $m^3$). According to the freight greening programme, there is no need to oblige a certain metric, but instead leave this open with the condition that the metric used is clearly disclosed.

With respect to **harmonised input data**, several interviewed stakeholders (transport associations, supplier of transport management systems, operator of freight greening programme) emphasise the importance of the use of primary data. They suggest to incentivise this by the CountEmissions EU initiative, e.g. by applying a labelling scheme based on data quality or by regulating the sharing of transport and fuel consumption data by OEMs or from fuel card providers. At the same time, some form of harmonisation of emission databases is considered to be important. This should also result in more detailed emission factors, for example, clearly showing differences in emission factors between countries.

The need for specific **implementation guidelines** was only discussed explicitly in six interviews. Only in one of these interviews, the development of (segment-specific) guidelines was rejected by a transport association. The representative of this association favours a relatively simple common methodology and therefore claims that detailed guidelines are not needed. The other stakeholders do, however, see the benefits of segment-specific guidelines, particularly to make the general methodology applicable for these specific segments. Two operators of freight greening programmes are convinced that the development of guidelines are incentivising the uptake of GHG emissions measurement and calculation. However, one of them also mentioned that the development of these guidelines is already going on, referring to the development of the guideline developed for transport within the chemical industry by CEFIC. A public authority pointed out that the EC should monitor the development of the guidelines, but that the actually development could be left to third parties. This opinion was shared by the majority of the stakeholders discussing this issue.

Stakeholders interviewed differ in their opinions on **verification**. Although the majority of the stakeholders discussing this issue is in favour of some form of verification, there are a few stakeholder who are against formal verification of the GHG emissions figures. Among the proponents are transport associations, individual transport operators, operators of freight greening programmes and public authorities. They claim that verification of the process and/or output may increase the reliability of the GHG emissions figures and hence it may contribute to the uptake of GHG emissions measurement and calculation.
An individual transport operators points out that verified figures will be important as it provides proof that their transport services are meeting specific sustainability standards. Such proof is needed in a ‘book and claim’ system that is increasingly used by shippers. There is no clear shared picture on how the verification scheme should look like, although

[165] He illustrated this with an example. Assume transport between the Netherlands and Italy, which could either go via Switzerland (direct route with less emissions) or via France (longer route with on average higher emissions). From an environmental efficiency perspective, the route via Switzerland is the preferred one. However, as the route goes through mountainous area, the emissions are per tkm higher.

most support is found for a verification scheme with certified (third party) verification bodies. There are, however, also transport associations who prefer simple sample checks by the government, particularly to minimise the costs of verification. More in general, the costs of verification are a concern among the stakeholders interviewed. For example, a public authority refers to the mandatory French scheme for GHG emissions measurement and calculation in transport, where transport operators complain on the relatively high verification costs. Several options to minimise verification costs are mentioned by the stakeholders interviewed. A transport association, public authority and operator of a freight greening programme suggest to base verification on sample checks (by certified verification bodies) instead of verifying all operations. Another operator of a freight greening programme suggest to develop standards for measurement and calculation methods and calculation tools, such that the application of these standards could be simply checked by accountants. Finally, as mentioned above, there were also some stakeholders opposing a (mandatory) verification scheme. According to one of the transport associations, verification of the GHG emissions measurement and calculation process should not be implemented because of the high costs. A supplier of transport management systems thinks that developing a certification scheme may delay the development of a harmonised framework for GHG emissions measurement and calculation. According to this stakeholder, first the framework should be set up and verification is something to be arranged at a later stage.

As for **complementary measures**, particularly the development of calculation tools was discussed by the interviewed stakeholders. Several transport associations and operators of freight greening programmes emphasise that such tools can contribute to the take up of GHG emissions measurement and calculation. Particularly the operators of freight greening programmes suggest that these tools could be best provided by private companies (with some kind of guidance/certification of the government), as these are better aware of the specificities of transport segments or countries. A supplier for transport management systems explicitly stated that accreditation of the tools is not a necessity, as history showed that setting up reporting requirements for tools (e.g. within GLEC) was sufficient to gain tool acceptance. In two interviews, the use of data exchange mechanisms was discussed. Both a representative from a transport association and an operator of a freight greening programme acknowledged that such a mechanism may support data sharing between agents along the supply chain.

