International Transport Forum | CPB Corporate Partnership Board

GHG Emissions Accounting and Reporting for Transport

Corporate Partnership Board Report

GHG Emissions Accounting and Reporting for Transport

Corporate Partnership Board Report

The International Transport Forum

The International Transport Forum is an intergovernmental organisation with 69 member countries. It acts as a think tank for transport policy and organises the Annual Summit of transport ministers. ITF is the only global body that covers all transport modes. The ITF is politically autonomous and administratively integrated with the OECD.

The ITF works for transport policies that improve peoples' lives. Our mission is to foster a deeper understanding of the role of transport in economic growth, environmental sustainability and social inclusion and to raise the public profile of transport policy.

The ITF organises global dialogue for better transport. We act as a platform for discussion and pre-negotiation of policy issues across all transport modes. We analyse trends, share knowledge and promote exchange among transport decision-makers and civil society. The ITF's Annual Summit is the world's largest gathering of transport ministers and the leading global platform for dialogue on transport policy.

The Members of the Forum are: Albania, Argentina, Armenia, Australia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Brazil, Bulgaria, Cambodia, Canada, Chile, China (People's Republic of), Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Dominican Republic, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, India, Ireland, Israel, Italy, Japan, Kazakhstan, Korea, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Mexico, Republic of Moldova, Mongolia, Montenegro, Morocco, the Netherlands, New Zealand, North Macedonia, Norway, Oman, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Tunisia, Türkiye, Ukraine, the United Arab Emirates, the United Kingdom, the United States and Uzbekistan.

About the Corporate Partnership Board

The Corporate Partnership Board (CPB) is the ITF's platform for engaging with the private sector and enriching global transport policy discussion with a business perspective. The members of the ITF Corporate Partnership Board are: Airbus, Allianz Partners, Alstom, Amazon, Aramco, AutoCrypt, Bosch, bp, CEIIA, Cruise, DHL, DP World, Enel X, ExxonMobil, FS Italiane, Honda, Hyundai Motor Company, Iberdrola, Kakao Mobility, Michelin, Microsoft, Mott Macdonald, NXP, PTV Group, RATP Group, Rolls Royce, Shell, Siemens, TotalEnergies, Toyota, Trucknet, Uber, Valeo and Volvo Group.

Disclaimer

Funding for this work has been provided by the ITF Corporate Partnership Board. This report is published under the responsibility of the Secretary-General of the ITF. It has not been subject to the scrutiny of ITF or OECD member countries, and does not necessarily reflect their official views or those of the members of the Corporate Partnership Board. Cite this work as: ITF (2024), "GHG Emissions Accounting and Reporting for Transport", *International Transport Forum Policy Papers*, No. 234, OECD Publishing, Paris.

Acknowledgements

The authors of this report are Parnika Ray and Diego Botero of the International Transport Forum (ITF), Alan Lewis of the Smart Freight Centre (SFC) and Verena Ehrler of the IÉSEG School of Management. The overall project was managed by Parnika Ray.

The work for this report was carried out in the context of a project initiated and funded by the ITF's Corporate Partnership Board. CPB projects are designed to enrich policy discussion with a business perspective. They are launched in areas where CPB member companies identify an emerging issue in transport policy or an innovation challenge to the transport system. Led by the ITF, work is carried out in a collaborative fashion in working groups consisting of CPB member companies, external experts and ITF staff.

The report draws from contributions and insights that emerged at the ITF Corporate Partnership Board (CPB) hybrid workshop held on 26 April 2024 at the Organisation for Economic Co-operation and Development (OECD) in Paris, France, along with insights shared and discussions held with members of the ITF Corporate Partnership Board (CPB) and subject-matter experts. The authors are thankful for information and insights provided by the workshop participants. Participants in this Workshop are listed in Annex B. Parnika Ray managed the workshop with support from Diego Botero.

The authors would like to thank the members of the Corporate Partnership Board companies that have attended the workshop and have been involved in this work: Amazon, Valeo, BP and Shell.

Several external experts were also consulted in the preparation of this report. Special thanks for further contributions and insightful comments during the review process go to: Amir Safaei (GHG Protocol), Buddy Polovick (US EPA), Boyong Wang (SFC China), Francois Cuenot (UNECE), Greg Waters (IFRS Foundation), Marc Cottignies (ADEME), Niccolò Pieri and Szymon Oscislowski (European Commission, DG Mobility and Transport), Usman Khan (CDP), and experts from SBTi.

The authors also thank ITF colleagues Camille Larmanou for assistance in publishing the report and Edwina Collins (external) for copy-editing the report, Elisabeth Windisch, Co-head of the ITF Research Centre, for reviewing the draft report, and Sharon Masterson, who manages the Corporate Partnership Board and its activities

Table of contents

Figures

Tables

Boxes

Acronyms

ADEME	Agence de l'environnement et de la maîtrise de l'énergie
BSR	Business for Social Responsibility
CBAM	Carbon Border Adjustment Mechanism
CCF	Corporate carbon footprint
CDSB	Climate Disclosure Standards Board
CEN	European Committee for Standardization
CNIS	China National Institute of Standardization
CSRD	Corporate Sustainability Reporting Directive
CSRGT	Continuing Survey of Road Goods Transport
DUKES	Digest of United Kingdom Energy Statistics
EDGAR	Emissions Database for Global Atmospheric Research
EFRAG	European Financial Reporting Advisory Group
EPA	Environmental Protection Agency
EPD	Environmental Product Declaration
EpE	Entreprises pour l'Environnement
ESG	Environmental, Social and Governance
ESRS	European Sustainability Reporting Standards
EU	European Union
EC	European Commission
EV	Electric vehicle
GHG	Greenhouse gas
GLEC	Global Logistics Emissions Council
GWP100	Global Warming Potential over one hundred years
IASB	International Accounting Standards Board
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICE	Internal combustion engine
IEA	International Energy Agency
IFRS	International Financial Reporting Standards
IFRS S1	General Requirements for Disclosure of Sustainability-related Financial Information
IFRS S2	Climate-related Disclosures
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
ISSB	International Sustainability Standards Board
LCA	Life cycle analysis
LSP	Logistic service providers
NFRD	Non-Financial Reporting Directive

NGFS	Network for Greening the Financial System
OEM	Original equipment manufacturer
OTAQ	Office of Transportation and Air Quality
PCF	Product carbon footprint
PCRs	Product category rules
RoRo	Roll-on roll-off
SASB	Sustainability Accounting Standards Board
SBTi	Science Based Targets initiative
SEC	Securities and Exchange Commission
SFC	Smart Freight Centre
SLOCAT Partnership	Sustainable, Low Carbon Transport Partnership
SMEs	Small and medium enterprises
TCFD	Taskforce on Climate-Related Financial Disclosures
TDC	Transport Data Commons
TFND	Taskforce on Nature-related Financial Disclosures
US EPA	United States Environmental Protection Agency
UNECE	United Nations Economic Commission for Europe
UNEP FI	United Nations Environment Programme Finance Initiative
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute
WWF	World Wildlife Fund
ZEFI	Zero Emission Freight Initiative

Glossary

Term	Definition
Air pollutant	CO, NOx, NMVOCs, PM10, PM2.5 and SOx emissions can be grouped into acidifying substances, particulates and ozone precursors. Transport contributes significantly to emissions of NOx, NMVOCs, PM, and CO. NOx contributes to acidification, ground-level ozone formation, and particulate formation.
Activity-based calculation	Calculating GHG emissions based on activity data for transport activities incorporates the travelled distance, vehicle occupancy rate (measured in weight or volume) and emission factors.
Backhaul	The return trip made by freight-carrying vehicles (i.e. trucks, ships) after delivering goods to a destination.
The Base Empreinte	The Base Empreinte® is the French official public database of emission factors and inventory data sets required to carry out carbon accounting exercises for organisations and environmental display of consumer products and services. The Base Empreinte® is a merger of Base Carbone® and Base IMPACTS®.
Black carbon	A fine particulate matter that results from the incomplete combustion of carbon-based fuels. It is a short-lived climate pollutant that strongly warms the atmosphere compared to CO_2.
CDP	A global not-for-profit organisation that created a global disclosure system for corporate and subnational entities. CDP enables investors, companies, cities, states, and regions to better manage their environmental impacts. The system covers environmental information, including emissions, deforestation, water security, transport, etc.
CO_2e	GHG emissions are calculated in “carbon dioxide equivalents” or CO_2e. It 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.
Corporate Sustainability Reporting Directive (CSRD)	Sets standards for the Environmental, Social and Governance (ESG) information that companies must report. The Directive requires European companies and foreign undertakings (publicly listed companies and companies above a revenue threshold) operating in European-regulated markets to disclose certain sustainability information when they are under the scope of the Directive.
CountEmissions EU	An upcoming regulation designed to address the barriers hindering the harmonisation of GHG emissions accounting and its uptake for multimodal,

	door-to-door transport services for passengers and freight in the European Union.
Emissions accounting	Accounting for emissions is the quantification of GHG emissions. It involves measurements, calculations, and allocation of emissions produced directly and indirectly from companies, cities, states, and regional activities within a set of boundaries. Aggregations and/or allocation towards freight or passenger activity are part of emissions accounting for transport.
Energy-based calculation	Calculating GHG emissions based on energy data for transport activities considers the quantity of energy (fuel) used, the refrigerants released and emission factors. Fuel spend and related price data may be used to compute the fuel consumption if primary fuel-use data is unavailable.
Emission factor	Emission factors, that relate the amount of energy used to the GHG emissions, are used in every GHG calculation, either directly in an energy-based calculation or embedded in the emission intensity used in an activity-based calculation, and so play a critical role in delivering an accurate calculation output.
Emissions intensity	The amount of GHG emissions released per unit of activity. In the freight transport sector, this activity is typically measured in tonne-kilometres, representing the emissions produced per tonne of cargo transported over one kilometre.
Greenhouse Gas	A gas that contributes to the greenhouse effect by absorbing infrared radiation, or gases that trap heat in the atmosphere. Based on the Kyoto Protocol, it includes carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3).
International Sustainability Standards Board (ISSB)	Established in 2022 as part of the IFRS Foundation to respond to market reporting standardisation needs. ISSB reporting standards seek to enhance investor-company dialogue that benefits both sides. ISSB developed decision-enabling and cost-effective standards allowing comparable and comprehensive information about sustainability-related risks and opportunities.
Harmonisation	A process of ensuring that practices are in alignment. For example, harmonisation can increase the comparability of GHG accounting practices by setting limits to their degree of variation.
ISO 14083	The International Organization for Standardization released the ISO 14083 in 2023. It is an accounting standard covering all transport operations, both passenger and freight, including handling goods at terminals and the transfer of passengers at transport hubs. It uses the approach developed in the GLEC Framework v.2.0 to link the emissions of transport operations to the passengers or cargo being transported.

Life cycle emissions	Emissions released during a product's entire life cycle, from the extraction of raw materials to the product's disposal or end use.
Modelled data	Developed using a model fed with primary data and/or GHG emission-relevant parameters of a transport or hub operation.
Primary data	Based on the ISO 14083 definition, it is the quantified value of a process or an activity obtained from a direct measurement or a calculation based on direct measurements.
RoRo	Roll-on/Roll-off (RoRo) transport is a shipping method in which entire vehicles, along with their cargo, are loaded onto specialised vessels using ramps. Upon arrival at the destination port the vehicles are unloaded to continue their trip. This form of multimodal transport is particularly efficient for short maritime distances and smaller freight volumes, offering a streamlined alternative to container shipping.
Science-Based Targets initiative (SBTi)	Develops standards, tools and guidance that enable companies and financial institutions to set consistent science-based targets in line with the 1.5°C target (control global warming to 1.5°C above pre-industrial levels).
Scopes	To help delineate direct and indirect emission sources, improve transparency, and provide utility for different types of organisations and different types of climate policies and business goals, three “scopes” (scope 1, scope 2, and scope 3) are defined for GHG accounting and reporting purposes based on the GHG Protocol Corporate Accounting and Reporting Standard.
Scope 1	Considers all of the company's GHG emissions directly produced from owned or operated assets. This definition is based on the GHG Protocol Corporate Accounting and Reporting Standard.
Scope 2	Accounts for indirect GHG emissions generated from the company’s energy consumption. This definition is based on the GHG Protocol Corporate Accounting and Reporting Standard.
Scope 3	Considers all other indirect emissions sources. Scope 3 emissions come from the reporting company’s upstream and downstream activities, considering the entire value chain. This definition is based on the GHG Protocol Corporate Accounting and Reporting Standard.
Secondary data	Based on the ISO 14083 definition, everything that is not primary data is considered secondary data.
Standard setting bodies	In the context of this report, it refers to organisations developing standards for GHG emissions accounting, such as ISO, GHG Protocol, etc.
Standardisation	A process of writing in a certain way that seeks to enforce a level of consistency or uniformity to certain practices or operations within the selected environment, e.g. the ISO standards.

The GHG Protocol	A multi-stakeholder partnership that offers cross-sector and sector-specific GHG emissions calculation tools. Most notably, the GHG Protocol published the Corporate Accounting and Reporting Standard, a voluntary standard that introduced the division of Scope 1, 2 and 3 emissions. GHG Protocol has also published the Scope 2 Guidance and the Product Life Cycle Accounting and Reporting Standard.
The GLEC Framework	Published by the Smart Freight Centre, the GLEC Framework provides transport sector-specific guidance for consistent implementation of the GHG Protocol for voluntary calculating and reporting emissions from freight transport and logistics operations.
Tank-to-wheel	Emissions generated from the direct use of transport vehicles. Also known as tailpipe emissions. It does not include well-to-tank emissions, which make up part of the total emissions (well-to-wheel).
Transport chain	A sequence of transport modes used to move goods from their origin to their destination. Along the chain, one or more transshipments take place.
Well-to-tank	Emissions generated from the production and transport of fuel (or another energy source such as electricity) for transport vehicle use.
Well-to-wheel	The total emissions associated with transport vehicle use. Including well-to-tank (indirect) and tank-to-wheel (direct) emissions.

Executive summary

Key messages

Enhancing alignment and strengthening implementation of transport emissions accounting and reporting standards are crucial, prioritise these over creating new frameworks

Established standards and methodologies for transport greenhouse gas (GHG) emissions accounting and reporting already exist. Policymakers should integrate these into current or new initiatives, embedding them in guidelines and legislation to ensure consistent and frequent reporting of transport emissions. This applies to both service-level and corporate transport emissions. While some harmonisation exists, further alignment and stronger implementation are essential. All stakeholders must adhere to established standards and methodologies.

GHG emissions accounting and reporting concerns companies of all sizes

In order to reliably decarbonise entire value chains, large companies, as well as small and medium enterprises (SMEs), must participate in GHG emissions data collection, calculation and reporting. Policymakers and industry must particularly support SMEs in this process without burdening them with additional economic costs and multiple non-harmonized information requests.

Transparent, high-quality and verified data is crucial for GHG emissions accounting and reporting

Organisations need clear data quality standards and accreditation processes to ensure the sourcing and sharing of high-quality primary and secondary data. Efficient and user-friendly data communication solutions are essential to reduce administrative burdens while maintaining data integrity and confidentiality. Additionally, regulations should incentivise the use of primary data for transport emissions calculations wherever possible, supported by reliable, neutral data repositories to encourage data sharing and increase trust in shared data. Reporting should clearly specify the source and quality of data used for any calculations.

Main findings

The transport sector contributes significantly to greenhouse gas (GHG) emissions, making it a vital sector to decarbonise. According to the ITF's Transport Outlook 2023, transport-related emissions may not fall fast enough by 2050 due to the increasing transport demand and current decarbonisation policies that lag behind high ambition scenarios. Global goals, such as the Paris Climate Agreement, underpin the efforts to reduce all GHG emissions, define industry transition pathways, and achieve net zero.

To support these global goals and facilitate regulations, numerous methodologies, standards, regulations and reporting frameworks have been developed over several years. While these methodologies and standards contain reporting guidance, they do not necessarily provide a platform for actual reporting, which is available separately. More recently, significant efforts have been made in the transport sector to harmonise the methodologies and standards that underpin these initiatives. However, aligning standardisation is one of the key aspects to achieving climate targets for transport and needs to be further advanced and supported by policy makers on the national and supra-national levels.

The two high-level, global anchor points for GHG accounting and reporting (for transport and non-transport activities) are the ISO 14000 series of standards, developed by the International Organisation for Standardisation (ISO), and the Greenhouse Gas (GHG) Protocol's standardised frameworks. The GHG Protocol's frameworks are designed to calculate and manage all GHG emissions from private and public sector operations, value chains, products, and mitigation actions. Within the ISO 14000 series, ISO 14083 is the leading transport service-specific standard. Both the GHG Protocol and ISO are voluntary frameworks that consist of interrelated documents for different applications. The implementation of the GHG Protocol and ISO therefore relies upon direct acceptance from the organisations to which they apply or reference within legislation or other voluntary initiatives such as CDP and the Science Based Targets Initiative (SBTi). The European Commission is developing a proposal for the accounting of GHG emissions of transport services, through a regulation referred to as CountEmissions EU, using the EN ISO 14083:2023 standard as the calculation methodology.

In recent years, GHG emissions calculation, standardisation and reporting have advanced for the freight and passenger transport sectors. The freight sector has notably made more progress than the passenger sector, due to the commitment of numerous actors – including companies, industry associations, governments, standard-setting bodies and NGOs – who have collaborated to develop and implement common, global methodologies, standards and frameworks and continue to do so for further refinement. As a result, these have already gained significant acceptance and uptake worldwide. While efforts have been made to link these different types of interventions together (i.e. methodologies, standards, reporting and regulations), more could be done to make these links transparent to their users, strengthen the impact and efficiency of these efforts, and avoid ever-increasing economic costs. Ideally, the same needs to be achieved for the passenger sector, bearing in mind the differences between modes, i.e. railways accounting and reporting may be more developed than for the airline industry.

Most reporting to-date has been voluntary. However, sub-national, national and supra-national-level regulations are already in place – or being developed – to enforce mandatory disclosure of corporate and product carbon footprints for all activities, assess risks related to climate transition and define ways of mitigating those risks. For example, the state of California (United States) passed the Climate Corporate Data Accountability Act in 2023 that requires both public and private US businesses with revenues greater than USD 1 billion doing business in California to report their overall GHG emissions comprehensively. Similar mandatory reporting regulations exist in the European Union, such as the Corporate Social Responsibility Directive (CSRD) passed in 2023. Beyond regulations, there is growing investor and public pressure on companies of all sizes to disclose their emissions and act upon emissions reductions.

Companies and transport service providers may face industry-specific challenges around data collection, interoperability of standards and comparability of reports. Addressing these challenges is crucial for the transport sector to contribute fully to global decarbonisation efforts. An in-depth, consistent, and transparent GHG inventory that disaggregates the contribution of transport services is essential for companies as it allows them to identify climate-related risks and enables them to manage these risks. GHG inventories also help them to improve their efficiency by optimising the use of resources. A company needs to know what its emissions are, where they come from, and how those can be reduced for the optimisation of its processes, to reduce its environmental impact, to gain investor confidence and build their reputation for being responsible. Hence, there is a strong business case for sustainability, and companies must take urgent action to decarbonise.

Top recommendations

Accelerate further alignment of different standards and methodologies to ISO 14083

ISO 14083 has emerged as the leading transport service-specific standard for effective data collection, calculation and reporting of GHG emissions in a global transport supply chain. Policy makers must enable further alignment of different standards and methodologies around ISO 14083 to support international cooperation and standardisation of transport GHG emissions accounting and reporting. New national regulations, standards and industry practices must build on ISO 14083 to ensure global alignment for international transport services.

Deepen collaboration between existing initiatives to optimise the efficiency and effectiveness of transport GHG emissions accounting and reporting

Collaboration already exists among different standard-setting and legislating bodies (e.g. ISO, GHG Protocol, European Commission) and reporting frameworks (e.g. CDP, CSRD) to align transport GHG emissions calculations and reporting requirements. However, continued collaboration between existing initiatives for further standardisation and interoperability is crucial for ease, efficiency and effectiveness of accounting and reporting by entities to reduce emissions. Collaboration between industry, decision makers, standard-setting bodies and reporting platforms is essential for strengthening global efforts to tackle emissions reduction.

Build an internationally applicable, harmonised framework and validation process for emission factors

Emission factors, that relate the amount of energy used to the GHG emissions, are used in every GHG calculation either directly in an energy-based calculation or embedded in the emission intensity used in an activity-based calculation, playing a critical role in delivering an accurate calculation output. Policymakers must enable the building of an internationally applicable, harmonised framework and validation process for emission factors (considering regional specificities), covering all energy carriers, to facilitate comparable and accurate emissions calculation and reporting.

Adopt data quality and sharing standards to support efficient, standardised and transparent GHG emissions accounting and reporting while ensuring data confidentiality

Data is the key input for emissions calculation and the output. It is the crucial information shared between the different stakeholders for emissions accounting. Therefore, data format, quality, generation frequency, and conditions under which the data is generated determine the meaningfulness of any emissions calculation and reporting. Policy makers must encourage the development and implementation of ISO standards for data quality and data quality monitoring, reliable tools for sourcing primary data, and high-quality data repositories. Guidelines for the development, update and format of data repositories, which are also publicly accessible and protect confidentiality of data sources require government support.

Increase training and awareness across all stakeholders to maximise the uptake and impact of best practices

Standards, principles and guidelines on best practices exist for data collection, calculations and reporting for GHG emissions, yet more awareness and uptake of what already exists is needed for all stakeholders. GHG emissions accounting and reporting is essential across the spectrum – from large companies to SMEs – to ensure decarbonisation across the entire value chain. Moreover, it is essential to introduce guidance to support the passenger transport sector in reaching the levels of experience already achieved in freight transport.

Understanding greenhouse gas emissions accounting and reporting for transport

Greenhouse gas (GHG) emissions from the transport sector represent one of the fastest-growing sources of global emissions, posing significant risks to both the environment and the economy. This report aims to demystify the complex landscape of emissions calculation and reporting for transport, which is often characterised by plethora of methodologies, standards, and regulations. The reporting landscape is rapidly evolving for transport and wider sustainability goals to support global commitments such as the Paris Climate Agreement.

Regulations at the national and supra-national levels are either already in place or being developed to enforce mandatory disclosure of corporate and product carbon footprints, assess risks related to climate transition and define ways of mitigating those risks. While effort has been made to link these different types of interventions together, more could be done to make these links transparent to their users and to strengthen the impact and efficiency of these efforts.

While reporting is still voluntary, investor and public pressure is mounting on companies of all sizes, whether public or privately owned, to disclose and reduce their emissions. Small and medium-sized companies (SMEs) are currently exempt from mandatory regulations but have started to experience pressure to disclose and reduce their emissions. While it is true that reporting can be burdensome for SMEs, governments and industry must support them in their sustainability journey to support global decarbonisation efforts. Companies that do disclose emissions and act upon emissions reductions are favourable to investors and strengthen brand reputation. Hence, there is a strong business case for sustainability and companies must act, as the cost of inaction is higher.

To understand and manage climate risks, a GHG inventory is required. Countries, for instance, already have GHG inventories and are reporting those to United Nations Framework Convention on Climate Change (UNFCCC) as part of their contracting commitment to the convention (198 countries in 2024). The same applies to the private sector. A company needs to know what its emissions are, where they come from, and how those can be reduced for the optimisation of its processes, to reduce its environmental impact and gain trust from investors. Hence a company must have an in-depth, consistent, and transparent GHG inventory.

The objectives of this report are to:

- assess the current state of GHG accounting and reporting practices in the transport sector
- identify key challenges and barriers to accounting and reporting of GHG emissions for transport, more specifically for the freight sector, and map out how these could be overcome
- highlight best practices and existing harmonisation efforts for GHG accounting and reporting practices.

This report provides a high-level roadmap for improving transparency and consistency in emissions accounting and reporting, ultimately supporting the industry in its efforts to reduce its environmental impact. It provides a broad overview to a wide audience with varying levels of expertise of some of the most important methodologies, data requirements, reporting practices and regulations that exist or are upcoming on this subject. While the recommendations target policy makers, the report aims to inform

industry, corporates, SMEs, and relevant NGOs. It showcases that alignment of GHG emissions calculation, reporting and standardisation have advanced for the transport sector because of international co-operation between stakeholders, and, as a result, it has already gained significant acceptance and uptake worldwide. Aligned standardisation is one of the key aspects to realising climate targets for transport. It needs to be further advanced and supported by policy makers on the national and supra-national levels.

The fundamental concepts of GHG emissions calculations are explained, reviewing the reporting requirements for transport-related emissions, and exploring the role of existing frameworks in guiding the transport sector towards more sustainable practices. This report covers GHG emissions only and does not cover other pollutants. Though providing a high-level overview of some of the most well-known accounting and reporting practices for transport, this report must be read in conjunction with technical guidance already published by standard-setting and reporting bodies for a more detailed understanding of methodologies, standards and reporting requirements. Due to the depth of the technical guidance already available, explaining those in detail is beyond the scope of this report. References to published in-depth technical guidance are provided in the reference section as well as throughout the chapters of the report. Additionally, readers must keep abreast of new developments in this area, which are occurring at a fast pace, as the report may not be able to capture those at the time of publication.

Chapters of this report are organised as follows: first discussing selected methodologies, then data requirements for these globally accepted methodologies, and finally selected reporting frameworks. The list, however, is not exhaustive. References are made to freight and passenger transport services, original equipment manufacturers (OEMs) and product carbon reporting. At times the focus is more on the freight sector as it has advanced more than the passenger sector thanks to the commitment of numerous companies, industry associations, governments, standard-setting bodies and NGOs that have come together to collaborate on the development and implementation of a common, global methodology framework. Lastly, a broad overview of global regulations and examples of work being done by some governments is discussed.

Product carbon footprint and corporate carbon footprint

The growing emphasis on sustainability and the reduction of GHG emissions has led to the development of various approaches for calculating and managing environmental impact. Among these, the concepts of product carbon footprint (PCF) and corporate carbon footprint (CCF) are particularly common. A third concept is the logistics network emissions. This concept, though not formalised like the other two, is related to GHG emissions reports provided by transport service providers on their operations and services. A GHG emissions report, linked to the service provided by the transport service provider to their customer, is more relevant for the transport sector. It can be used as a contribution to related product and corporate carbon footprints.

The PCF focuses on the total GHG emissions associated with the life cycle of a specific product, from raw material extraction, manufacturing, and transport to its use and eventual disposal or recycling. It is a detailed assessment that captures emissions at every stage of a product's life, explaining the environmental impact of producing, using, and disposing of that item (GHG Protocol, 2011b). Companies often use PCF to assess the environmental performance of individual products, which can inform product design, marketing, supply chain management, and sustainability strategies.

The CCF, on the other hand, represents the total GHG emissions a company generates. This includes direct emissions from owned or controlled sources, indirect emissions from the generation of purchased electricity, and all other indirect emissions occurring in the value chain of a company. CCF provides a

comprehensive view of a company's climate impact, considers all of its operations, from production to business travel, to waste management and so on. As such, transport emissions can occur in several parts of a company's value chain including upstream and downstream activities, depending on the precise nature of their activities. CCF is crucial for managing and reducing a company's overall environmental footprint and meeting regulatory and voluntary reporting requirements (GHG Protocol, 2004).

Consistency between product-level and corporate-level carbon footprint calculations is vital. For example, in industries like automotive manufacturing, the emissions reported for individual products (such as cars) must align with the overall corporate emissions. Discrepancies between these figures can lead to confusion and undermine the credibility of both PCF and CCF reporting. Hence, using standardised and comparable PCF and CCF accounting and reporting practices is essential. This aspect is discussed further in later chapters of this report.

As regulatory pressures increase, companies that proactively address their product carbon and corporate carbon footprints will be better positioned to meet future regulatory requirements, optimise their lean supply chain management, and succeed in a market that increasingly values sustainability.

Financial implications of climate risk in the transport sector

As efforts to address climate change intensify, the financial sector faces increasing pressure to account for climate-related risks, particularly those stemming from GHG emissions. The transport sector, a significant contributor to global emissions, is particularly vulnerable to these risks.

The integration of climate risk into financial decision-making is becoming increasingly important. Climate risks are recognised as financial risks. For example, the relationship between emissions intensity and credit ratings underscores the financial risks associated with carbon-intensive operations. As carbon regulations become stricter, with measures like carbon taxes and emissions trading systems, the financial burden on high-emissions companies will rise, further affecting their profitability and creditworthiness. Such mechanisms depend on globally agreed calculation and reporting mechanisms, such as those discussed in this report that specifically relate to the transport sector and cover all aspects of the calculation – methodology, data (including emission factors – see Box 1. Emission factors**)** and verification processes.

The growing expectations from regulators and investors for transparent disclosure of climate-related data have made it imperative for companies, including those in the transport sector, to address both physical and transition risks associated with climate change. Physical risks, such as extreme weather events and gradual climatic shifts, can disrupt operations, damage infrastructure, and lead to significant financial losses. Transition risks, driven by policy changes, technological advancements, and shifting consumer preferences towards low-carbon alternatives, can lead to stranded assets and increased operational costs.

The Network for Greening the Financial System (NGFS), comprising over 130 central banks globally, has highlighted how physical and transition risks can impact the financial stability of companies across various sectors and entire economies (Cheng, 2024). For instance, climate-related events can damage infrastructures and disrupt supply chains, leading to systemic financial repercussions (ITF, 2024). According to scientific research, emissions are directly linked to more severe climate impacts, such as floods and rising sea levels, which elevate financial risks for companies (Cheng, 2024). These risks are not uniform and vary by geography, sector, and the level of economic development in the affected regions. Hence, shifting from carbon-intensive assets and promoting low-carbon alternatives is needed. With its significant reliance on fossil fuels, the transport sector faces challenges in managing these risks (Cheng, 2024).

One example of an international organisation that is committed to supporting companies in understanding and managing these financial risks is the United Nations Environment Programme – Finance Initiative (UNEP-FI) Risk Centre. Through a range of technical workshops, working groups, and resources, the Risk Centre helps companies integrate climate risk into their broader risk management frameworks. This support is particularly relevant for the transport sector as it navigates the evolving landscape of climate-related financial risks and strives to reduce its environmental impact

Methodologies and standards for greenhouse gas emissions accounting

Established methods and standards for accounting GHG emissions of transport (both passenger and freight) have been developed over the past two decades. They describe how calculation and reporting of GHG emissions should be executed. This chapter provides a high-level roadmap to understanding the most frequently used global methods, standards, and transport sector-specific frameworks. Moreover, this chapter discusses the challenges associated with emissions accounting, along with recommended actions to overcome those challenges. Additionally, some best practices for GHG emissions accounting are provided for companies and policy makers.

Based on a European Commission study, standards are defined as calculation and/or allocation rules that stand by themselves and can be referred to when the rules of the standard are being followed. Methodologies also provide a set of rules, in this context concerning the calculation, allocation and reporting of emissions of transport services, that can be linked to one or more regulations, policies, reporting or incentive programmes etc. (Schroten et al., 2023).

Overview of methodologies and standards for overall greenhouse gas emissions accounting

The two leading global anchor points for GHG accounting and reporting are the ISO 14000 series of standards, developed by the International Organisation for Standardization (ISO), and the Greenhouse Gas Protocol's standardised frameworks, designed to calculate and manage GHG emissions from private and public sector operations, value chains, products and mitigation actions.

Both the GHG Protocol and ISO are voluntary standards frameworks and rely for their implementation upon direct acceptance from the organisations to which they apply, or reference within legislation or other voluntary initiatives such as CDP and the Science Based Targets initiative (SBTi). It appears that the GHG Protocol is generally referenced by companies whereas governmental organisations tend to refer to ISO standards.

Both the GHG Protocol and ISO consist of several interrelated documents for different applications, with the GHG Protocol standards tending to be slightly higher level in nature, leaving more flexibility for interpretation in terms of calculation approach. The main reference points for GHG Protocol are the Corporate Accounting and Reporting Standard, the Corporate Value Chain (Scope 3) Accounting and Reporting Standard, the Product life Cycle Accounting and Reporting Standard and the Scope 2 Guidance and (GHG Protocol 2004, 2011a, 2011b, 2013). Within the ISO 14000 series, the most common reference points are ISO 14040 and 14044, covering principles and requirements for life cycle assessment; ISO 14064, covering principles and requirements for the GHG inventory of an organisation; and ISO 14067, covering principles and requirements for a product carbon footprint, although many more standards have been developed to address specific application challenges. For example, ISO 14083 is the transport service-specific standard for effective data collection, calculation and reporting of GHG emissions in a global transport supply chain.

Emissions accounting is complex and can be daunting for companies. The starting point for calculating GHG emissions, in both the ISO 14000 series and the GHG Protocol, is a bottom-up assessment of energy

use, followed by conversion to GHGs through applying an appropriate emissions factor. However, the terminology used and how the calculation outputs are presented differ significantly. For ISO, the reporting reflects whether the emissions occur due to the direct operation of the emissions source or within the wider economic value chain but does not further categorize the indirect emissions according to the contractual relationship between organisations.

In contrast, the GHG Protocol takes a further step by categorising the direct and indirect emissions according to three Scopes (See Figure 2). These are primarily determined by the contractual relationship between the reporting organisation and the organisation responsible for the operational emissions (GHG Protocol, 2004)[1]. This adds significant complexity to the accounting and reporting process because the same emissions can appear within different Scopes and sub-categories of the various organisations within a corporate value chain. This insight can be beneficial for companies in understanding and prioritising their decarbonisation actions. However, the misalignment in terms of presentation can be daunting as it can obscure the fundamental similarities of the calculation approaches.

It is important to consider that most accounting methodologies and standards are not in competition with the GHG Protocol. Rather several build upon or refer to the GHG Protocol, depending on the context, and note where and how they are aligned with the GHG Protocol to ease this administrative burden from companies.

The evolution of transport-specific methodologies and standards for greenhouse gas emissions accounting

The development of a standardised, transport sector-specific GHG calculation and reporting methodology has been a long process. It originated out of isolated activities being developed in various locations (national or regional level) and for different applications (modal or sub-modal level) at the instigation of either legislators or companies from within the sector willing to show leadership (see Table 1). Early examples include:

- The voluntary SmartWay transport programme established by the United States Environmental Protection Agency (US EPA) for freight transport operators to demonstrate their commitment to transparency and environmental improvement.
- The Clean Cargo programme established in 2003 to support sharing standardised GHG data for maritime container transport between operators and their customers.

However, the need for harmonisation was evident and steps were taken to address the issue. The following is a specific example of harmonisation efforts for the freight sector.

Harmonisation of freight transport emissions accounting

Around 2010, an increasing number of initiatives and calculation tools were springing up independently and the need for harmonisation of approaches was becoming apparent. The commissioning of a research project, COFRET (Carbon Footprint of Freight Transport), funded by the European Commission between 2011 and 2015 brought things to a head (COFRET, 2015). COFRET, originally tasked with developing a European calculation tool for freight transport GHG emissions, identified with advice from its industry advisory board, that the real need was for harmonising calculation approaches through consensus building at global level. This was emphasised in 2012 when, for example, the European Standards Agency (CEN) working separately and in parallel, produced a standard for passenger and freight transport GHG calculation (EN 16258) and the International Air Transport Association (IATA) produced a recommended

practice for calculating air transport emissions, that were in conflict with each other. Other similar examples of differences also exist.

In the subsequent years, research conducted through COFRET and the foundation of the Smart Freight Centre, in 2013 (see Annex A for timeline), as a focus for industry efforts to pull together a harmonized industry-led methodology for freight transport GHG calculation and reporting, led to two key outputs:

1. Firstly, the ISO International Workshop Agreement IWA 16:2015 "International harmonised method(s) for a coherent quantification of CO_2e emissions of freight transport", which set out a series of steps agreed as being necessary for the development of a future freight transport GHG calculation and reporting standard through ISO (ISO, 2015).
2. Secondly, the publication of the initial version of the GLEC Framework by the Smart Freight Centre in 2016, carrying the 'Built-on GHG Protocol' mark, making it the *de facto* freight transport annexe to the GHG Protocol. (see example in Figure 1).

Table 1. Selected standards and methodologies for transport greenhouse gas emissions accounting

Standard/ Methodology	Transport modes covered	Transport sector covered	Geographical coverage	Type of instrument
GHG Protocol: Corporate Value Chain (Scope 3) Standard*	All modes	Passenger and freight	Worldwide	Standard
GLEC Framework v3	All freight modes	Freight	Worldwide	Methodology framework (Aligned with/ Built on GHG Protocol)
ISO 14083**	All modes	Passenger and freight	Worldwide	Standard (Aligned with ISO 14000 series and GLEC Framework. Therefore, aligned with GHG Protocol by association.)
SmartWay programme	All freight modes	Freight	North America	Programme and methodology (Aligned with GHG Protocol and GLEC Framework)
Clean Cargo Carbon Emission Accounting Methodology	Sea transport of containers	Freight	Worldwide	Programme and methodology (Aligned with GLEC Framework)
ICAO/IATA RP1678	Aviation	Freight	Worldwide	Standard
Article L. 1431-3 of the French transport code (Objectif CO_2)	All modes	Passenger and freight	France	Legislation with methodology and programme (Objectif CO_2)
CountEmissions EU	All modes	Passenger and freight	Europe	Legislation with methodology. (Aligned with ISO 14083. Therefore, aligned with GLEC Framework by association.)