As for **applicability** of the CountEmissions EU framework, the stakeholders interviewed differ widely in their opinion. Particularly among the transport associations and associations representing transport users, there are quite some proponents of a voluntary scheme. They point out that such a scheme would already provide a good incentive to take up (harmonised) emissions measurement and calculation within the transport sector and that this will not clash with sector-specific initiatives in this field. Many of the other stakeholders, including individual transport operators and users, favour a (more) mandatory scheme, as this would better contribute to a level playing field for GHG emissions measurement and calculation in the transport sector. There are, however, different ideas on how a mandatory scheme should look like. Several stakeholders (with different backgrounds) suggest to start with large companies only or with transport segments with relatively straightforward emission calculations, as this would significantly reduce the overall administrative burden. There are, however, also some stakeholders (again with different backgrounds) who prefer a mandatory scheme for all transport companies in order to ensure a full level playing field. Two operators of freight greening programmes suggest to allow for different levels of detail in calculations or input data used within such a mandatory scheme. This would allow, for example, companies that have not (yet) access to high quality data (e.g. primary data) to start with emissions measurement and calculation based on general default values, while companies that are able to apply more sophisticated calculations are incentivised to do so. The use of a labelling scheme for data quality would support such a scheme. By one of these operators it is also suggested that different requirements could be considered for different transport segments, in order to reduce the administrative burden for companies and to allow for more accurate calculations. This suggestion is supported by one of the individual shippers. Finally, one of the operators of a freight greening programme suggest to make shippers responsible for measurement and calculation emissions (in freight transport). In general, shippers have more funding opportunities (as they are on average larger) to finance emissions measurement and calculation initiatives. Furthermore, by making shippers responsible, the bargaining position of transport operators for passing through the costs of emissions measurement and calculation will be improved, addressing the problem of the relatively high costs of measurement and calculation for small operators.

## Assessment of the impacts

Two companies interviewed mentioned that costs would be some of the most significant impacts of the measure, namely on IT systems, data, and salaries. Both companies also mentioned that this could be particularly impactful for SMEs. However, it was also mentioned that there could be some cost reduction from having to use a harmonised method instead of several methods.

Both companies also agreed in that behavioural changes from the accounting alone are unlikely.

## External developments affecting the uptake of GHG emissions measurement and calculation

In some of the interviews, external developments that may affect the (future) uptake of GHG emissions measurement and calculation in the transport and logistics sector have been discussed. Two representatives from transport associations mentioned the extension of the EU ETS to road or maritime transport as an incentive to take up emissions measurement and calculation by operators within these sectors. A representative from another transport association expects that there will emerge an autonomous increase of the demand for GHG emissions measurement and calculation, although it is uncertain in what time frame. Finally, also one of the individual transport operators expects that the demand for GHG emission figures will increase from all players in the ecosystem (i.e. clients, governments, NGOs, etc.).

## Alternative applications of harmonised GHG emissions figures

In several interviews, alternative applications for harmonised GHG emissions figures were mentioned. Many stakeholders (including transport associations, consumer and passenger federations, individual transport operators and freight transport service users) suggested that harmonised GHG emissions figures could be used to develop a clear (and EU-wide) labelling scheme. The same type of stakeholders also indicate that these figures may be used as criterion in sustainable financing schemes. Using the figures to further develop green public procurement schemes is also mentioned as an option by representatives from a public authority, a transport management systems supplier and a freight transport service user. Operators from freight greening programmes see opportunities to use the harmonised GHG emission figures to (further) develop policy measures, like a $CO_2$ taxation scheme.

Finally, one of the freight transport service users suggest that the harmonised GHG figures may be used as input for the development of sustainable delivery services.

## G.5.5 Short survey-questionnaire to member states

### Current situation and motivations

Currently France requires the disclosure of GHG emissions for transport services provided for both goods and passenger transport and for all journeys that begin and end within French territory. A penalty system for failing to comply will enter into force in 2025.

The methodology requires disclosure at the service level with a well-to-wheel scope. Guidelines are developed by the French Ministry for Ecological Transition and the method covers four levels of precision: the use of default values (only for service providers of up to 50 employees), values calculated by the provider for their entire activity, average values per subset of activities, and measurements during execution of the service.