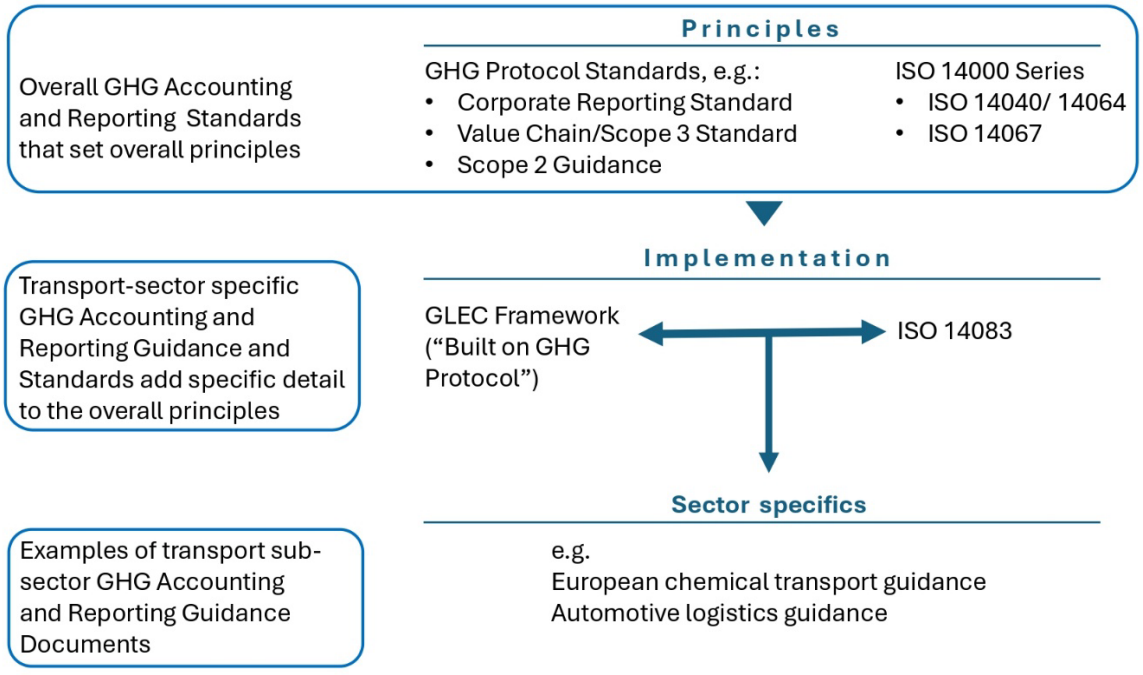
Sources: Schroten et al. (2023) ; European Parliament (2024).

***Notes:** The GHG Protocol Scope 3 standard includes guidance for transport and non-transport activities.

** The European Committee for Standardisation (CEN) has transposed ISO 14083 as an equivalent European standard EN ISO 14083:2023 (European Parliament, 2024)

Table 1 provides a non-exhaustive list of standards and methodologies that have been referred to in this chapter and beyond. Some examples are multi-sectoral while others are sector specific. The multi-sectoral documents tend to provide higher-level principles for GHG emissions accounting, whereas sectoral documents show how those principles can be implemented in specific, more focused applications. In combination these documents provide a workable hierarchy of standards and accompanying guidance, as set out in Figure 1. The figure highlights the role of the GLEC Framework in providing an essential functional link for freight transport between the GHG Protocol and the ISO 14000 series, specifically through its methodological alignment with ISO 14083.

Figure 1. Greenhouse Gas calculation and reporting hierarchy



Source: Based on information from GHG Protocol, ISO 14000 Series, GLEC Framework and ISO 14083

Overview of selected methodologies, standards, regulations and target setting for transport

This section provides general guidance for understanding the emissions accounting landscape for transport. A brief overview of some of the most well-known standards and methodologies relevant to GHG emissions calculation and reporting for freight transport and passenger transport services is provided below. The emphasis is on how corporates can calculate their GHG emissions using these standards and methodologies starting from the building block of an individual transport operation or service. This section should be read in conjunction with the more detailed technical guidance provided by each standard or methodology setting body. This section also explores the alignment in underlying methodologies between several standards, programmes and regulations. Corporates must use the available guidance to urgently

account for their emissions and act to reduce emissions in their full value chains to meet global decarbonisation goals.

The GHG Protocol: Corporate Accounting and Reporting Standard

The GHG Protocol is a multi-stakeholder partnership of private, public and non-governmental organisations convened by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). The Corporate Accounting and Reporting Standard guides businesses in developing a GHG inventory and reporting their emissions to stakeholders. The GHG Protocol offers cross-sector and sector-specific calculation tools and other publications that provide in-depth guidance for challenges highlighted by stakeholders to facilitate the accounting and reporting process.

The Corporate Accounting and Reporting Standard covers the seven greenhouse gases included in the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3) and is based on five pillars (GHG Protocol, 2011a):

- Relevance: Enable insightful emissions reporting that meets the decision-making needs of a wide range of stakeholders, considering an appropriate inventory boundary that reflects the economic reality of the reporting company.
- Completeness: Account for and report on all GHG emissions within the boundaries of the reporting business.
- Consistency: Allow comparisons of emissions over time through standard methodologies. Time-consistent reporting is particularly relevant for long-term objectives.
- Transparency: Disclose relevant assumptions and methodologies employed for calculating GHG emissions. Addressing changes in data, boundaries, and methodologies is equally essential to facilitate the verification process.
- Accuracy: Provide GHG emissions accounting that reflects the activities comprised in the inventory boundaries. Quantification of GHG emissions should not be systematically over or under actual emissions, and any eventual discrepancy should be minimised as much as possible.

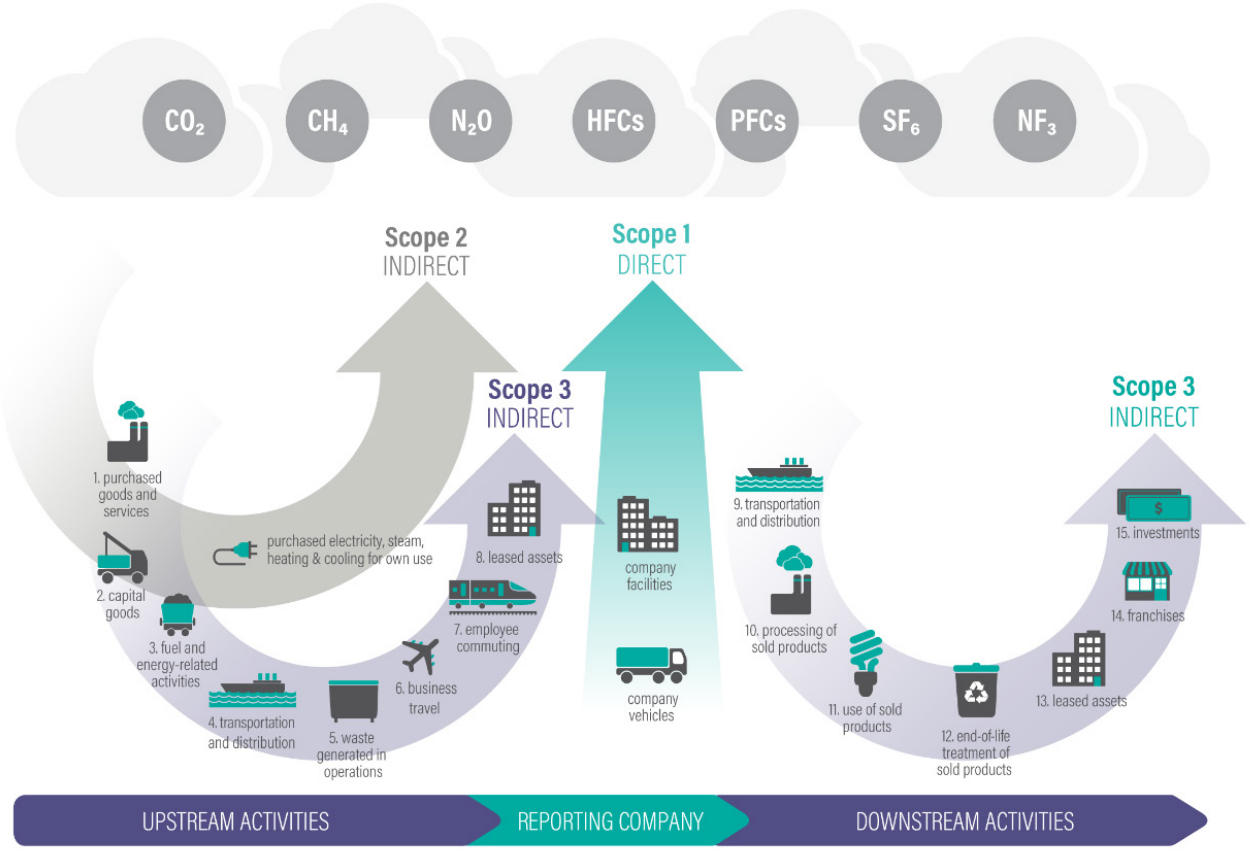
Additionally, the latest Land Sector and Removals Guidance (GHG Protocol, 2024) introduces three new principles:

- Conservativeness: Use conservative assumptions, values, and procedures when uncertainty is high and accurate estimates are not practicable. Conservative values and assumptions are those that are more likely to overestimate GHG emissions and other metrics and underestimate removals.
- Permanence: Ensure mechanisms are in place to monitor the continued storage of reported removals, account for reversals, and report emissions from associated carbon pools.
- Comparability: Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.

The GHG Protocol introduced the division of GHG emissions into three scopes. This granularity allows companies to identify their main emissions sources and relevant actions for reduction. Scope 1 refers to emissions directly produced from owned or operated assets. Examples of Scope 1 emissions are those produced by vehicles and buildings owned by the company. Scope 2 accounts for indirect emissions generated from the company's energy consumption. Finally, Scope 3 gathers all other indirect emissions

sources. Scope 3 emissions come from the reporting company's upstream and downstream activities, considering the entire value chain. For example, the transport and distribution of goods bought or sold by the reporting company in vehicles and facilities not owned or controlled by the reporting company must be included in Scope 3 (See Figure 2**).** Considering how challenging it is for most companies to report Scope 3 standards due to low data availability, the GHG Protocol published the Corporate Value Chain (Scope 3) Standard (GHG Protocol, 2011a) and the Scope 3 Calculation Guidance (GHG Protocol, 2013), both relevant in accounting for transport activity emissions.

Figure 2. Overview of Greenhouse Gas Protocol scopes



Source: GHG Protocol (2013), *Technical Guidance for Calculating Scope 3 Emissions (Version 1.0),* p.6, https://ghgprotocol.org/sites/default/files/2023-03/Scope3_Calculation_Guidance_0%5B1%5D.pdf.

In addition to the emissions disaggregation suggested in the standards, the GHG Protocol provides flexibility by allowing five methods of calculating to account for transport-related emissions:

- Fuel-based: relying on the combination of quantity of energy (fuel) used and refrigerants released (For an explanation of fuel emission factors see Box 1)Fuel spend and related price data may be used to compute the fuel consumption if primary fuel-use data is not available. Companies may optionally calculate emissions from unladen backhaul (i.e., the return journey of the empty vehicle).
- Site-specific: relying on the energy-use and refrigerant release data from storage or distribution facilities allocated to products (unit- or volume-based).

- Distance-based: using calculations based on transport activity as an intermediate reference point.
- Average data: relying on the volume of products, average number of days in storage, and volume, or weight-based emission factors of each distribution activity.
- Spend-based: relying on environmentally extended input-output (EEIO) factors, which estimate GHG emissions on averages typical of specific industries. These EEIO factors are then multiplied by the number of units of economic value to estimate their emissions.

Refrigerants and empty returns must be included in the emissions calculation for both Site-specific and Average data methods approved for transport operations.

The fuel-based method based on primary data is considered the most accurate way of calculating transport GHG emissions. Distance-based is the next most accurate, followed by the average data method. While this flexibility is appreciated by companies who may not have access to primary data or lack the capacity to collect data (typically smaller companies), there is also criticism that different companies use different types of data input, making comparison difficult. Some standards described later in this chapter, such as the GLEC Framework and the ISO 14083, are more prescriptive and do not accept the spend-based calculation methodology due to its poor reliability for transport GHG calculations.

The GHG Protocol pioneered standardised accounting and reporting activities, serving as a reference for other frameworks (i.e., GLEC Framework, PCAF), voluntary reporting platforms (i.e., GRI, CDP), mandatory disclosure regulations (i.e., the state of California in the United States, EU) and target setting initiatives (i.e., SBTi).

Box 1. Emission factors

Emission factors, that relate the amount of energy used to the GHG emissions, are used in every GHG calculation, either directly in an energy-based calculation or embedded in the emission intensity used in an activity-based calculation, and so play a critical role in delivering an accurate calculation output.

GHG emissions = energy used x emission factor

Hence, a lot of work has been focused on calculating such emission factors. Unfortunately, this has resulted in a proliferation of values from activities conducted within the organisational structures of different transport modes, different research entities and different countries. While some of this work results in legitimate testing and development of the methodologies for the calculation and use of emission factors, or the generation of values that represent fuel specifications for specific applications, much of it has merely led to confusion among those companies wishing to decarbonise their transport solutions. The result is the potential for conflict and a risk of companies selecting sources/values purely on what is beneficial to the individual entity, rather than what is correct. The challenge is exacerbated because, over several years, many countries and international bodies have embedded various independently generated values into their own legislations, meaning that a voluntary international standard such as ISO 14083 will not override them.

This issue becomes more important as an increasingly wide set of technical solutions to climate change are proposed, particularly new and increasingly complex low-carbon energy solutions, supported by financial mechanisms that aid the implementation of lower-emissions fuels on a lifecycle basis according to the associated emission reduction. Not only is it important for the climate impact that the emission calculations are correct but when dealing with large amounts of transport energy even a small difference of opinion over an emission factor value can lead to a significant difference in the associated financial transaction. While there may be no such thing as a 100% correct value, it is essential that there is a consensus and linked convention based around values within an agreed, small uncertainty threshold. Without an agreed and validated set of emission factors for a wide range of the most common energy sources, and a mechanism whereby legitimate variations or new energy carriers can be calculated, systems such as carbon pricing or carbon insetting can be considered at risk of conflict and associated legal dispute.

Source: ISO (2023); Lewis (2024).

The GLEC Framework: A methodology for all freight modes

The GLEC (Global Logistics Emissions Council) Framework provides sector-specific context and additional guidance to help with the consistent implementation of the GHG Protocol for calculating and reporting emissions from freight transport and logistics operations. It is now in its third iteration after significant collaborative development since its initial publication. Fundamental elements of the GLEC Framework include:

- the reporting of the full energy life cycle (well-to-wheel/-wake emissions),
- the reporting of emissions linked to all Intergovernmental Panel on Climate Change (IPCC) greenhouse gases,
- its applicability to all freight transport modes, and

- its holistic approach to transport operations (insisting on the inclusion of GHG emissions that result from repositioning trips and empty running).

The GLEC Framework is based on, and aligned with, the most well-respected existing freight transport GHG accounting methodologies, which helped to ensure fast and supportive uptake by major stakeholders within the freight transport sector. This uptake and the award of the Built on GHG Protocol mark provided an impetus for its subsequent use as the basis for the 2018 SBTi transport sector guidance and inclusion as an approved methodology by CDP. It has subsequently been followed by new sector-specific initiatives such as the Sea Cargo Charter and embedded in existing programmes such as EPEAT (Electronic Products Environmental Assessment Tool).

One of the key successful aspects of the GLEC Framework is the way that it links the vehicle operations that are the focus of transport operators to the movement of the goods within the vehicle that are the primary interest of their customers. This link provides consistency in GHG calculation from all key perspectives within the transport value chain. It enables coherent reporting of transport services at the contractual level and at the organisational level by all company types and sizes, meaning it can be used by all stakeholders, whatever their place in the transport value chain.

In the years since its publication, the GLEC Framework has become the methodology reference point for freight transport stakeholders and as a starting point for the GHG emission factors and emissions intensities used in calculations where more specific (primary) data is unavailable.

Version 2 of the GLEC Framework (Smart Freight Centre, 2019), together with the EN 16258 standard for passenger and freight transport (now withdrawn in favour of ISO 14083), was one of the core documents used to produce ISO 14083, and so provides a common perspective for the implementation of both the GHG Protocol and ISO 14083. The latest (3rd) version of the GLEC Framework reflects some of the terminology changes introduced in ISO 14083 and the latest scientific and industry-generated information about GHG emissions from freight transport. In its latest form, the GLEC Framework is a guidance document aligned to both ISO 14083 and the GHG Protocol, providing an invaluable single point of reference for whichever high-level GHG anchor point is preferred by the implementing organisation. (Lewis, 2024; GLEC, 2024)

ISO 14083: A new standard to calculate GHG emissions for passenger and freight transport operations

ISO 14083 (Greenhouse gases – Quantification and reporting of greenhouse gas emissions arising from transport chain operations) is a relatively new standard within the wider ISO 14000 series of standards. ISO 14083 covers GHG emissions from all transport operations, both passenger and freight, including handling goods at the terminals and transfer of passengers at transport hubs. In doing so, it uses the approach developed in the GLEC Framework v.2.0 to link the emissions of transport operations to the passengers or cargo being transported (Lewis, 2024).

As indicated in the title, the standard focuses on GHG emissions linked to transport operations as they fulfil the elements of a multi-leg transport chain. It includes the GHG emissions linked to the production and distribution of the energy used to power the transport and those caused at the point of operation, which is essential if the standard reflects the energy transition required to decarbonise the overall economy.

National legislations tend to be more closely aligned to ISO standards than the GHG Protocol. For example, the European Commission has designated ISO 14083 as the basis for its CountEmissions EU regulation and the strong support provided by the US EPA during the development of ISO 14083. The People's Republic

of China and India are now taking initiatives to anchor transport GHG calculation guidance to ISO 14083, using the GLEC Framework as supporting guidance.

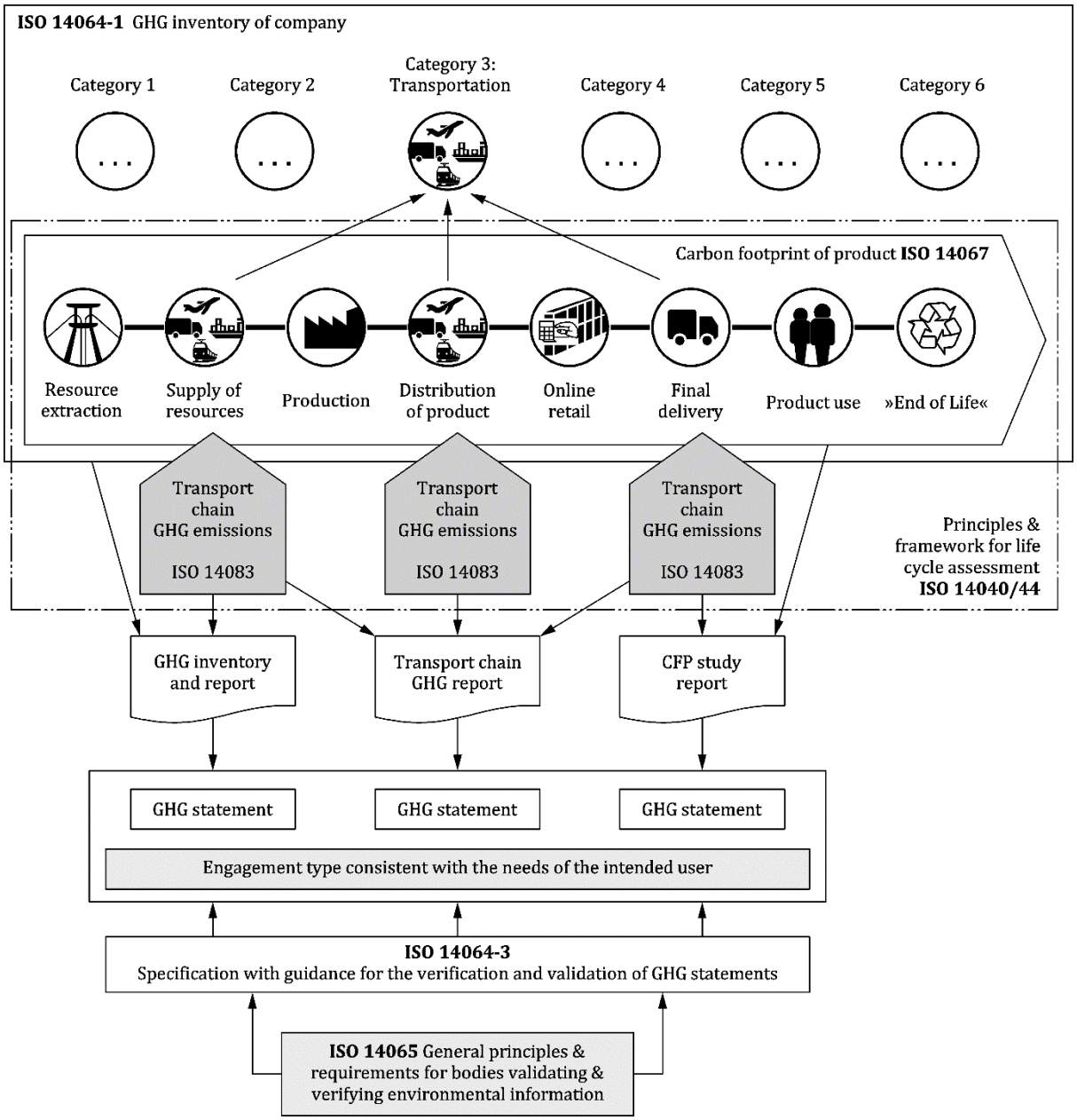
ISO 14083 is designed to provide additional details that naturally slot into the corporate or product GHG calculations defined by ISO 14064 and 14067, respectively (see Figure 3**)**.

As well as its normative elements that focus on GHG emissions from transport operations, the standard also includes several annexes that provide additional guidance on topics such as black carbon emissions, the impact of transport packaging and the role of linked IT systems for vehicle and consignment tracking in generating electricity-related emissions.

Although emission factors are not its primary focus, ISO 14083 contains a first, high-level specification for the composition and presentation of the emission factors used in transport GHG calculations. There is also a selection of indicative values for the main transport energy sources (although these are already known to be out-of-date as the sources used have since been updated).

First published in 2023, ISO 14083 will stay in its current form until the first possible scheduled revision cycle in 2028. Revisions at that point might include further development of the current informative annexes or consideration of additional transport life cycle elements such as vehicle production and end-of-life treatment (ISO, 2023).

Figure 3. Relationship between the ISO 14040 and the ISO 14060 families of standards, using the example of a freight transport chain



Source: ISO 14083:2023 Greenhouse gases — Quantification and reporting of greenhouse gas emissions arising from transport chain operations, (ISO, 2023).

The development of emissions accounting and reporting standards has been a successful international co-operation between different stakeholder groups and organisations. Industry, research organisations, NGOs and governmental bodies worked on advancing the global alignment of standardisation efforts. For example, the working group of ISO brought together experts from all these areas, ensuring that ISO 14083 is built on best practices from previously developed emissions accounting standards and tools. This way, a continuous learning could be achieved. Given this dynamic of reciprocal constructive alignment and the

important developments in the global landscape of GHG accounting and reporting (linked to net-zero targets and mandatory climate disclosure regulations), standards are also updated over time. For instance, the GHG Protocol began a corporate standard update process at the beginning of 2023 to align them with international best practices to ensure that these effectively provide a rigorous and credible accounting foundation for businesses to calculate and support their net-zero targets.

CountEmissions EU: An upcoming regulation for accounting of GHG emissions for transport services

A harmonised European calculation standard for transport was first suggested in 2011 in the White Paper on Transport initiative (No. 29) (European Commission, 2011). This initiative sought to harmonise carbon footprint practices and methodologies. Later, the 2020 Sustainability and Smart Mobility Strategy, produced by the DG Mobility and Transport, envisaged the creation of an EU framework for harmonised measurement of transport and logistics emissions.

The result was the proposal for a regulation on the Accounting of GHG Emissions of Transport Services (European Commission, 2023a), also called CountEmissions EU, which was adopted in July 2023. CountEmissions EU builds on the work of previous international initiatives and EU-level projects. Article 4 of the proposal establishes the EN ISO 14083:2023 standard as the common reference methodology. CountEmissions EU forms part of the Greening Freight Transport Package [2]. This package aims to improve sustainability and operational efficiency, particularly in freight transport at the modal and system levels.

CountEmissions EU is designed to address the barriers hindering the harmonisation of GHG emissions accounting and its uptake for multimodal, door-to-door transport services for passengers and freight (Pieri, 2024).

- First, it will ensure comparability of results from GHG emissions accounting of transport services. This objective aims to provide a common reference methodology and a harmonised set of input data for accounting emissions from transport services, as well as address the issue of the sensitivity of emissions data.
- Second, it will facilitate the uptake of GHG emissions accounting of transport services in business practice.

These objectives aim to provide a harmonised approach for implementing the common reference methodology and supporting its use across all transport segments and modes.

Unlike the EU's Corporate Sustainability Reporting Directive (CSRD), CountEmissions EU is not mandatory. Instead, it adopts a binding opt-in approach: It imposes the requirement to use the common framework only when an entity providing or organising a transport service chooses or is mandated by other means (i.e. for contractual reasons or by other EU of national legislations) to calculate and disclose greenhouse gas emissions data for this service. Therefore, when providers or organisers of freight or passenger transport services starting or ending in the European Union disclose GHG information regarding those services to third parties, whether for commercial or regulatory purposes, they must comply with the CountEmissions EU regulation. As such, CountEmissions EU provides the substance for transport GHG reporting by sharing synergies with other EU legislation such as the CSRD, despite having different levels of aggregation and scope. Furthermore, it incentivises behavioural changes among reporting entities and customers to reduce GHG emissions. Standardisation also facilitates the uptake of GHG emissions accounting of transport services to determine the main sources and how to reduce emissions.

According to Articles 5 – 8 of CountEmissions EU, and with the support of the European Environmental Agency, two databases will be developed to prioritise the use of primary over secondary data: one for the GHG emission factors and another for GHG emission intensities at the EU level. Quality assurance of external databases of GHG emissions intensity by third parties is provided at the EU level, and modelled data must be used in conformity with the reference EN ISO 14083:2023 methodology (Pieri, 2024).

Conformity with CountEmissions EU will be addressed through verification by accredited conformity assessment bodies. The verification shall address the calculation methodology, the sources of input data, the correctness of the calculation and the metrics applied. As part of the proposal, the European Commission includes the importance of verifying emissions reporting as a key driver for trust and standard uptake. SMEs are exempted from verification as this could lead to additional costs.

Science-Based Targets initiative (SBTi): A target-setting initiative

Limiting climate change to 1.5°C is crucial to preventing catastrophic climate breakdown. According to the IPCC, global warming has already started affecting all regions, increasing the risk of extreme weather, droughts and wildfires (IPCC, 2023). To achieve net zero, it has become obvious that businesses have a vital role to play in driving down GHG emissions and building a resilient, zero-emissions economy. To support businesses to play their part in combating the climate crisis – CDP, the United Nations Global Compact, the We Mean Business Coalition, the World Resources Institute (WRI), and the World Wildlife Fund (WWF) joined forces to establish the SBTi, a globally recognised corporate climate action organisation. The SBTi has evolved from an initiative to a formal voluntary standard-setter that develops standards, tools and guidance to enable companies and financial institutions to set science-based targets in line with 1.5°C. By 2024, over 6 000 companies globally had set targets validated by the SBTi.

Aware of the key role the transport sector has in meeting the 1.5°C climate goal, as it is one of the main GHG emitters, the SBTi has been working to develop sector-specific guidelines, releasing the first Transport Sector Guidance and Tool in 2018. This tool is aligned with the GLEC Framework as its methodological basis, enabling target setting for multiple transport categories. Companies using these first transport-specific resources set GHG reduction targets in line with well below 2°C above pre-industrial levels. As of June 2022, the SBTi only validates targets aligned with a minimum ambition of 1.5°C for GHG Protocol Scopes 1 and 2, and 1.5°C or well below 2°C for Scope 3.

The Science-Based Target-Setting Guidance for the Maritime Transport Sector (SBTi, 2023a) is the first global framework for maritime companies to set near- and long-term science-based targets in line with 1.5°C. The Maritime Transport Guidance covers emissions for ship owners, cargo owners, logistics service providers, and other companies that want to calculate emissions from employee commuting. It does not cover financial institution portfolios and recreation or fishing vessels. The guidance provides a target-setting tool to calculate the carbon intensity of activities and develop emissions reduction targets for important decision making around short-term actions towards long-term decarbonisation goals.

In 2021, the SBTi published the guidance, Science-Based Target Setting for the Aviation Sector. This included decarbonisation pathways for the aviation sector as defined by the International Energy Agency (IEA), showing the GHG emissions reductions required to meet with a well-below 2°C ambition. Later, the SBTi released the Technical Aviation Report (SBTi, 2023) detailing an interim pathway for aviation companies to set 1.5ºC-aligned targets. This report targets freight and passenger transport, as well as companies that use aviation services. It harmonises the Science-Based Target Setting Guidance for the Aviation Sector (SBTi, 2021) with the SBTi current criteria, allowing aviation companies to meet the minimum ambition levels required by the criteria, and set net-zero targets.

The Land Transport Guidance (SBTi, 2024) helps to harmonise existing sector-specific guidance within the SBTi's current criteria and incorporates a new method for automotive manufacturers to set 1.5°C emissions reduction targets. The SBTi, in collaboration with the Smart Freight Centre, will develop a more comprehensive Automotive Standard to align with SBTi's Corporate Net-Zero Standard and incorporate best practices available for the sector to decarbonise, potentially using a full life cycle approach (see UNECE section). The Automotive Standard will allow companies from the automotive industry to decarbonise in line with 1.5°C aligned scenarios. Companies will also be able to internalise the main projections and assumptions embedded in the decarbonisation model to develop carbon-reducing strategies.

All sectoral standards are based on SBTi's Corporate Net-Zero Standard Criteria and companies must use the SBTi's Sectoral Decarbonization Approach, or the Absolute Contraction Approach (depending on the emissions sources and/or sector) to set targets. Furthermore, the SBTi requires companies to follow the GHG Protocol Corporate Standard, Scope 2 Guidance, and Corporate Value Chain Standard to account for GHG emissions when developing and submitting targets for validation.

Full life cycle analysis: Product carbon footprint

GHG emissions accounting for transport services and the transport chain are the fundamental building blocks for bottom-up assessment of energy use. Corporate reporting for transport can be developed from those building blocks as they aggregate the bottom-up assessment, which then feeds into the more extensive corporate report that includes emissions from all sources. The reference to harmonisation in this report means starting from these fundamental building blocks and ensuring that those building blocks are used in the different methodologies, standards and reporting frameworks to get alignment (e.g., ISO 14083 based on the GLEC Framework). In this context, Product Carbon Footprint for vehicles for full life cycle analysis adds another layer to the energy use assessment beyond transport services. Since GHG emissions accounting for transport services (which include the methodologies and standards described so far in this chapter) may not capture the full picture, Product Carbon Footprint calculations are the next step in emissions accounting that must be considered. UNECE below is one example of a global transport specific life cycle analysis methodology.

UNECE: Life Cycle Analysis for the transport sector

The UNECE (United Nations Economic Commission for Europe) plays an important role in global transport regulations, particularly in vehicle certification, safety, environmental standards, and automation. UNECE's scope extends far beyond continental Europe and North America, with 152 UN member states as contracting parties to its transport legal instruments.

In the context of Life Cycle Analysis (LCA) for automotive products, UNECE emphasises the need for consistency between corporate-level GHG reporting (Scope 3) and product-level carbon footprint calculations. This alignment is vital to avoid discrepancies and ensure accuracy in reporting. For example, in industries like automotive manufacturing, the emissions reported for individual products (such as cars) must align with the overall corporate emissions for the credibility of both product carbon footprint (PCF) and corporate carbon footprint (CCF) reporting.

Moreover, as the automotive industry transitions towards electric vehicles (EVs) and other low-carbon technologies, there has been a noticeable shift in the distribution of emissions across a product's life cycle. Traditionally, the use phase contributed significantly to a vehicle's overall emissions, particularly for internal combustion engine (ICE) vehicles. However, for EVs, the manufacturing phase contributes a greater share of its emissions. This change will be further emphasised as electricity production is decarbonised and will necessitate a greater focus on upstream emissions, the energy or vehicle cycles, rather than emissions resulting at the point of use. The work of the UNECE highlights the shift in carbon emissions from the use phase to the manufacturing phase as vehicles transition to low-carbon fuels and electrification.

UNECE is focusing on developing an internationally harmonised LCA methodology for the automotive industry, considering the entire life cycle of vehicles (as shown in Figure 4**),** from production to disposal. This effort, which began in late 2022, involves multiple sub-working groups and aims to finalise a standard by 2025, aligning with EU regulatory timelines. The initial focus is on passenger cars, with plans to expand to other vehicle types. The development of standardised LCA methodologies by bodies like UNECE is essential to ensure that PCF calculations are accurate, comparable, and consistent across different products of the same categories and companies manufacturing and commercialising such products.

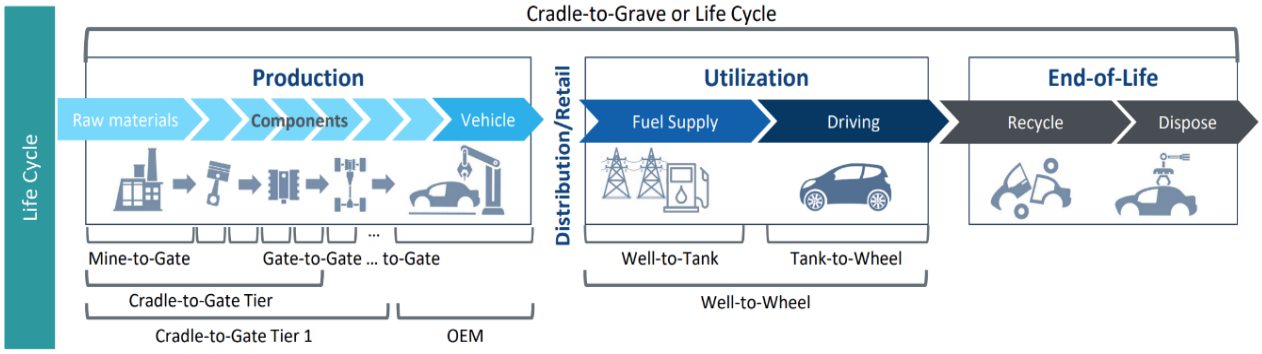
The UNECE also acknowledges the complexity faced by the automotive supply chain in providing consistent data to various Original Equipment Manufacturers (OEMs), highlighting the urgent need for harmonised methodologies. The UNECE's work in this area is driven by the broader goal of decarbonising the inland transport sector by 2050, in line with global efforts to combat climate change.

Other related initiatives are ongoing to provide standardisation of vehicle carbon footprint over the life cycle. These include developing Environmental Product Declarations (EPDs) for electric and plug-in hybrid vehicles and partnerships like the Catena-X consortium, which focuses on digitalising automotive supply chain information. The UNECE also recognises the growing importance of regulatory actions, such as the EU's Carbon Border Adjustment Mechanism (CBAM) and France's link between manufacturing emissions and fiscal incentives. These developments will further drive the need for robust LCA methodologies in the automotive sector. Fiscal incentives linked to manufacturing emissions are clear indications that financial and market outcomes are increasingly being tied to the carbon footprint of products. This trend underscores the importance of accurate, transparent, and standardised PCF reporting, as companies that fail to comply may face significant financial and reputational risks.

The distinction between PCF and CCF is crucial for understanding and managing the environmental impacts of individual products and entire organisations. The insights from UNECE underline the importance of consistency, harmonisation, and standardised methodologies in PCF reporting and the need for

consistency between product-level and corporate-level emissions reporting, especially as regulatory pressures increase. Companies that proactively address these challenges will be better positioned to meet future regulatory requirements and to succeed in a market that increasingly values sustainability.

Figure 4. Life Cycle Assessment methodology for automobiles



Source: CLEPA (2022).

Beyond UNECE, several other initiatives are developing automotive/transport-specific methodologies to determine product carbon footprint:

- Product Category Rules (PCRs) for jets, rail, buses and cars under EPD International
- industry consortium Catena-X to digitalise automotive supply chain information with application on carbon footprint
- TranSensus LCA EU Horizon project to determine a carbon LCA methodology for EVs
- component-specific standards and methodologies, for example on batteries
- Digital Product Passports in the transport sector with high-impact carbon footprint parameters included.

Key challenges and linked actions

Table 2 identifies some of the key challenges for emissions accounting and associated actions that stakeholders can take to address such obstacles.

Table 2. Key challenges and linked actions for transport emissions accounting

Key challenges	Actions required from all stakeholders
Lack of awareness of the existing methodology standards.	Communicate the existence of ISO 14083 and the GLEC Framework as its companion implementation guidance for the freight sector. Encourage international passenger transport bodies to develop a guidance document equivalent to the GLEC Framework to support the practical implementation of ISO 14083 for GHG calculation and reporting for passenger transport emissions.
Apparent discrepancies between ISO 14000 series and the GHG Protocol.	Highlight the many correspondences between the GHG Protocol and ISO 14000 series that are obscured by the differing terminology and how the GLEC Framework and ISO 14083 bring together the two sets of high-level standards for the transport sector. Encourage greater strategic and institutional alignment between ISO and GHG Protocol.
Lack of awareness of the harmonisation already achieved across the various established methodologies, target setting and reporting initiatives.	Owners and promoters of the initiatives (ISO, GHG Protocol, CDP, SBTi, SFC, US EPA, ICAO/IATA, IMO) should proactively acknowledge the core common calculation elements and how they are supported by ISO 14083, and by the GLEC Framework for freight transport.
Lack of uptake of ISO 14083 in some areas and industry sub-sectors.	Follow the example set by the European Commission in using ISO 14083 as the basis for its CountEmissions EU regulation rather than attempting to generate a new approach. Follow the example set by transport and industry sub-sectors, such as the Roll-on/roll-off (RoRo) industry and the European chemical transport sector, in developing and promoting sector-specific guidance that adds detail and implementation support for specialist companies.
The fast pace of change in understanding GHG emissions conflicts with the slow pace of change in international legislative frameworks.	This mismatch can mean that international/formal regulations are known to be out of date, with no transparency as to a swift update (e.g. references embedded to out-of-date IPCC global warming potentials). Increasing training, awareness and buy-in across all stakeholders is essential to speed up change in international legislative frameworks.
Lack of a calculation standard and harmonised rules for the specification of emission factors.	Create active standardisation of emission factor calculation methodology and values between similar initiatives, removing uncertainty and market confusion. Support projects that directly address this issue, such as the European Commission-funded “CLEVER” project.
The perception that GHG calculation and reporting is only for large companies.	Active participation of large companies and SMEs is required for reliable transport value chain decarbonisation. Whilst large companies are indeed better resourced to meet the additional challenges that come with GHG calculation, they are also responsible for a much bigger emissions portfolio and for a contractual value chain that contains many SMEs, i.e. without active participation of the SMEs, large companies cannot make reliable decarbonisation decisions. Policymakers and industry must particularly support SMEs in this process without burdening them with additional economic costs and multiple non-harmonised information requests.