The French government believes that this helps create non-cost-based competitiveness and allows companies to measure their carbon footprint linked to the services they hire.

### Analysis of the problems and their drivers

The French government emphasizes that while the lack of a common methodology is an important problem driver, and that a methodology that can be used across different modes is necessary, so is the lack of simple access to this information. In this regard it is also necessary to harmonise the information format and transmission methods.

They also acknowledge the need to safeguard the confidentiality of sensitive business information and ensure that data will only be used for carbon accounting.

### Policy measures

The government of France believes that the measurement method should account for methodologies already in use across sectors and ensure coherence between them, for example with guidelines already in place in the maritime sector. This methodology should also be based on “indisputable calculation rules”, especially ones that are well regarded beyond the EU, as otherwise they could be challenged.

They also believe that the information exchange system should be supported by tools, such as the EVE IT solution implemented in France, which aims to facilitate information exchange between service providers and customers.

Some shortcomings they anticipate include the need to explicitly address private car use, complexities in the transport market regarding the heterogeneity of company sizes and revenue, which might imply the need to provide extensive support to the sector, and even include exemptions, for example, for small companies. The number of companies also presents complications for enforcement.

### Assessment of the impacts

The French government anticipates that opportunities for IT companies could appear in the short term, while behavioural changes towards more sustainable modes would only appear in the long term. The measure could also create awareness for individuals and companies to evaluate their carbon footprints and decarbonisation strategies.

While there is no evidence of environmental cost being a major decision factor (compared to monetary cost) for individuals and companies to choose services, it is an essential first step to help them if they wish to do so.

In regards to costs, the French government experiences administrative costs in the form of large teams working on legislation, implementation, consulting and participation in drafting the upcoming ISO 14083 Standard.

They also expect to spend €600-700 thousand in IT systems between 2020 and 2023 to facilitate the implementation (adjustment cost). Enforcement costs would be estimated to increase in the short term and increase only marginally after. If authorities control the calculation method then the cost is borne by the State, and if certification of the calculation is made mandatory, then the cost is borne by businesses.

### External developments affecting the uptake of GHG emissions measurement and calculation

The French government is in general aware of other efforts to harmonise, such as EN 16258, ISO 14083, Regulation (EU) 2015/757 for the maritime sector, and the LCA guidelines from the IMO.

## G.5.6 Stakeholders workshop

### Analysis of the problems and their drivers

The stakeholders in general agreed with the problem drivers as presented, discussion during the workshop was focused on giving details on the ways the problem drivers manifest themselves for each stakeholder.

The stakeholders that participated in the workshop in general agreed with the problems and problem drivers defined. Different stakeholders agreed in that the large differences seen between outputs of different measurement and calculation methods and input data (up to 55% according to a stakeholder from a network implementing green transport programmes) are too big to be useful and comparable. The problem of limited uptake was also discussed by transport users in light of the unavailability of information at the point of sale, for both passenger and goods transport.

The contextual factor of lack of demand was also briefly mentioned by a network implementing green transport programmes, pointing that there is no major requirement for emissions reductions neither top-down nor from customers, and that requests for information tend to be very business specific.
For the driver **'No set of common methodological principles to apply GHG emissions measurement and calculation'** the stakeholders agreed on the need to have a methodology that can be applied across different modes and sectors. In this regard some challenges were identified. Sectoral variability and the need or not for sector specific guidelines (which

seems to be deeply connected to the input data used) was discussed, where it was concluded that even if primary data is used, which would minimise the need for different methodology applications, some minimal guidelines could be necessary, for example for calculations at parcel level in goods transport that need to account for volume and size.

Stakeholders related to maritime transport and aviation were also adamant in highlighting that having different standards across regions can make measurement and calculation for cross-border traffic unmanageable.

For the driver **'No set of harmonised input data to apply GHG emissions measurement and calculation'** stakeholders mentioned a number of related issues, among them the high variability seen in emissions factors, even when the same measurement and calculation method is used. This variability can also be seen in factors being different across geographies, a problem that affects stakeholders operating internationally and globally since it creates conflicts in the measurement and calculation. It was also mentioned that obtaining the input data in the first place can be challenging because of how distributed the data is.

The use of primary data was brought forward as a way to overcome these issues, however, it was noted that obtaining primary data can be quite complex and there can be a trade-off between the ability to report at all and the quality and accuracy of the data.

For the driver **'Reluctance to reveal sensitive data'** stakeholders generally agreed in that there can be legitimate business reasons to withhold data, but also legitimate reasons to request it for emissions measurement and calculation. The concern of the different stakeholders is that requests for data could be exploited if there are no clear guidelines on what can be requested and what cannot be, and some stakeholders mentioned that having an intermediary sharing results but not the source data could be needed.

In the case of the driver **'Lack of trust concerning GHG emissions output data'** stakeholders mentioned the need to verify and check the data for accuracy. The possibility of stakeholders using calculations that underestimate their emissions was also mentioned.

An additional source of lack of trust was also mentioned to be the lack of clarity in who can claim emissions savings between the user or provider of a product or service, which allows for double counting.

For the problem driver **'Perceived complexity and high costs of GHG emissions measurement and calculation'** it was mentioned that higher accuracy, especially that coming from using primary data, can come with increased costs that especially SMEs can find hard to cover.

## Policy measures

The development of CountEmissions EU is supported by the stakeholders that participated in the workshop. Reasons to do so include obtaining accurate and usable decision-making information to ensuring that the situation of different organisations are accurately represented in comparison to other (both to demonstrate their progress in reducing emissions and prevent others from masking their own emissions).

Regarding the methodological framework, stakeholders had a limited understanding of the contents of the upcoming ISO Standard so their input in using this standard either directly or as a basis for CountEmissions EU was also limited. However, there was a clear preference from the majority of stakeholders, especially those operating internationally, for a standard that can be used globally and that accounts for developments elsewhere in the world to prevent having to comply with diverging standards.

The stakeholders debated in depth the provision of input data. The use of primary data was suggested by some stakeholders representing networks implementing green transport programmes and transport users and service providers as a way to overcome many of the issues presented by the use of emissions factors (as discussed in the section on problem drivers), avoiding the need for them and already measurement and calculation for real variations and providing for more accurate measurements that are able to accurately reflect emissions savings from companies without allowing companies to underestimate their emissions by using inaccurate factors.

It was, however, also noted by representatives of transport users and transport associations that the complexity and cost of obtaining primary data could warrant the use of modelled data in many cases. In this regard some stakeholders suggested that the use of primary data should be incentivised, and factors only used as fallback. However, there was no discussion on where these factors should come from.

Regarding the format of emissions output data, a representative form a network implementing green transport programmes mentioned that clear rules would increase transparency and improve data sharing by specifying what is allowed and what is not allowed. Others did not directly disagree, but the suggestion of relying on a gatekeeper that preserved confidentiality was brought forward.

The stakeholders also discussed the provision of sector specific guidelines. Stakeholders from networks implementing green transport programmes and from transport associations mentioned that there are already some privately developed sector specific guidelines, suggesting that this measure could be their preference. A representative from a network implementing green transport programmes also mentioned that it would be a good idea for the EU to provide more accurate factors. It was discussed, as previously mentioned, that the need for sector specific guidelines should be minimised, possibly by using primary data.

Regarding verification of data and calculations, some stakeholders emphasized the need to have a third party in charge of the verification of the data since it can guarantee quality while preserving confidentiality. Representatives from aviation suggested that this third party could come from the sector. The need for a certified process was also briefly mentioned by some stakeholders.

In this regard, various stakeholders believe that the private sector is well positioned to provide software tools that can be certified, as there are already carbon management services offered in the market which could be expanded to include emissions measurement and calculation. Having certified tools could satisfy the need for verification if the data is also verified. A representative from aviation also mentioned that it is possible that a private platform might increase willingness to share data as opposed to a State platform.

It was mentioned during the workshop that the interpretation given to the preferences of stakeholders for voluntary or mandatory instruments from the Open Public Consultation gave mixed results and should not be interpreted as defining a strong preference for one or the other. In this regard, stakeholders in the workshop did manifest that a mandate would be more appropriate to ensure that the data is available, and if the ambition is global.
It was also mentioned, however, that SMEs could have trouble adapting at first.