Best practices

The following are some best practice guidelines for the transport sector for accounting GHG emissions, as well as insights for policy makers on what businesses should do:

- Follow the established standards/methodologies and embed them in any existing or new GHG calculation tools, regulations, voluntary and mandatory initiatives.
- Make best efforts to base calculations upon primary data sourced by the operator and shared through the value chain.
- Use established calculation tools that have been checked against ISO 14083 and the GLEC Framework, for example via the SFC's Conformity Assessment Scheme.
- Get calculations independently checked by a competent GHG auditor who follows an appropriate verification process and checklist, such as the SFC's Conformity Assessment Scheme.

Data collection and standardisation

Data is the critical input and output for transport-related emissions calculation. It is the key information shared between the different stakeholders of emissions accounting. The data required by any entity that is calculating its emissions is based on the methodology or standard being used for calculation and later for voluntary or mandatory reporting. Therefore, data format, data quality, data generation frequency, and conditions under which the data is generated determine the meaningfulness of any emissions calculation and reporting. This chapter gives an overview on:

- forms of data used as input to the emissions calculation system
- approaches and requirements for sourcing this data for input, quality requirements, and comparability
- default data collections, why they are necessary and what it takes to ensure they are meaningful as sources for emissions calculations
- key obstacles and challenges experienced when sourcing data for emissions calculation and communicating it with other stakeholders of the freight transport system
- examples of successful solutions for maximisation of data quality and transparency in emissions accounting.

To explore the above, the different approaches of data collection and standardisation for some of the most widespread and established transport emissions calculation standards and tools are considered. These include the GHG Protocol, ISO 14083, GLEC Framework v3, CountEmissions EU proposal for regulation, France's The Base Empreinte, UN Global Compact, US SmartWay programme, SFC China Initiative, SBTi and UNECE. Some of these approaches have already been described in the previous chapter, while country specific approaches will be described in a later chapter. The following approach is based on the definitions and terms used in ISO 14083. As for the previous section, this section should also be read in conjunction with the technical guidance provided by the standard or methodology setting body.

Before looking into the details of data collection, it is important to map out some key priorities present in all the leading emissions accounting standardisation approaches:

- When calculating emissions, it is always desirable to work with measured, i.e. primary, data for analysing transport chains, solutions or networks to be able to more clearly identify possible improvements for the specific, given situations.
- Emissions calculations should cover at least all GHGs listed by the most recent IPCC, and ideally also Black Carbon emissions, i.e. the emissions of "small, dark particles produced from the incomplete combustion of biomass and fossil fuels" (Bond et al., 2013).
- GHG emissions are calculated in CO_2e (Carbon Dioxide equivalents).
- Emissions calculations must cover not only the emissions caused by the transport operation itself, but also the provisioning of the fuel required for carrying out this transport operation (well-to-wheel approach).
- Empty runs and cooling emissions need to be included in transport emissions calculations.

- Transport emissions are calculated by multiplying the transport activity, for example in tonne-kilometre (tkm), with the relevant emissions intensity.

As it is not always possible to gain access to all transport activity data and/or all necessary data to calculate a transport operation specific-emissions intensity, other valid approaches, which enable a meaningful calculation of transport emissions, have been identified. The following section explains the difference between the two categories of data, i.e., primary and secondary data, used as input for GHG emissions accounting.

Primary and secondary data in emissions accounting and reporting

One of the central objectives of transport emissions calculation standardisation is to achieve transparency and clarity. Clearly defined processes and procedures for identifying the relevant data and how to evaluate and communicate them are key, and there must be no space for interpretation. Leaving no space for interpretation is even more important as the interrelations of emissions and transport solutions are often complex and calculating the GHG emissions of specific transport chains can be a challenge, especially as many transport chains, transport networks, and transport organisations are international.

Moreover, the complexity of GHG Protocol Scope 3 emissions calculation and reporting, which includes indirect emissions throughout a company's value chain, presents significant challenges. Leading companies are beginning to tackle this issue by employing the calculation methodologies developed over the past decade and engaging with suppliers to enhance data accuracy. For example, many companies are now breaking down their Scope 3 emissions into specific categories, allowing them to identify and address the most significant sources of emissions within their supply chains.

Using a clearly defined and harmonised vocabulary is, therefore, a prerequisite. It is required to facilitate a joint understanding, to share approaches and tools, and to better communicate and exchange information. Consequently, it has always been agreed by the entire stakeholder group working on the development of ISO 14083, including industry, researchers, consultants, and policy makers, that using one set of definitions is desirable. Therefore, the definitions used in ISO 14083 are those found in previous emissions accounting-related ISOs and other standards and tools. From the beginning, everyone engaged in transport emissions calculation standardisation agreed on the need to work towards one global alignment of standards, tools, and approaches.

The definitions of primary data and secondary data used in ISO 14083 are therefore based on those of ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification (ISO, 2018). They are identical to those used in the GLEC Framework v3 and reflect the understanding of primary data used in the GHG Protocol and related approaches.

Definition of primary data

According to ISO 14083 (ISO, 2023), primary data is defined as "quantified value of a process or an activity obtained from a direct measurement, or a calculation based on direct measurements", and it can "include GHG emission factors and/or GHG activity data". The GHG Protocol defines primary data as "Data from specific activities within a company's value chain" (GHG Protocol Scope 3).

In other words, primary data is the data that is collected where the transport operation or hub operation is carried out. Usually, entities executing such an operation have access to this primary data. It is essential that ownership of the facilities where the transport operation is carried out is not a precursor for access

to data. For example, a truck driver has access to the primary data of fuel consumption for the transport carried out by the truck they are driving, yet they might not own the truck.

Consequently, transport or logistics operators should use primary data to calculate their own transport emissions. Also, transport buyers should aim to receive calculation outputs from their logistics providers based on these primary data to calculate the total emissions of the transport operations carried out for them (GLEC Framework v3.1, Smart Freight Centre, 2024).

The question arises: How and where can primary data be obtained? While information on the transported distance can usually be traced from the Transport Management System (TMS), the weights of the transported goods can be found in the Bill of Lading[3].

However, it is challenging to source relevant information for emissions intensity calculations. This information can be collected in the form of fuel receipts, energy consumption, etc., and it can concern individual trips and operations or annual aggregations over the same type of energy source for the same category of transport operations, i.e. transport operations of the same characteristics. The aggregated values must reflect energy consumption or emissions intensity for a year's worth of vehicle movements. (GLEC Framework v3.1, Smart Freight Centre, 2024)

The fuel and energy consumptions are then translated using emissions intensities into emissions in CO_2e. Methods approved by the GHG Protocol for measuring transport operation-related energy consumption as described in the previous chapter include: Fuel-based, Distance-based, Spend-based, Site-specific and Average-data. (GHG Protocol, 2011a, 2013)

Primary data reflects the real energy consumption related to a specific transport operation or a group of operations with similar characteristics. It allows accurate computation of emissions for these particular operations. Therefore, a calculation based on primary data is required to optimise efficiency and minimisation of emissions.

Such primary data is not always available, though. Instead, secondary data can be used.

Definition of secondary data

The definition of secondary data compared to primary data is simple: everything that is not primary data is secondary data. Based on ISO 14083, secondary data "do not fulfil the requirements for primary data." Secondary data can include data from databases and published literature, default GHG emission factors from national inventories, calculated data, estimates or other representative data and data obtained from proxy processes or estimates. (ISO, 2023)

Two sub-categories of secondary data are further distinguished: modelled data and default data.

Modelled data is developed using a model fed with "primary data and/or GHG emission relevant parameters of a transport operation or hub operation." (ISO, 2023). So, data for energy consumption and emissions are modelled on "available information on types of goods, consignment sizes, journey origin, destination and intermediate handling locations, and any information about the vehicles used, load factors, etc.". The more detailed and exact the model and input data are, the more accurate the generated secondary data.

So why use modelled data when models are fed with primary data? This is because modelled data is not always necessarily generated based on primary data only. In fact, modelled data is an alternative in case not all required data is available in a primary data quality.

If primary data is unavailable or inaccessible, and if there is no possibility to model data, then using default data as a fallback alternative is possible. According to the GLEC Framework v3, “the last resort is to use default data representative of average industry operating practices” (Smart Freight Centre, 2023).

Such representative values allow entities to estimate a transport operation's or network's emissions. However, it will always remain an industry-typical value for an operation, not the value corresponding to the specific situation, operation, and solution.

It must be remembered that secondary data will always be needed to simulate and estimate transport operations that have not been carried out yet, i.e. ex-ante calculations.

In summary, an organisation aiming to minimise its emissions should always endeavour to get access to primary data for its emissions calculation. While industry default values can always be informative when a company wants to benchmark its own footprint, only primary data measures the realised performance.

Overview of data collection, verification and standardisation

It is widely understood that data used for analysing GHG emissions of transport operations should be primary data. Furthermore, data needs to cover emissions from well-to-wheel (sometimes also called well-to-wake for maritime and aviation), i.e. both the transport operation itself as well as the provision of the fuel and energy.

Differences in the various data collection, verification and standardisation approaches are, therefore less related to data itself than to the format in which it is communicated and reported, as explained in the following:

The GHG Protocol distinguishes between Scope 1, Scope 2, and Scope 3 emissions when it comes to transport. These depend on whether the reporting organisation carried out the transport operations, where within the value chain of the reporting organisation the transport takes place, and which form of energy is used. In case the reporting organisation is also the owner of the vehicles or facilities used for the transport operation, the related emissions emerging from the tailpipe are regarded as direct emissions of the organisation and are, therefore, Scope 1 emissions. If the vehicle uses electricity for its propulsion, the emissions are classified as Scope 2, because energy used by electric cars is typically purchased electricity, hence electric vehicle emissions usually fall under Scope 2 of the reporting organisation. Suppose an external entity carries out the transport operations for the organisation. In that case, the related emissions from the tailpipes are considered indirect emissions for the organisation that engages the external entity and, therefore, Scope 3 emissions. However, for the external entity, the same emissions will fall under its Scope 1 or Scope 2. Scope 3 also includes the emissions related to the production and transport of fuel, the well-to-tank emissions, as these are indirect emissions of an organisation.

These differences reflect the different objectives of the GHG Protocol, ISO 14083 and the GLEC Framework. The GHG Protocol is applicable to all sectors and aims to standardise the emissions accounting and reporting of companies, organisations and cities. On the other hand, ISO 14083 and the GLEC Framework aim to calculate emissions of transport chains and networks, regardless of ownership of transport and transport operation facilities. So, while the same data is covered for the emissions calculation of transport operations, the grouping of data varies.

All emissions accounting frameworks considered here aim to provide a tool that ensures reliable, accurate and transparent emissions accounting and reporting. However, it is important to know that standards are not verification tools. Data and process verification are therefore desirable.

The GHG Protocol states that it is not a verification standard. Instead, it supports organisations and companies in sourcing, processing, and reporting data in a way that verification can be carried out more easily.

The Smart Freight Centre, the publisher of the GLEC Framework v3, has an accreditation process for several years to provide certainty to end users regarding which calculation tools follow the Framework and is preparing to extend this to ISO 14083. It has recently set up a Conformity Assessment Scheme linked to the GLEC Framework and ISO 14083 to allow companies that calculate and report logistics GHG emissions to verify their calculations using a specific verification checklist.

A further step towards verification harmonisation will be realised when the CountEmissions EU regulation enters into force (European Commission, 2023a). CountEmissions EU is a legislative proposal for a European Union framework for harmonised measurement of transport and logistics emissions, adopting the EN ISO 14083:2023 standard, as part of the Greening of Freight Package accepted in July 2023 (see Chapter 1, section on CountEmissions EU for additional information). Verification of output data is planned as a secondary act during the implementation phase of the regulation. A verification carried out by an accredited conformity assessment body, as well as the use of certified calculation tools for emissions accounting are a part of the requirements of this proposal.

Existing and upcoming data repositories

If collecting primary data is not feasible, companies should not halt their carbon measurement efforts. Instead, leveraging secondary data becomes a viable alternative. Secondary data from internationally recognised databases or repositories and publications can fill in the gaps.

While the efforts for data collection improve, open-access data repositories which provide reliable sources for default values (input data) are still scarce. This is because such data repositories require a clear format for collection and communication, with precise quality requirements to receive compatible and meaningful data. Obtaining regular, reliable and publicly accessible data across regions and transport modes remains an outstanding issue with shippers, logistics service providers and carriers worried about disclosing too much information by sharing their data. Nevertheless, currently, several data repositories for default data exist. Some repositories are international, some are national, and some are transport mode-specific. Some are continuously updated, while others are outdated without clear requirements towards data updates. Efforts are being made by multi-stakeholder partnerships in the sustainable, low-carbon movement to provide support to data collection, open access data and capacity-building efforts for data interpretation (SLOCAT, 2023). Relevant examples of currently existing or built repositories are provided below.

In the United States, the EPA launched the SmartWay programme as a neutral third party, facilitating the data exchange of carriers, 3PLs and shippers (SmartWay, 2024). Participation is voluntary. The SmartWay programme, is aligned with ISO 14083, GHG Protocol and the GLEC Framework. The approach provides a standardised benchmarking and reporting system and the result is a rich data depository with around 4 000 carriers, shippers, and logistics providers of all sizes contributing their primary data to the platform.

The SmartWay approach is probably one of the best examples of data collection for developing a data repository. Carriers, shippers and logistics providers feel at ease sharing their data without exposing too much of their business. The platform also offers companies an incentive for those who share their data to qualify as programme partners. This is considered an asset and strength as EPA publishes performance rankings of carriers and logistics firms. Consequently, the data available on the SmartWay platform is up-

to-date and renewed continuously. Canada has adopted the tool already, Mexico is piloting it, and other countries worldwide are looking into implementing it. Additional details on the SmartWay programme are provided in a later chapter of this report.

Further, recent regulations such as those in the state of California (the Climate Corporate Data Accountability Act) require companies with revenues greater than USD 1 billion to annually report their Scopes 1, 2 and 3 GHG emissions regardless of whether these companies are publicly traded or private firms (SB-253, 2023). Such reports will also provide good sources for data repositories if the data is anonymised and clustered into categories of similar characteristics.

In the European Union, the Emissions Database for Global Atmospheric Research (EDGAR) provides independent estimates of the global anthropogenic emissions and emissions trends, based on publicly available statistics, for the atmospheric modelling community as well as for policymakers (European Commission, 2024a). This repository is used, for example, by the SLOCAT Partnership[4] (Partnership on Sustainable, Low Carbon Transport) for their flagship SLOCAT Transport, Climate and Sustainability Global Status Report – 3rd Edition (SLOCAT, 2023) which provides a global and regional overview of the current state and urgent steps needed on climate and sustainability action for the future of transport and mobility.

Further, the CountEmissions EU proposal will build two separate databases as input data for the calculation of GHG emissions of transport services:

- the core EU database of default values for GHG emissions intensity
- the central EU database of GHG emissions factors of energy carriers.

Both databases will be developed and maintained by the European Environmental Agency (EEA), with the support of EU projects, namely the CLEVER project financed under Horizon Europe programme (CLEVER, 2024). Furthermore, a technical quality check of external databases and datasets will be performed by EEA. This will allow the best use of data already available and collected by third parties, given that they are compliant with the adopted methodology, i.e. the EN ISO 14083:2023.

In France, the *Agence de l'Environnement et de la Maîtrise de l'Énergie* (ADEME) (French Agency for Ecological Transition) provides emission factors and default values in the national database *Base Empreinte* (ADEME, 2024b). This repository is linked to the French regulation GHG Information for Transport Services adopted in 2012. The French regulation will be updated to align with the ISO 14083:2023 and the future European regulation CountEmissions EU. Additional information on French regulations is provided in the next chapter. The regulation is also a basis for developing a repository once data is anonymised.

On an international level, the United Nations Economic Commission for Europe (UNECE) works to make high-quality transport data accessible. For this purpose, UNECE has launched the Transport Data Commons (TDC), a coalition of currently more than 30 leading organisations in transport working together to create a shared, public, accessible, and frequently updated database for the transport sector (UNECE, 2023). TDC uses four different data sources:

- Public Data: Data from open public repositories collected and aggregated by TDC for ease of access.
- Community Data: Data sets submitted by individuals and organisation partners; moderated by TDC.
- TDC formatted: Data sets that are already in the SDMX format (Statistical Data and Metadata eXchange format) or added via API (Application Programming Interface) and programmed with SDMX converter.

- TDC harmonised: Data sets that have been formatted, validated, and derived from multiple sources by TDC.

UNECE's vision is to develop a common data platform where all participating organisations can contribute and extract transport and emissions data for modelling greenhouse gas emissions and other impacts (UNECE, 2023). By sharing primary data, transparency can be improved. With the impending implementation of the EU Carbon Border Adjustment Mechanism (European Commission, 2023b)[5], UNECE expects that such a sharing of primary data will be feasible soon, even internationally.

Although not repositories in the strict sense of the word, other important sources for default emission factors and intensities are: the GLEC Framework, which publishes updated emission factors regularly, IATA CO_2 Connect (IATA, 2022), the EU Emissions Trading System (EU ETS, n.d.), the International Council of Clean Transportation (ICCT, 2024), and the International Maritime Organisation (IMO). Further examples are the Handbook of Emission Factors (HBEFA, n.d.), the Guideline for Shipper Energy Conservation Action in Japan, which contains energy intensity values that are embedded within national emissions reporting legislation, and the UK Government GHG Conversion Factors for Company Reporting (GOV.UK, 2024a).

The Network for Transport Measures (NTM), a non-profit organisation initiated in 1993 to establish a common base of values for calculating the environmental performance for various modes of traffic, including goods transport and passenger travel, also publishes emission factors (NTM, n.d.).

A final example is the China National Institute of Standardisation (CNIS), which has proposed developing specific emission factors for China and adapting the GLEC Framework v3 for China in co-operation with Smart Centre China and other partners (Wang, 2024).

Key challenges and linked actions

Access to primary data remains a challenge. In a survey carried out by the ITF in 2023 of companies associated with its Corporate Partnership Board, respondents stated that most of their emissions fall under the GHG Protocol Scope 3 emissions category and that, at the same time, the data for Scope 3 causes the most significant challenges when it comes to sourcing and reporting (ITF Presentation, 2024).

Main challenges identified were a perceived lack of comparable and harmonised reporting standards and ways of calculation, differences in metrics, boundaries, and emission factors, sourcing data from upstream and downstream suppliers, and the fragmentation of legislation between national and supranational levels, as well as global regions (ITF Presentation, 2024).

These challenges are also confirmed by a survey carried out by the GHG Protocol. While many participants in the survey confirmed that the development of a corporate standard is a simplification and success, a continued alignment of GHG emissions accounting and reporting is requested, and a "need to further enable consistent and comparable GHG emissions disclosures" (GHG Protocol Survey, 2023), e.g. regarding the identification of organisational and operational boundaries, in order to identify Scope 3 emissions clearly. Although the survey may not be transport-specific, transport does fall under Scope 3 for several companies, even if they are not transport sector-specific companies and hence are of relevance. Data quality specifications, reporting requirements, and definition of boundaries for identifying relevant data remain challenges for the transport sector.

To enhance understanding, which should contribute to the closing of some of the gaps, the UN Global Compact Network has run extensive information and training sessions, providing a platform to exchange

experiences and develop competencies, including a whole series on Scope 3 emissions, which includes transport, organised by UN Global Compact Network UK (UN Global Compact, 2024). The UN Global Compact Network has a strategic partnership with GHG Protocol, SBTi and CDP which provide the knowledge for emissions calculations, target setting and reporting. Topics covered by GHG Protocol in the past included:

- challenges related to data collection and comparability
- challenges related to data repositories
- challenges related to data sharing and why it is important to overcome them for building good data repositories
- general approaches for sharing data to build good repositories
- global perspective.

While challenges remain, the onus is also on companies to invest in developing capacities and competencies, start data collection for their operations, use existing data repositories and embark on their sustainability accounting and reporting journeys to meet decarbonisation goals.

Table 3 identifies some of the key challenges to data availability and associated actions that stakeholders can take to address those obstacles.

Table 3. Key challenges and linked actions for transport data availability

Key challenges	Actions required from all stakeholders
Lack of standardisation of data quality and data quality monitoring.	Development and implementation of (additional) ISO standards for data quality and data quality monitoring are needed.
Limited understanding of how best to source Scope 3 data.	Provision of training by industry organisations, professional schools, higher education institutes, and NGOs. Continued co-operation among organisations and other developers of accounting standards to advance further alignment of accounting and reporting methods and tools.
Lack of clear processes and procedures for updating data repositories to ensure high-quality, up-to-date sources for default values. Scepticism in the private sector towards transport emissions reporting and data sharing due to concerns of too much disclosure of internal company structures.	Guidelines are required to develop, update, and format data repositories that are publicly accessible, as well as regulations to protect the confidentiality of data sources.
Lack of harmonisation of digital data standards to ensure consistency and interoperability of digital GHG data transfer between supply chain partners.	Close collaboration is required between transport companies and digital service providers to ensure system compatibility and support integrating GHG calculations into digital data transfer initiatives.
Lack of understanding of the suitability of different data types for different levels of decision making.	Increase uptake of training on transport data, its collection and use in decision making by industry stakeholders.

Best practices

It remains important for companies to base their calculations on primary data, as only primary data allows them to truly identify, analyse and improve the GHG emissions of an organisation. The use of secondary data can be useful to estimate impacts, but always introduces an element of uncertainty. In addition to a full alignment of transport operation calculation standards, the following developments are needed to overcome existing challenges and to close remaining gaps:

- Internationally applicable formal standardisation of data quality, building on the data quality requirements and guidelines developed by organisations such as Smart Freight Centre (SFC).
- Accreditation processes for data quality.
- Simple data communication solutions which allow the sharing of primary data without additional administrative burden whilst simultaneously ensuring the required data quality.
- Regulations that incentivise the use of primary data for emissions calculation.
- Suitable, up-to-date default data repositories managed by neutral platform providers so that companies feel comfortable sharing their data.

While the knowledge of these best practices exists, more awareness and uptake of those already existing is essential for the freight sector. Similar guidelines need to be established for the passenger transport sector as it is currently lagging the freight sector in GHG emissions accounting and reporting.

Reporting greenhouse gas emissions for transport

Sustainability emissions reporting frameworks have been developed over the past couple of decades for companies to use once accounting has been achieved. Some of these frameworks can be sector- or jurisdiction-specific, while others can apply broadly to companies in various sectors and are not limited by jurisdiction. For companies that have been publishing sustainability reports for a long time, or for those starting on their sustainability reporting journey, the plethora of reporting frameworks that exist can be challenging. Often, companies feel the burden of navigating different reporting frameworks or are unsure of which framework to adhere to. Another challenge can be the lack of interoperability of reporting frameworks and the fact that different sustainability reports may not be comparable.

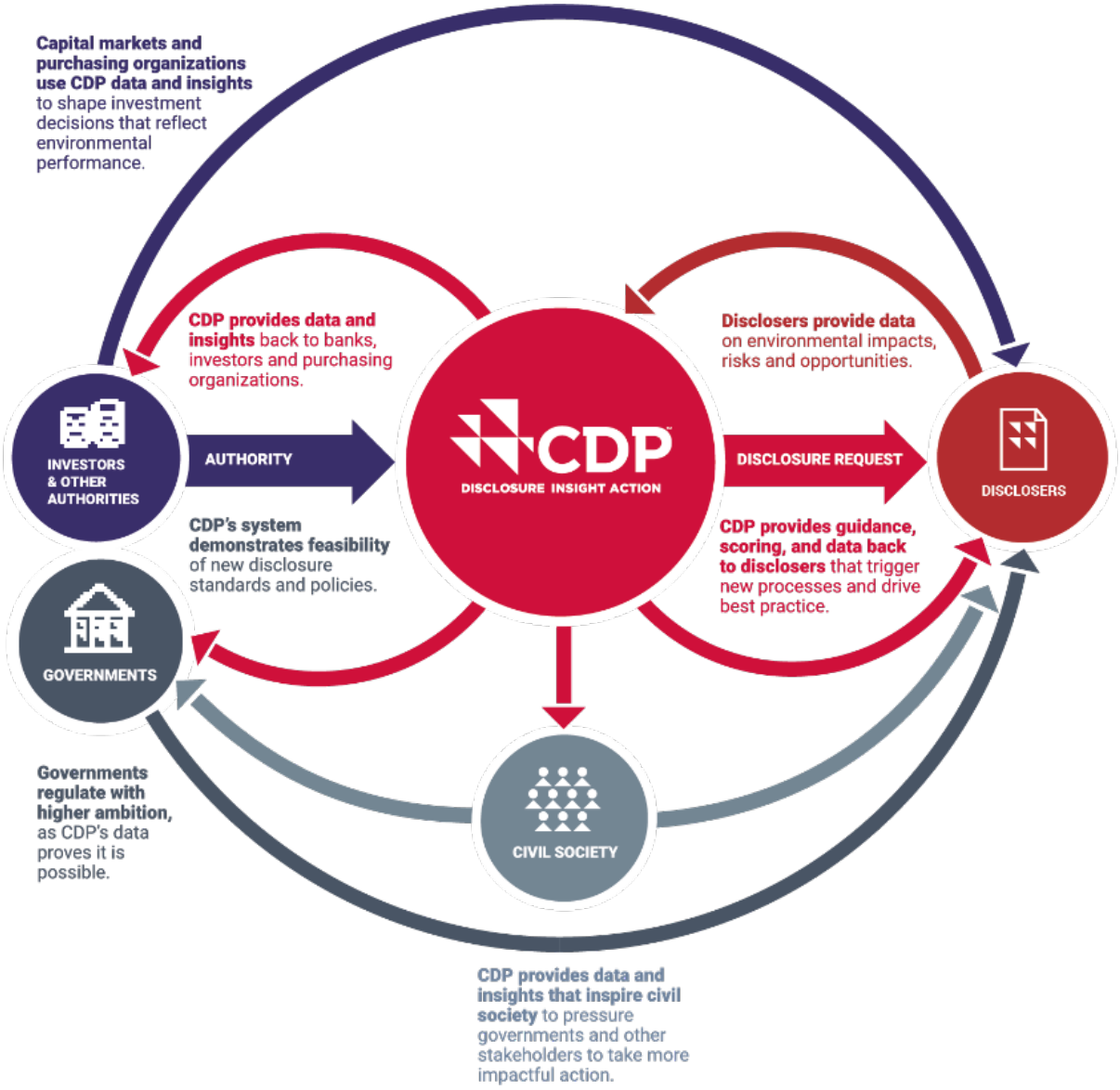
The cost of inaction, however, is higher than action due to the strong business case for sustainability. In recent years, a growing number of companies have acknowledged this and acted. There are reporting frameworks recognised by investors, governments and companies themselves as being a global benchmark to which companies sign up voluntarily for disclosures. Further efforts are also being made by the reporting bodies to enhance interoperability and reduce the burden on companies. In several jurisdictions, reporting is mandatory or will soon be mandatory for large companies with a certain revenue size, whether publicly listed or privately owned. While methodologies contain reporting guidance, they do not necessarily provide a platform for actual reporting. This chapter presents some of the most well-known reporting frameworks, the challenges, the way forward and best practices for stakeholders.

CDP: Global environmental disclosure system

In 2000, CDP created an environmental disclosure system to better understand the impact economic activity has on the environment. This reporting system enables various corporates and subnational entities to disclose environmental information such as emissions (from various sources including transport), deforestation, water security, etc. Over the last two decades, disclosure and transparency have been increasingly demanded by capital markets and customers and are now a business norm. Measuring environmental information and determining accountability allows investors, companies and governments to act on their environmental impact and build sustainable economies.

CDP has used market incentives to drive voluntary action, where mandatory disclosure regulations are not yet in place. Capital markets and purchasing organisations increasingly request their portfolios and supply chains for environmental disclosures. Reporting organisations voluntarily sign up to CDP to disclose this information. CDP then provides decision-useful data and insights directly to requesting stakeholders. In parallel, CDP offers feedback to disclosers, providing guidance, scores and data to evaluate progress and identify best practices. Based on CDP's data and insights, financial markets shape their investment decisions, and governments can regulate with higher ambition (See Figure 5).

Figure 5. CDP's Theory of Change



Source: CDP (2024).

CDP's reporting cycle raises awareness and helps the development of regulations while incentivising voluntary participation. CDP-collected data has proven that companies receive more capital from investors when they act on their environmental impact and reduce it. According to CDP, companies that disclose sustainability data have a competitive advantage over non-reporting companies (CDP, 2024). Disclosers are better at assessing climate-related risks and opportunities and identifying where they can act. Companies that report can potentially save additional costs and improve their market and public reputation, attracting more capital.

While CDP specifies key performance indicators (KPIs) for companies, it does not prescribe methodology (for example, the GLEC Framework is referenced as an allowed methodology), which does not guarantee comparability between reporting peers. While CDP does not make judgment on the standards or methodologies applied by companies to produce their inventories, it expects that any tool used will adhere

to best practices and observe important aspects such as the accuracy and completeness principles found in standards like the GHG Protocol.

Emissions are classified into Scopes 1, 2, and 3, following the GHG Protocol before disclosure In 2023, about 65% of transport service disclosures via CDP, from a global sample of 1 060 companies, reported their Scope 1 emissions. About half reported their Scope 2, while only 38% disclosed Scope 3 emissions (See Box 2). Disclosing Scope 3 emissions has proven to be much more difficult than the first two Scopes due to the wide range of categories that enter Scope 3 and the lack of relevant information. Scope 3 requires more effort and engagement within the companies' supply chain than Scopes 1 and 2. The amplitude of this scope creates grey areas that companies are unsure whether to include in their Scope 3 accounting and reporting. Obtaining data from third parties represents an additional challenge for the emissions disclosers identified as part of their Scope 3. The non-compulsory nature of disclosures and the limited resources of certain small and medium enterprises (SMEs) that play a key role in upstream and downstream activities significantly reduce the availability of sustainability information.

Box 2. Transport services: What is being reported, gaps and how to incentivise reporting

From 2019 to 2023, there was a significant increase of 224% in companies reporting from the transport service industry, with more than 1 060 transport service providers using CDP. However, this rise was not accompanied by an increase in the coverage of the different sources of emissions from transport services. By 2023, 65% of transport service providers disclosed Scope 1, while only 49% disclosed Scope 2. Companies reporting any transport-related category under Scope 3 represent 38% of the entire sample size. The percentage keeps decreasing when comparing companies that disclose some of the emissions categories that are relevant to their operations (31%) versus companies that disclose all relevant categories (11%). This confirms the joint research conducted by SFC and CDP in 2020 that suggested that reporting of transport emissions lacked quality and consistency at that time.

The relevance of categories is determined by a company's share of total emissions. A study conducted by CDP concluded that, for companies in the transport sector, 33% of emissions fall under Scope 3, highlighting the importance of accounting for these emissions. Within Scope 3, three categories represent more than half of this Scope's emissions. Those are Category 4 Upstream transportation and distribution, which is the biggest contributor with 10.3% of total emissions, followed by Category 3 'Fuel- and energy-related activities (that are not included in GHG Protocol Scopes 1 and 2)' with 7.9%, and Category 1 'Purchased goods and services' representing 5.8% of total emissions. BCG and CDP (2023) identify three measures for companies to increase Scope 3 reporting.

First, corporates with a climate-responsible board are 4.8 times more likely to set Scope 3 targets aligned with a 1.5°C transition plan. An engaged board with climate-competent members incentivises data collection and mandates climate-aligned key performance indicators for management. Second, engaging suppliers is essential for Scope 3 upstream emissions management. Requesting transparency on supply chain emissions data can be enforced with contractual requirements, leveraging the company's purchasing power. Finally, estimating internal carbon pricing (ICP) is essential to assess risks and opportunities. Knowing the ICP of the company incentivises Scope 3 emissions collection.

Source: CDP (2022); CDP and BCG (2023); Smart Freight Centre and CDP (2020); CDP (2024).

In terms of alignment, CDP is highly compatible with accounting standards and aligned with other reporting frameworks. CDP has been aligned with the Taskforce on Climate-Related Financial Disclosures (TCFD)

since 2018, piloting questions on EU Taxonomy since 2023 and with the International Financial Reporting Standards (IFRS) S2 since 2024. In addition, CDP is aligned with the GHG Protocol, making it indirectly compatible with other frameworks. Future alignments will look to harmonise with national reporting standards. CDP is approximately 82% aligned with the proposed US Securities and Exchange Commission (SEC) rule, and it is deepening its co-ordination with the European Financial Reporting Advisory Group (EFRAG) via an official partnership. Finally, the Taskforce on Nature-related Financial Disclosures (TFND) and CDP are working together to transition from partial to complete alignment.

International Sustainability Standards Board (ISSB)

The International Sustainability Standards Board (ISSB) was established in 2022 as part of the IFRS Foundation to respond to market reporting standardisation needs. The IFRS Foundation launched the ISSB with the intent of leveraging the standard-setting process and longstanding relationships with global regulators developed through the International Accounting Standards Board (IASB). The ISSB's mission is to enable companies to disclose useful and comparable information for investment decision-making. The ISSB has incorporated and consolidated the work of other voluntary investor-oriented initiatives, including the Integrated Reporting Framework, the Sustainability Accounting Standards Board (SASB), the Climate Disclosure Standards Board (CDSB) and the TCFD, reducing disclosure costs when dealing with several stakeholders.

The ISSB has issued two standards:

- IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information is a general standard that introduces the framework of sustainability-related financial information disclosure. IFRS S1 leverages accounting and financial principles and ISSB disclosure channels with investors to bring sustainability reporting to a level of rigour and assurability comparable to IFRS Accounting Standards (IFRS, 2023a). The Standard requires disclosure of material information regarding a company's sustainability-related risks and opportunities (i.e. not just climate-related disclosures) and uses the TCFD's four disclosure pillars of Governance, Strategy, Risk Management and Targets and Metrics.
- IFRS S2 Climate-related Disclosures builds on the framework established in the general requirements standard and adds disclosure requirements regarding climate-related risks and opportunities. Like IFRS S1, the Standard uses the same four disclosure pillars as the TCFD, and companies which disclose in accordance with IFRS S2 fulfil the TCFD recommendations. Requirements in the Standard include disclosures regarding physical and transition risks, a company's ability to adapt its planning, business model and operations to those risks and opportunities, transition plans, for companies that have one , and the climate-related risks and opportunities in a company's value chain (IFRS, 2023b).

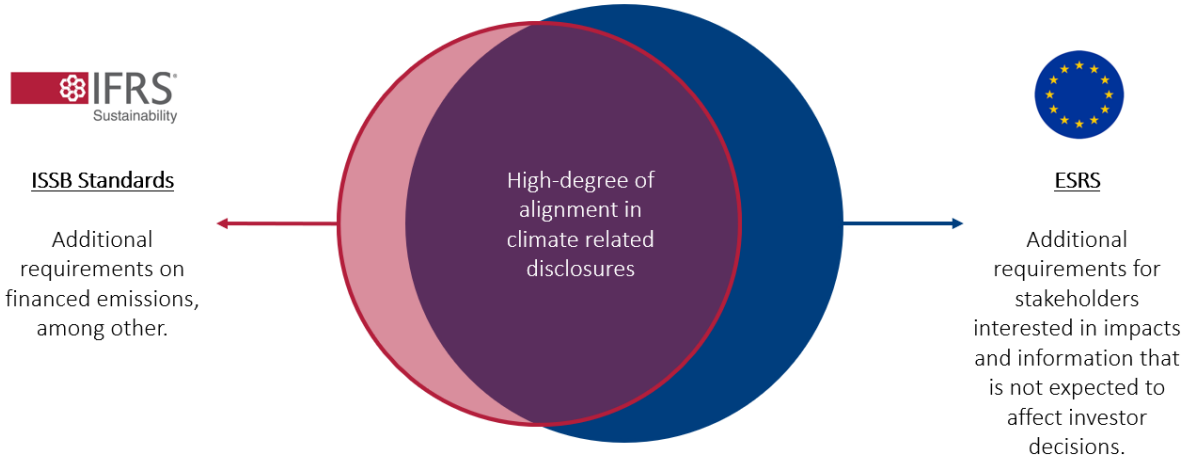
Both IFRS S1 and S2 leverage the industry-based approach of the SASB Standards, enabling companies to disclose information that is specific to the transport sector. Specifically, IFRS S1 requires companies to consider the content in the SASB Standards when identifying and disclosing information about sustainability-related risks and opportunities, and IFRS S2 contains industry-based guidance derived from the SASB Standards. Both the SASB Standards and ISSB Standards use the Sustainable Industry Classification System (SICS®) to define different industries within the transport sector, enabling comparability between peers. The nine industries defined by SICS® are air freight and logistics, airlines, auto parts, automobiles, car rental and leasing, cruise lines, marine transport, rail transport, and road transport. Corresponding to these industries there are nine SASB Standards that contain a set of disclosure

topics and associated metrics that are specific to each industry. As an example, the Road Transportation SASB Standard contains metrics regarding GHG emissions, workforce conditions, and crash and safety management, among others (Waters, 2024).

Emissions disclosure under IFRS S2 is aligned with the GHG Protocol, which requires emissions disaggregation by Scope 1, 2 and 3. However, when regulators require companies to disclose, there can be discrepancies in the inputs, assumptions, and estimation techniques used to calculate GHG emissions.

Ultimately, the ISSB aims to help countries move from a voluntary reporting environment towards a mandatory one. The ISSB views its standards as a global baseline for jurisdictions to adopt and build upon. For example, jurisdictions with broader ambitions beyond the needs of capital markets can require additional disclosures to stakeholders. According to IFRS, more than 20 jurisdictions have already decided to use or are taking steps to introduce ISSB Standards in their legal or regulatory frameworks (IFRS, 2024). Almost all the climate-related disclosures in ISSB standards are included in the European Sustainability Reporting Standards (ESRS). The Interoperability Guidance (EFRAG and IFRS, 2024) is designed to reduce complexity and work duplication for companies, demonstrating the alignment of general requirements and the additional steps to comply with both standards (See Figure 6).

Figure 6. ESRS-ISSB standards interoperability



Source: Adapted from Waters. (2024).