### Assessment of the impacts

Costs and complexity were at the heart of many of the issues brought forward by the various stakeholders that participated in the workshop. Stakeholders also mentioned in some occasions that SMEs could face disproportionate impact from the policy, due to the costs and complexity of measuring emissions accurately, and that they could face struggles adapting to it.

The comments from stakeholders about private platforms being well positioned to provide emissions measurement and calculation tools also seems to suggest that the providers of these tools could also have economic gains from this activity.

It was also mentioned a by a couple of stakeholders that the accurate measurement is needed to inform decision-making, but critically any concrete behavioural changes that could stem from this were missing from the discussion.

### External developments affecting the uptake of GHG emissions measurement and calculation

In general, the stakeholders knew or were aware of a number of initiatives that aim to promote and assist in the uptake of emissions measurement and calculation. Among them the drafting of the ISO 14083 Standard, the GLEC Framework, and the recent IATA Standard.

## G.6 Conclusions

### Current situation and *motivations*

The initiative has received general support from almost all stakeholders in the open public consultation and targeted survey. This view was also notable in the targeted interviews and confirmed during the stakeholders workshop, while the short survey-questionnaire sent to member states also reinforced support for it, with national-level initiatives already in place. Stakeholders generally recognise that a harmonised measurement and calculation framework is needed as emissions become increasingly embedded in the broader policy ecosystem and the decisions making processes of consumers/purchasers of services. Businesses are strongly motivated to adequately measure their emissions, which according to targeted interviews is in response to pressure from investors/purchasers, a perception of competitive advantage associated with their products, as well as regulatory requirements as also reinforced in the member states survey-questionnaire. Many see better measurement and calculation as a way to ensure they stay on track to meet their already ambitious (and publicly communicated) sustainability strategies. The results from the targeted survey-questionnaire suggest that a majority of the stakeholders consulted already perform some form of emissions measurement and calculation, although not necessarily for all activities and not necessarily frequently. This notion is also be confirmed by the targeted interviews. What is clear is that it is not a common practice to measure, calculate or communicate transport emissions at the service/trip level of detail.

Emissions measurement and calculation is more mature and harmonised in organisations involved with freight transport than it is in organisations involved in passenger transport. Passenger transport operators do acknowledge that emissions is increasingly looked at during procurement processes and that they need to do more.

Stakeholders highlighted during the call for evidence, the targeted survey-questionnaire and the targeted interviews that there are already ongoing harmonisation efforts and some harmonised methodologies exist, although they could lack the necessary detail for implementation. This was also validated during the workshop. The majority of methodologies currently in use consist of the GLEC and GHG Protocols, but also PEF and sector-specific methods were mentioned.

The survey and interviews suggest that there are many motivations to measure GHG emissions, including internal measurement and calculation, marketing, customer demands and competitiveness in procurement processes, the most prevalent being internal measurement and calculation. This is particularly true for SMEs that responded to the survey. Targeted interviews suggest there is an element of risk management for private sector organisations: they know emissions will be increasingly important to competitiveness (or investor relations) and are therefore investing in systems to both measure/calculate emissions and communicate them effectively.

All consultation activities, however, consistently revealed that emissions are not yet a primary factor in decision-making for acquiring products and services. It is clear that price, time and reliability (quality) remain the primary motivators with emissions amongst the secondary considerations. The survey suggests that SMEs are even less likely to consider it than large companies. During targeted interviews and the workshop the issue arose that it is also hard to consider emissions during decision-making since this information is not available at the point of sale, either for freight or passenger transport, and the response to the short survey-questionnaire revealed that this is something for which a reporting requirement is helpful in addressing.

## Analysis of the problems and their drivers

In general the open public consultation, the targeted survey and the targeted interviews showed that stakeholders agreed with the problem definition, even across users and operators of different modes of transportation, although the targeted survey shows that this agreement is more nuanced among SMEs. The workshop reaffirmed this views.