Corporate Sustainability Reporting Directive (CSRD)

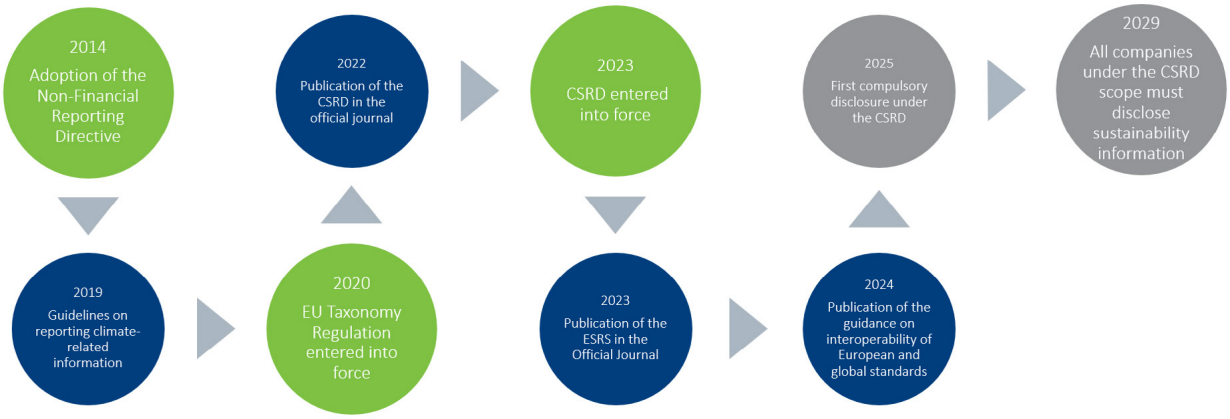
Financial markets are more aware than ever of the importance of understanding climate-related financial risks and opportunities. To answer this demand, the European Union has been developing reporting standards for the last decade to guide companies in disclosing sustainability information and providing a common reporting framework for interested stakeholders.

The Corporate Sustainability Reporting Directive (CSRD) (European Commission, 2022) sets standards for the Environmental, Social and Governance (ESG) information that companies must report. The Directive requires European companies and foreign undertakings operating in European-regulated markets to disclose certain sustainability information when they are under the scope of the Directive, i.e. it is mandatory for publicly listed companies and companies above a certain threshold in terms of revenue

generated. In line with the EU Taxonomy and the EU Green Deal, the CSRD internalises a common understanding of which sustainable economic activities have a substantial and positive impact on the environment and people and seeks to redirect investments towards these. The CSRD also incorporates double materiality, meaning that companies account for and report on the impact of their activities on the environment and how sustainability matters affect the company (Inside-Out and Outside-In accounting and reporting).

The CSRD is a continuation of the already existing Non-Financial Reporting Directive (NFRD), adopted in 2014 (see Figure 7). The CSRD presents more requirements, strengthening the rules that apply to social and environmental information companies must disclose. It concerns a broader range of large companies than its predecessor, including small and medium undertakings listed on EU-regulated markets. The European Commission has also included foreign companies, or companies that own a branch or subsidiary in the European market, in the scope of the Directive when their revenues obtained in EU-regulated countries are above EUR 150 000.

Figure 7. CSRD policy making timeline



Source: Adapted from European Commission (2024b).

The CSRD requires companies to report in accordance with EU standards. The ESRS introduces the structure and disclosure requirements for reporting companies (European Commission, 2023c). The ESRS aims to reduce the burden on complying companies while highlighting the efforts being made to meet the Green Deal agenda. The reporting standards provide a clear picture to investors of the sustainability impact of companies and, consequently, their investments by covering the full range of sustainability information (i.e. Environmental, Social and Governance (ESG) issues). In addition, from a transport sector perspective, CSRD can incorporate GHG emissions of transport services calculated and collected following the principles set in the CountEmissions EU (European Commission, 2023a).

CountEmissions EU and CSRD account for transport emissions according to the GHG Protocol. However, they differ in scope and level of aggregation. CountEmissions EU is not mandatory. It does not mandate reporting, and targets all entities providing or organising freight and passenger services starting or ending in the European Union, that share and calculate GHG emissions of transport services. Moreover, CountEmissions EU focuses on single transport services GHG emissions using ISO 14083 as its methodological basis. On the other hand, the CSRD is mandatory for certain types of companies, and considers emissions from all the activities of reporting companies. Such emissions are disclosed at the entity level, targeting a higher level of aggregation.

Disclosing sustainability information will become more rigorous under the CSRD and easier to compare. ESG information disclosed by companies under the scope of the Directive will have to be audited to corroborate its veracity. Moreover, the standards were conceived to provide additional interoperability with global standards like the ISSB and GRI, reducing the burden and preventing unnecessary double reporting.

CSRD commenced in 2023 and the first category of companies in the scope of the Directive will publish their sustainability reports in 2025, benefiting a wide range of stakeholders. The European Commission adopted a first set of sector-agnostic ESRS in 2023 and will continue to adopt sector-specific standards, including a Road Transport sector standard, under the framework of the Directive.

As a result, financial markets will benefit from better sustainability information from companies. Investors can better understand how they contribute to the green transition and be aware of the risks and opportunities that come with these investments with more rigorous, clear and standardised reporting frameworks. The Directive also aims to meet the transparency expectations of other stakeholders, such as civil society or the media, for which accountability is essential. The third beneficiary is the companies themselves. The Directive guides companies to monitor sustainability information that should matter to them in their management and their path to becoming climate-resilient companies.

Including SMEs and micro undertakings is critical for the reporting framework. EFRAG is developing voluntary, proportionate reporting standards within the CSRD framework for smaller companies. It is important to include smaller undertakings in reporting standard frameworks so that essential sustainability information is available to large companies from their value chain and to banks that must comply with the CSRD. SMEs' optional reporting seeks to lower the burden of doing so, while potentially providing the robust data that bigger companies need to incorporate in their exercise. Initiatives like this are of great importance in solving some of the problems that companies face when reporting for Scope 3 emissions.

Key challenges and linked actions

Table 4 identifies some of the key challenges for emissions reporting and associated actions that stakeholders can take to address such obstacles.

Table 4. Key challenges and linked actions for transport emissions reporting

Key challenges	Actions required from all stakeholders
Lack of awareness of how the existing methodologies and standards feed into reporting frameworks.	While methodologies contain reporting guidance, they do not necessarily provide a platform for actual reporting, which is available separately. Reporting programmes should explicitly highlight and promote the preference for ISO 14083 as a preferred calculation route for transport specific GHG emissions calculations as it covers all modes for passenger and freight transport operations worldwide. Moreover, ISO 14083 is aligned with most widely accepted frameworks such as the GLEC Framework and therefore with the GHG Protocol by association. CountEmissions EU is aligned with the ISO 14083.

Key challenges	Actions required from all stakeholders
Apparent discrepancies between the ISO 14000 series and GHG Protocol for GHG emissions calculations which may cause confusion for reporting.	Highlight the correspondences between the GHG Protocol and ISO 14000 series that are obscured by the differing terminology and how the GLEC Framework links the two for freight transport operations. Also highlight the alignment between different calculation methodologies and standards that feed into reporting. Encourage greater strategic and institutional alignment between the ISO and GHG Protocol to ease transport GHG emissions calculations and reporting.
Lack of awareness of the linkages between the established methodologies, target setting and reporting initiatives.	Owners and promoters of initiatives and legislative proposals (such as ISO, GHG Protocol, CDP, SBTi, SFC, US EPA, ICAO/IATA, IMO, CountEmissions EU) should coalesce around a set of core content for presentation of transport GHG calculation outputs, as set out in ISO 14083 and the GHG Protocol, and prescribe that users follow these standards in order for reported data and transport emissions disclosures to be accepted.
The perception that GHG calculation and reporting is only for large companies.	Active participation of large companies as well as SMEs in GHG emissions data collection, calculation and reporting is essential for reliable decarbonisation of entire value chains. SMEs and the IT service providers that they rely upon for business intelligence need to include data collection that leads to GHG emissions calculation and reporting that follows ISO 14083, the GLEC Framework, and GHG Protocol as core parts of their service offering. Policy makers must provide guidance such as EFRAG which is developing voluntary, proportionate reporting standards within the CSRD framework for smaller companies. It is important to include smaller undertakings in reporting standard frameworks so that essential sustainability information is available to large companies from their value chain and to banks that must comply with mandatory reporting regulations like the CSRD.
Although passenger transport currently comprises between 60% and 70% of transport GHG emissions, the user base is highly fragmented. Most individual passengers are not well educated about the meaning of reported GHG emissions results.	Make a stronger effort to educate the public about the impact of their personal transport decisions on their GHG emissions profile. Build on the growing awareness among businesses related to GHG emissions from their corporate travel to promote transparent GHG reporting in the passenger transport sector. Encourage more passenger transport operators to calculate and actively promote/report their GHG emissions to their users.
Lack of awareness of how companies, policy makers and customers can profit from meaningful and transparent reporting.	Continue developing aligned reporting formats with suitable user interfaces that are easy to use and read. Disclosing emissions and acting on reducing those emissions is essential to meet global decarbonisation goals. Financial markets, policy makers and civil society will benefit from better sustainability information from all types of entities. Policy makers can regulate better, while civil society becomes more aware of how they contribute to and can help reduce GHG emissions.

Best practices

The following are some best practice guidelines for the transport sector for reporting GHG emissions, as well as insights for policy makers on what businesses should do:

- Follow the established standards and embed those in existing or new reporting initiatives/programmes. Incorporate the prescribed reporting format and frequency for service-level and corporate transport GHG emissions, in particular, present both total GHGs and emissions intensity values in conjunction with each other.
- Wherever possible, set up a feed of information from contracted providers that transfers the required information based on primary data inputs. Use an established, standardised and interoperable data protocol, such as CatenaX[6], PACT (the Partnership for Carbon Transparency)[7] or iLEAP (Integrating Logistics Emissions and PCFs)[8], to streamline this transfer and make it useable by all value chain partners.
- Make the data types used in the calculations clearer, i.e. whether primary, modelled, or default data is used, and highlight where less-accurate secondary data is relied upon. List any assumptions/exclusions from the calculations to maximise transparency while reporting. Indicators such as the primary data share (PDS) as defined in the GHG protocol, help to provide better transparency when disclosing corporate GHG emissions reports, by sharing how much primary data has been used without disclosing the data itself, which might be confidential. This would strongly incentivise companies to increase primary data used if/when competitors are using high PDS. PDS needs to be accompanied by a strong compliance mechanism to ensure the declared PDS is trustworthy.
- Follow the example set by the French government in establishing requirements for reporting the GHG emissions from transport services to their customers, but this must be done in a way that is based on international standards such as ISO 14083 and the GHG Protocol.
- Ensure that reported data has independently been checked by a competent GHG auditor who follows an appropriate verification process and checklist, such as SFC's Conformity Assessment Scheme.
- Co-operate with industry initiatives and financial institutions to make reporting good practice and a prerequisite for excellence labels such as the SmartWay programme (EPA, 2024) and Poseidon Principles (Poseidon Principles n.d.).

Country-Specific Insights

Supra-national, national and state-level governments are adopting regulations to introduce accounting and reporting requirements for GHG emissions for companies. These regulations cover all sectors and activities, including transport. These initiatives were country-specific in their beginnings, but recent developments confirm the need and want for an alignment on a supra-national level, as it is necessary for international transport and trade. In 2010, France implemented the requirement to calculate and report emissions for transport. With the introduction of EN 16258 and the involvement of France in the subsequent development of ISO 14083, the related requirements are aligned with international approaches. Also, the contribution of the US EPA, which has had the SmartWay partnership since 2004, to the development of ISO 14083 reflects the desire for global alignment and efforts. Additionally, some governments, through their designated public sector agencies, have also established guidelines and data repositories to facilitate emissions reporting for companies.

An overview of some country-specific transport regulations and programmes are detailed in this chapter to provide insight into what governments are already doing and future regulations that will come into effect. Several insights are based on presentations and discussions held during the ITF workshop on this topic in April 2024 (ITF CPB Workshop, 2024). These country insights appear in alphabetical order, cover a wide geography, and are not an exhaustive list of examples. While the information presented is accurate at the time of publication of this report, readers should check latest policy developments for the countries listed as those are subject to change.

China

China accounts for approximately 27% of global GHG emissions. The global logistics industry is a major contributor to GHG emissions. Within China, commercial freight vehicles alone generate about 50% of the country's transport-related emissions, which is about 10.2% of China's total GHG emissions. Moreover, freight emissions are growing faster than most other sectors. In response to this growing challenge, the Chinese government has implemented "dual carbon goals", which aim to achieve peak emissions by 2030 and carbon neutrality by 2060. The transport sector, a critical focus of this policy, is targeted for significant safety, compliance, efficiency, and sustainability improvements. For example, China is accelerating the manufacturing and adoption of zero-emission/electric trucks. This policy, alongside pressure on multinational companies to address environmental issues, has created a strong impetus for the Chinese logistics industry to begin calculating and reporting their GHG emissions. However, the logistics sector remains highly fragmented, with most carriers being small-scale operators, which poses significant challenges (Wang, 2024). While the full scale of policy interventions in China for greening freight is not captured here, some insights from China's Smart Freight Centre (SFC) work are presented next.

Since its establishment in 2014 the SFC in China has been addressing the challenges of GHG emissions calculation and reporting within the logistics sector to accelerate the reduction of logistics emissions. The Centre aims to foster collaboration within the Chinese logistics ecosystem and scale decarbonisation solutions. SFC China primarily collaborates with three groups: multinational companies and large Chinese shippers that are buyers of freight and logistics services, logistics service providers (LSP) and supply chain carriers through partnerships with various stakeholders. These include the Chinese Federation of Logistics and Purchase, GIZ China, and shippers, who, according to SFC China, provide safe, compliant, efficient and

sustainable logistics services. SFC China aims to build a robust carrier pool and promote green freight initiatives nationwide. The Centre is also developing a national green freight programme focused on zero-emissions vehicles, including non-heavy-duty vehicles (Wang, 2024).

SFC China's work is further strengthened through close collaboration with key Chinese government ministries and associated think tanks, including the Ministry of Transport, Ministry of Ecology and Environment, and the Ministry of Industry and Information Technology. Partnerships with NGOs, academia, business networks, foundations and development agencies also influence freight buyers and suppliers. These collaborations are designed to integrate sustainability practices within the logistics sector and develop a national green freight framework.

SFC China operates through five strategic programmes to achieve its goals. These include:

- building a community of shippers, carriers, and other stakeholders to lead in sustainable logistics
- introducing harmonised standards for GHG calculation and reporting
- establishing platforms like the Zero Emission Freight Initiative (ZEFI) to facilitate practical actions
- developing capacity-building programmes to enhance industry capabilities in reducing emissions and promoting carriers that are committed to sustainability. These programmes are designed to embed sustainability within the logistics sector, focusing on safety, compliance, efficiency, and other critical factors (Wang, 2024).

Several key drivers are pushing the logistics industry in China towards GHG emissions reporting and calculation. These include national and international regulations, such as the EU's CBAM and China's tightening national regulations, which mandate companies to report their emissions. In addition, voluntary initiatives like SBTi and CDP have gained traction in China, encouraging large shippers and LSP to disclose their emissions. Customers also increasingly demanding logistics companies to calculate and report their emissions. Despite these drivers, the industry faces challenges, particularly in developing a harmonised methodology, creating tools and emission factors, and building the necessary capacity for effective GHG calculation and reporting.

SFC China has worked with industry associations to develop industry standards aligned with the GLEC Framework. The GLEC Framework has been translated to Chinese and the first batch of China specific emission factors have been developed for the industry. Additionally, SFC China is in discussion with the China National Institute of Standardisation, proposing to develop a National Standard compatible with ISO 14083 and the GLEC Framework, wherein SFC would bring its expertise and knowledge on standards development (Wang, 2024).

SFC China is focused on several strategic goals in the short term. The aim is to establish a logistics GHG emissions calculation and reporting community in China in collaboration with key partners to set the standard for companies to achieve full emissions transparency and track progress. This would support the development of national standards that align with ISO 14083 and the GLEC Framework, adapting the GLEC guidelines to the Chinese market, and assisting companies in developing in-house capacity for GHG emissions calculation and reporting. The Centre is also committed to enhancing the capacity of the logistics industry to move towards sustainable practices.

France

In France, the ADEME is a public industrial and commercial organisation under the supervision of the Ministry for Ecological Transition and Territorial Cohesion, the Ministry for the Energy Transition and the Ministry for Higher Education and Research. ADEME provides environmental expertise and acts as a facilitator to accelerate the ecological transition by funding environmental research projects, disseminating sustainable best practices, and monitoring their implementation and effectiveness (ADEME, 2024a). ADEME covers transport and mobility, air quality, renewable energies, agriculture, forestry, urban planning, buildings, etc. ADEME has contributed to the development of valuable methodologies, standards and data banks that facilitate accounting and reporting GHG emissions in the French transport sector due to its collaboration with the public and private sector.

One of the first significant contributions of ADEME to the transport sector was the development of a calculation tool to assist shippers in quantifying GHG emissions based on tonne-kilometres and vehicle-kilometres. This tool was instrumental in the creation of the GHG Transport Protocol that the *Entreprise pour l'Environnement* (EpE) group published in 2005 (EpE, 2005). This protocol developed by ADEME and the private sector member companies of the EpE established the basis for voluntary accounting and reporting and verifying GHG emissions from the transport sector. The protocol emphasised the importance of carriers reporting GHG emissions to shippers, complementing modelling tools used by shippers to estimate their transport-related emissions. The protocol was aligned with the International Financial Reporting Standards (IFRS) principles, Bilan Carbone (a GHG emissions accounting tool developed by ADEME (2010)), the GHG Protocol and the ISO 14064 standard (EpE and ADEME , 2005).

Over time, the French Transport Code included regulation *Article L1431-3* (Légifrance, 2015), which came into effect in 2013, requiring any public or private entity organising or selling passenger or freight transport services carried out by one or more transport modes and departing from and travelling to a location in France to communicate their greenhouse gas emissions. Initially focused on CO_2, the regulation was later expanded to cover all GHGs, aligning with the European EN 16258 standard (published in 2012). This compulsory disclosure of transport service emissions applies to all companies, regardless of their size. To define the measure's scope and guide transport service providers through the accounting and reporting process, the French Ministry for an Ecological and Solidarity Transition released the GHG Information for Transport Services in 2012 and updated it in 2019. This methodology guide builds upon ADEME's previous work on emissions accounting methodology and national estimations for fuel intensities and emission factors, and upon multiple working groups with stakeholders representing transport services providers and their beneficiaries.

In addition to guides and standards, the French government supports other tools to transport and logistics companies to facilitate accounting for GHG emissions and setting decarbonisation targets. Base Empreinte provides an open-access database on emission factors (formerly part of Base Carbone) and environmental impact indicators (formerly part of Base Impact) at the national level (ADEME, 2024b). Centralising such crucial data facilitates the accounting process, especially for small enterprises. Moreover, Objectif CO_2 provides an online platform for road transport service providers to self-evaluate their emissions, establish a three-year plan to reduce them and receive feedback on their progress and the adjustments needed to meet their objectives. It aligns with the methodology provided in the GHG Information for Transport Services guide. Objectif CO_2 is part of the broader programme *Engagements Volontaires pour l'Environnement* that includes other initiatives, such as Fret21 (for shippers) and EVcom (for freight forwarders), that aligns the objectives of the entire logistics chain, facilitating the adoption of green practices (EVE, 2021).