The lack of a harmonised method and the lack of available data appeared as major problem drivers in the open public consultation and the targeted survey-questionnaire, and were also prevalent in interviews and the workshop. Even if the call for evidence, the targeted interviews and the stakeholders workshop mention that harmonisation has been somewhat solved, these methods lack some specificity and large variance in the results can be evidenced depending on the data used. The short survey-questionnaire to member states also implies that the lack of data is also related to the lack of harmonisation of the format of this data and its transmission methods.

The reluctance to share data was strongly discussed during interviews the workshop. Reasons given included the need to preserve sensitive costs and operations information, especially among SMEs who have less bargaining power, or due to transparency issues, especially in bigger organisations. It was mentioned during the workshop that rules about what can and must be shared could help, suggesting that the lack of said rules could be another important motivation. The response from member states also highlights the need to protect business confidentiality.

Lack of trust in the output of the measurements was also brought up, especially during the call for evidence, interviews, and workshop. The large variance in outputs of the same methodology depending on the data contributes to this issue, as well as a possible use of modelled data and emissions factors to underestimate emissions.

Complexity and high costs of accurate emissions estimates were heavily discussed in the context of the type of input data during the interviews and the workshop. Primary data seems to be preferred by most stakeholders, but this presents higher complexity and costs, while modelled data and the use of emissions factors - while easier to implement - offer less accuracy. This issue was mentioned to be particularly relevant for SMEs, which the survey seems to support at least in terms of employees needed (SMEs were more likely to report needing a large team for emissions measurement and calculation), however this notion is challenged by one of the interviews, where it is claimed that the less complex operations of SMEs make implementation easier overall.

The contextual factor of lack of demand was also brought up in the consultation activities, namely the interviews and workshop. Stakeholders do not see major benefits from obtaining emissions estimates, while it increases their costs in a higher proportion.

## Policy measures

Regarding the design of the policy, there is strong support among all stakeholders and through all consultation activities for a methodology/framework that closely considers already existing work in harmonisation (e.g. GLEC). In this regard, the response obtained from the member states questionnaire suggests that the success of the measure can be highly dependent on being based on established methodologies, especially those with global scope, as otherwise it could open the way for dispute.

The survey, interviews and workshop also revealed that most stakeholders believe sector specific guidelines to be necessary, with a possible role for each sector in collaboratively developing and implementing them. The interviews and workshop did show that some stakeholders also see this as a risk leading to less harmonisation. This could be mitigated (according to some workshop participants) by a centralised approval of any sector specific guidelines (i.e. showing they were consistent with the EU framework). And during the workshop it was mentioned that a preference for primary data could minimise the need for these guidelines in general.

There seems to be a preference for a mandatory instrument across the survey, interviews, open public consultation and workshop, although this preference is much more nuanced in the case of the open public consultation. It is also observed in the survey that SMEs have a bigger propensity to prefer optional methods, or for exceptions in the mandatory instrument. This could be due to a disproportionate impact of a mandatory instrument on SMEs, something that is mentioned as a possibility during interviews and workshops. Interview participants in particular suggested large businesses should take on more of the early costs associated with CountEmissions EU, then work with the SMEs in their ecosystem to facilitate knowledge and process transfer.
The call for evidence, survey and interviews reveal that GHG emissions ($CO_2$ equivalents) are the preferred scope of the method. The interviews and the survey also show that service-level estimations are the most favoured (which is also the case for the member states questionnaire response), followed by product-level estimations. In all consultation activities there was a strong preference for a methodology that would have global scope, in large part because this matches the scope of the operations of many organisations, and compliance would become complicated otherwise.

Well-to-wheel boundaries were also the most preferred by stakeholders in most consultation activities, however, full life-cycle emissions were more strongly supported in the open public consultation, especially among citizens, a stakeholder group that is absent from other consultation activities. The survey also reveals that support for life-cycle emissions is strong among transport service users. In this sense there seems to be a strong division among beneficiaries of transport services (individuals and businesses not directly participating in transport activities) and stakeholders that are a more integral part of the transport system, suggesting also a divide between what is desired by society and what is considered reasonable by the system. From the side of enforcers of regulation, the response to the Member State questionnaire reveals a preference for well-to-wheel boundaries as well, further reinforcing this trend.

A system for verification was also prominent as a necessity across all consultation activities. The open public consultation and the interviews revealed, however, that this can be a costly procedure, while the interviews and the workshop suggested that a system where the methods, tools, and data can be verified to produce verified outputs, with a preference for primary data. In this regard, the survey showed that the role of public or private entities in the procedure was unclear, but the interviews and the workshop suggested that the private sector is well positioned to provide tools for businesses, while the data could be verified by the public sector or through measurement and calculation practices. In the response to the member states questionnaire, it was evidenced that France provides such tools and platforms in partnership between the government and a number of private organisations, which could be a compromise in this point.

For data sharing, during the workshop it was mentioned that clearer rules could help in the process, and during various activities it was mentioned that a neutral third party, which not necessarily has to come from the public sector, could also help. In this regard the member states questionnaire also suggests that the tools offered could also double as a data sharing platform.

In general, stakeholders mention a need to pay close attention to SMEs in the policy design to some degree, however, there are some caveats. The open public consultation revealed that respondents considered slightly less necessary that the methodology caters to companies of different sizes (especially among citizens and NGOs), while they did strongly support that verification and validation could be done if not too burdensome (which possibly relates to company size). As previously mentioned, participants in the interviews and the workshop also show concern in that the methodology or a mandatory requirement could be especially burdensome on SMEs. The response to the member states questionnaire reveals a preference towards methodological guidelines that are less stringent for smaller companies. There is overall a concern about designing the policy to be compatible with SMEs, but the way in which this is done is not entirely clear between stakeholders and between consultation methods.

## Assessment of the impacts

Unsurprisingly, the survey revealed that stakeholders believe that the initiative will be more impactful if a mandatory instrument is used. Respondents felt that the external effects of transport could dramatically increase in this case. However, respondents in the survey also do not expect large emissions reductions from the measurement and reporting alone. The insights from the interviews and the workshop also revealed a similar situation, where there is little behavioural change directly from measurement and reporting, however, the information could still be used to set and benchmark emissions reduction goals and having this information ex ante is a required (but likely not sufficient) for decision-making in this regard.

One of the most significant impacts revealed by all consultation activities is the cost that it would signify for the different stakeholders. According to the call for evidence, interviews and workshop, this cost is increased if there is a need to comply with diverging requirements, either across countries or regions, or due to not considering existing developed methodologies, something which is also reinforced by the open public consultation where respondents generally agree with cost savings deriving from a single harmonised method (although citizens and NGOs are less likely to agree in this point). The interviews, survey and workshop also suggest that the burden of complexity and cost might be larger for SMEs, while the survey also reveals that SMEs are more likely to claim they would need a large team for calculating transport emissions, supporting that their perceived labour costs could be bigger.

The results of the survey and insights from the workshop also suggest that there is a place for IT companies to provide services and tools related to emissions measurement and calculation, from which they can derive benefits.

While the lack of demand came up as a factor in the problem definition during the consultation, no impacts were clearly identified by stakeholders in this area beyond the fact that the uptake will be much higher (in this case it could be interpreted that the requirement is creating the demand).

## External developments affecting the uptake of GHG emissions measurement and calculation

In general, the stakeholders consulted through different activities were aware of numerous developments in emissions measurement and calculation, namely efforts in creating harmonised methods such as GLEC, GHG Protocol, ISO 14083, PEF, and sector specific methods, which could help to some degree in the uptake of emissions measurement and calculation. The member states questionnaire also revealed that from 2025 onwards a penalty system will enter into force in France for failure to comply with reporting requirements.

In the interviews there was also mention of an expansion of EU ETS to road and maritime transport, which would increase the uptake of emissions measurement and calculation in these modes of transportation.

## Alternative applications of harmonised GHG emissions figures

The survey and interviews revealed that stakeholders see the possibility of green public procurement and certified green delivery as possible applications of GHG emissions figures. The interviews also revealed that labelling schemes, access to sustainable financing, and further policies like carbon taxation could be other applications for the harmonised method.

In general the initiative would seem to facilitate and create demand for emissions measurement and calculation, which is important. However, the initiative should be seen as an enabler that could be necessary but not sufficient for sustainability objectives to be achieved, and on top of which other policies tackling these objectives can be built.

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