The French regulatory environment on accounting and reporting GHG emissions seeks to update the national standards to align with the latest international practices and widen the scope of required reporting. The GHG Information for Transport Services guide is still based on previous international standards. However, it is not yet fully aligned with ISO 14083 and the upcoming European regulation called CountEmissions EU. ADEME recognises that French regulation is not outdated but needs to be aligned with ISO 14083:2023 and CountEmissions EU (Cottignies, 2024). Aligning national standards with the latest international standards and supranational regulations will reduce the burden on the private sector. ADEME recognises that the scope of reporting must be widened to include international transport services. Finally, other considerations by ADEME to streamline reporting consist of better harmonisation of information and practical guidelines for when and how GHG information should be communicated. To support these goals, ADEME has developed solutions for automatic data transfer, which are now operational through the EVE programme of voluntary commitments from the freight sector. ADEME is also exploring ways to compile passenger emissions annually rather than for individual trips to provide more comprehensive information.

One general conclusion of the French experience is that even with an early and significant commitment of authorities to put legislation and methodological frameworks in place, the calculation and reporting of GHG emissions by companies have not been widely implemented so far.

Morocco

Morocco's Mohammed VI Foundation for Environmental Protection has developed a tool for calculating emissions factors within their decarbonisation programme. In 2023 the Foundation published an updated version of the accompanying guidelines (FM 6, 2024). The objective of this tool is to meet Morocco's specific requirements regarding the calculation of emission factors. The tool calculates GHG emissions by multiplying the activity data with emission factors, which aligns with the GHG Protocol, the GLEC Framework v3, and the other tools mentioned beforehand. Next, to quantify the climate impact, the result is multiplied by the applicable Global Warming Potential at one hundred years (GWP100). This climate impact is noted as tCO_2e. In many cases, the emission factors integrate the GWPs and directly convert the activity data into tCO_2e. By default, the GWPs used are those of the latest IPCC report and should continue to align in the future as new reports are published.

The tool provided enables companies and organisations to calculate their specific emission factors, using their primary data. The guideline also proposes, as alternative, default values specific for Morocco. These default values, as well as the tool, take a well-to-wheel approach and cover passenger transport and freight transport. For the following freight transport modes default values are given, differentiated into different vehicle categories: air freight, road freight, sea transport, rail.

The tool and guideline updated in 2023 are a revised version of a tool already developed in 2013. The update has been developed jointly by a working group that included the Mohammed VI Foundation for Environmental Protection in co-operation with industry representatives, the transport department, research organisations, and NGOs. It was of particular importance to this working group, involved in the process, to ensure international alignment with other emissions calculation approaches, such as:

- US EPA: GHG Emission Factors Hub
- UK Department for Energy Security and Net Zero: Government Greenhouse Gas Conversion Factors for Company Reporting
- France ADEME: Base Carbone®

As the tool aims to support the calculation of GHG emissions for the entire country of Morocco, it covers all different sources of these emissions, and transport is only one of these, next to other sectors such as agriculture, construction, heating, waste management, etc. In line with the principles applied by the Bilan Carbone® ADEME Guide to Emission Factors (Version 6.1) published in 2010 (ADEME, 2010), the emission factors of the carbon tool of the Mohammed VI Foundation reflects manufacturing, maintenance and infrastructure.

The Mohammed VI Foundation is engaged in training for the private sector, training of trainers, and offering tutorials in universities to spread the tool's understanding and use. Training on the ISO 14083 has been added to further link to the international standardisation efforts.

United Kingdom

GHG reporting in the United Kingdom is required of companies listed on the UK stock market and unlisted companies above a given size threshold according to the Streamlined Energy and Carbon Reporting (GOV.UK, 2024b) requirements. Reporting is at an aggregated, corporate level, which would include transport GHG emissions as a constituent element. However, they are not required to be listed as a specific item within the report.

The associated guidance follows principles similar to those set out in the GHG Protocol, including reference to the likely significant contribution of value chain emissions to a company's overall GHG inventory. However, according to the GHG Protocol definitions, the formal reporting boundary only includes Scope 1 and 2 emissions. This would mean that the vast majority of transport emissions could be excluded legitimately from most corporate GHG reports given that the transport service would usually be provided by a third-party operator and so be classed as a Scope 3 emission. In theory, even a specialist transport company could exclude emissions from any services they provide using a subcontractor.

Despite the potential to exclude transport from required GHG reports, the UK has a long history of collecting and making available the information needed to calculate transport GHG emissions. This comes in several forms:

- The Continuing Survey of Road Goods Transport (CSRGT) is completed each year by a selection of registered vehicle operators chosen randomly at the level of individual vehicles. This provides a statistically representative picture of the road freight transport market in the United Kingdom, including a range of values that inform energy use and emissions in comparison with vehicle use at overall and trip level (GOV.UK, 2019).
- The Digest of United Kingdom Energy Statistics (DUKES) collates a detailed compendium of the United Kingdom's production, characteristics and use of different fuels. This includes energy provision to the transport sector that allows visualisation of the extent and speed of the transport energy transition (GOV.UK, 2023).
- The UK government publishes a set of Greenhouse Gas Conversion Factors for Company Reporting, which is updated annually. Now the joint responsibility of the Department for Energy Security and Net Zero and the Department for Environment, Food and Rural Affairs, this database is often called the Defra factors colloquially. The database contains emission factors that allow organisations with access to primary fuel-use data to convert that energy consumption to emissions for all economic sectors including transport. It also contains a comprehensive set of emissions intensity values covering all transport modes, with a particular detailed focus on road transport, that allows the calculation of Scope 3 transport emissions.

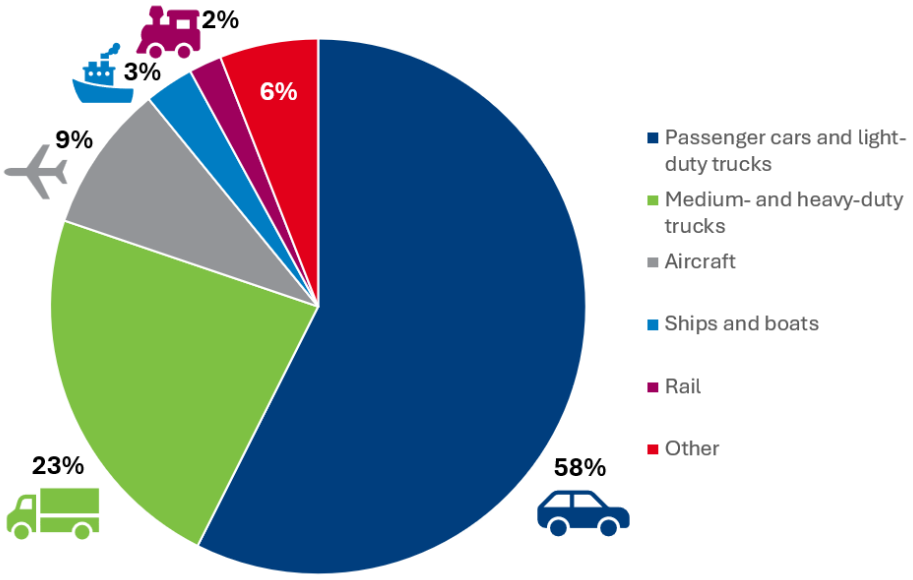
The transport sections of the Greenhouse Gas Conversion Factors for Company Reporting tend to dominate the make-up and hence the use of the database. The combination of a range of data formats presented in exceptional detail, available free of charge, has made these values a widely used resource for Scope 3 transport GHG calculations worldwide, due to those responsible for designing, compiling and maintaining the database. This database is backed up by a comprehensive methodology report that supports the database transparently. However, this is also problematic in that the data is compiled from and only directly applicable to emissions reporting in the United Kingdom.

The methodology used for producing the road transport emissions intensity values is the same as that used in similar databases where the fuel consumption is determined at zero loads and fully laden and the intermediate loads are interpolated on a linear basis. Data is then presented in four conditions: empty, fully laden, 50% loaded, and average (for each vehicle category). The average load figures include empty running but do not specify the extent of empty running and the average load when loaded. The database is being kept up-to-date as the energy transition for transport continues, with new fuels being added as they start to penetrate the market.

United States

SmartWay, a programme of the US Environmental Protection Agency (EPA) within the Office of Transportation and Air Quality (OTAQ), focuses on improving freight transport efficiency and lowering GHG emissions (as well as tracking, reporting and reducing pollutant levels) through a collaborative, market-based partnership (EPA, 2024). SmartWay was launched in 2004 as a public-private partnership aimed at helping the freight industry to benchmark, report, and improve their emissions performance. The aim is also to enhance energy security, reduce climate forcing and other air pollutants, highlight the freight industry's efforts to reduce emissions and provide a standardised benchmarking and reporting system (see Figure 9). The EPA's OTAQ, which oversees regulatory programmes for vehicles, fuels, and engines, plays a critical role in developing and enforcing environmental standards and fostering industry collaboration through initiatives like SmartWay.

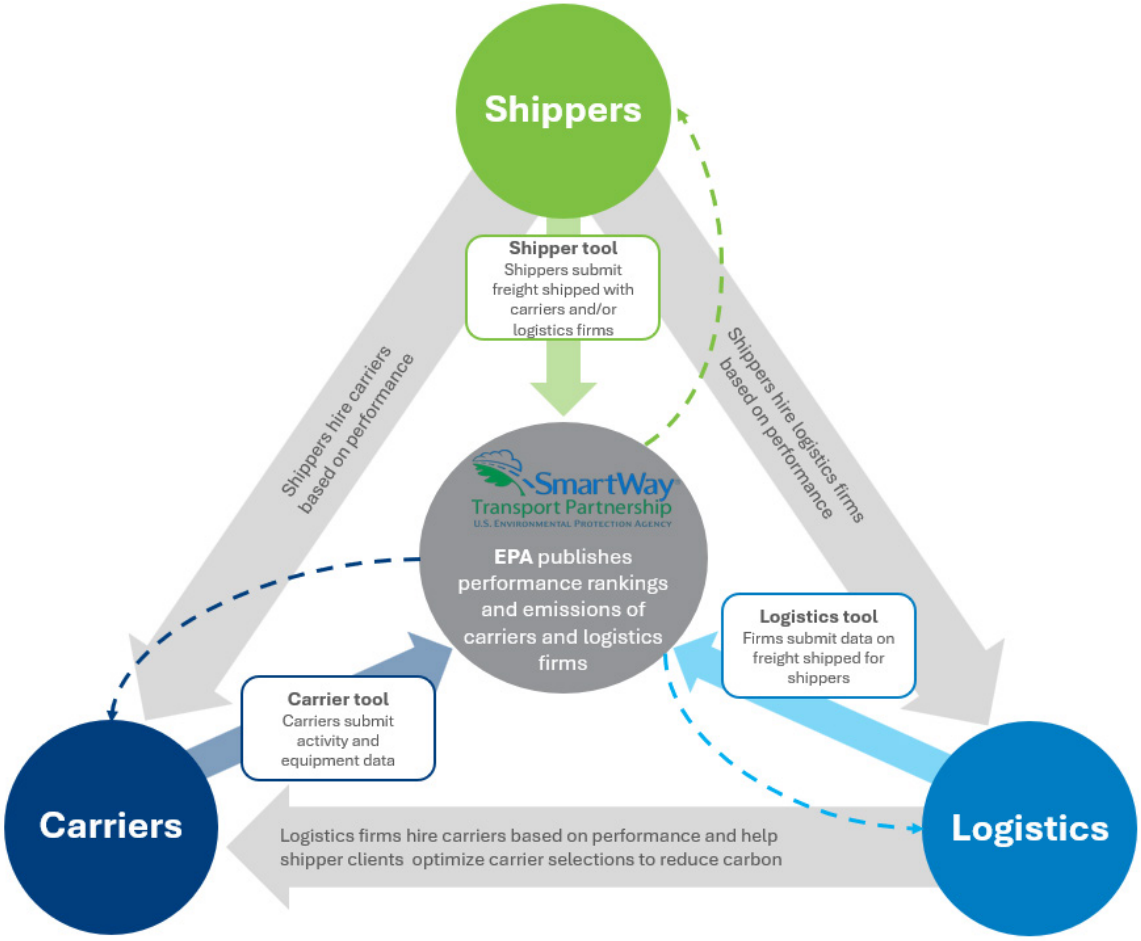
Figure 8. 2021 Greenhouse Gas emissions from United States domestic transport, by mode



Source: Adapted from US Environmental Protection Agency (EPA); SmartWay, (2024).

According to the EPA, transport is now the single most significant source of GHG emissions in the United States. While passenger cars still emit the majority of emissions, as indicated in Figure 8, freight is close to a-third of the total emissions, and freight transport emissions are growing more rapidly than in passenger transport. Hence, focussing on freight transport is the key aspect of the SmartWay programme. SmartWay has grown significantly since its inception, now encompassing over 4 000 carriers, shippers, 3PLs and affiliated partners across various economic sectors as well as small businesses, owner-operators and Fortune 500 firms. SmartWay's methodology involves annual benchmarking and reporting of emissions data by carriers across different transport modes. This data rates and ranks environmental performance, helping companies improve efficiency and reduce emissions. The programme includes trucking, rail, barge, marine, and air freight carriers (SmartWay, 2024).

Figure 9. SmartWay programme benchmarking process



Source: Adapted from US EPA SmartWay Programme (2024).

SmartWay's success has led to its adoption in Canada and efforts to integrate with Mexico for a North American platform. Various countries have modelled their green freight programmes after SmartWay, underscoring its influence on global standards. The programme collects detailed emissions data from carriers, including fuel consumption and pollutant levels, and uses this data to provide performance ratings of carriers and logistics firms as indicated in Figure 9. This information is publicly available and used for various purposes, including environmental dashboards and academic research.

SmartWay's methodology aligns with international standards and protocols, including the GHG Protocol and ISO 14083 standard. The EPA collaborates with organisations like the Global Logistics Emissions Council (GLEC) and the World Resources Institute (WRI) to ensure consistency and harmonisation in emissions reporting.

While the EPA does not mandate GHG disclosure in the transport sector (freight or passenger), developments in state-level regulations, such as those in California, may influence future reporting requirements These regulations in California include the Senate Bill No. 253, Climate Corporate Data Accountability Act (SB-253, 2023), and the Senate Bill No. 261, Climate-Related Financial Risk Act (SB-261, 2023). SB-253 requires public and private companies with annual revenues greater than USD 1 billion to report their Scope 1, 2 and 3 GHG emissions annually. Starting in 2026, reporting entities must annually

report Scope 1 and Scope 2 GHG emissions from the prior fiscal year. While starting in 2027, they must report Scope 3 GHG emissions, including indirect upstream and downstream supply-chain emissions from the prior fiscal year. GHG reports are required to conform to the GHG Protocol. SB-261 requires entities with annual revenues of USD 500 million to disclose climate-related financial risks and measures taken to mitigate or adapt to these risks starting in 2026. SmartWay data is expected to support compliance with such emerging regulations.

In SmartWay's context, primary data refers to the original data collected directly from sources. For SmartWay, primary data includes detailed emissions data provided annually by transport carriers. This data encompasses fuel consumption, fuel types used, miles (revenue and empty), and operational characteristics specific to each carrier. Shippers and 3PLs do annual accounting of miles and tonne-miles of freight shipped with SmartWay registered carriers and non-SmartWay carriers. Shippers and 3PLs report by mode, operation, subsidiary and so on. It is gathered through SmartWay's reporting processes to rate and rank environmental performance.

Secondary data includes data that has been processed, analysed, or compiled from primary sources. In SmartWay's case, secondary data may involve aggregated emissions factors, performance benchmarks, and published ratings that result from analysing the primary data. This secondary data supports compliance with regulations, informs industry practices, and contributes to broader emissions reduction efforts.

In other words, SmartWay uses primary data collected directly from carriers to generate secondary data that helps regulate compliance and promotes efficiency and emissions reduction. Additionally, the Global Logistics Emissions Council (GLEC) has established a North American default value based on SmartWay's BIN6 rating. This default value is a benchmark for carriers not participating in SmartWay, representing a rating one degree lower than the most polluting SmartWay carriers. This approach ensures a conservative estimate for non-reporting carriers and incentivises participation in the programme.

To summarise, the SmartWay programme provides the following information to support GHG emissions accounting and reporting in the North American context:

- Total mass CO_2 freight emissions (plus NOx, PM, BC) for the United States and Canada
- Total mass emissions per mode
- Emissions intensity factors (g/mile and g/tonne-mile)
- Emissions intensity factors per mode
- Tank-to-Wheel (TTW) emissions.

SmartWay facilitates tracking and reporting by business unit or subsidiary and an annual reporting cycle based on prior calendar year activity. It publishes Scope 1 and 2 data reports for carriers and Scope 3 data for shippers and 3PLs and provides publicly accessible data sets. This data is used by firms in their public disclosure and other reporting. Overall, the EPA acts as a neutral third-party facilitating data exchange between Carriers, 3PLs, and shippers and is aligned with prevailing global frameworks and methodologies.

Conclusions and way forward

Significant progress has been made in the standardisation and harmonisation of GHG emissions calculation and reporting for the transport sector in recent years. Many companies have long monitored their energy and fuel consumption to optimise transport costs and efficiency. However, since the Kyoto Protocol, the need to optimise energy efficiency globally reduce fuel consumption and GHG emissions has become paramount. The transport sector, which is poised for substantial growth, plays a critical role in contributing to these reduction goals.

To achieve energy efficiency and reduce emissions, a standardised international approach is necessary to calculate these emissions transparently and meaningfully. The global community has supported the development of such standardisation tools for GHG emissions in transport. The two widely recognised standards are the GHG Protocol, aimed at broader corporate emissions, and the ISO 14083, focusing specifically on both passenger and freight transport emissions. During research conducted for this report it appeared that some stakeholders, such as French public sector agencies, prefer the ISO 14083 over the GHG Protocol which is considered a private initiative. While corporates largely use the GHG Protocol, they welcome the adoption of ISO 14083 in regulations for the transport sector.

Emissions accounting and reporting is continuously evolving as stakeholders better understand the complex relationship between emissions and climate change. New developments in transport technologies and operations and communication mechanisms necessitate ongoing adaptation of emissions accounting and reporting tools. Industry, being deeply embedded in international processes, depends on clear, internationally applicable standards, which makes continuous standardisation crucial.

Achievements to-date

The publication of ISO 14083 in 2023 marked a milestone in the standardisation of emissions reporting for all transport modes. The latest version of the GLEC Framework (v3.1) is now fully aligned with ISO 14083. This was developed by experts in collaboration with industry and is based on the GLEC Framework v2.0, which aligns with the GHG Protocol. Further, the European Commission's proposal for the regulation CountEmissions EU will equip the European Union with a tool for calculating and disclosing GHG emissions of transport services, making use of the existing EN ISO 14083:2023. These alignments show the convergence of leading tools to ensure compatibility and consistency.

Primary data is regarded as essential for accurate GHG emissions reporting. While secondary data can provide estimates, primary data ensures precise identification and improvement of emissions. All stakeholders acknowledge this fact. The use of primary data must be encouraged and rewarded through regulation to improve transparency and accuracy. In parallel, there is consensus on the need to account for well-to-wheel emissions, and the total life cycle emissions of fuel sources, especially for fuels with low- or zero-tailpipe emissions. Building consensus among stakeholders through collaboration is an important achievement.

Moreover, many governments have launched efforts to support standardised emissions accounting and reporting, e.g. France, the United Kingdom, the United States, China and many more. The French government, for instance, established requirements for reporting GHG emissions from transport services

to their customers over ten years ago. The CountEmissions EU regulation, once applied, will be applicable to all EU member states.

Challenges and opportunities

One of the main challenges in GHG accounting is the difficulty of sourcing high-quality primary data. There is a need for clear data quality standards and accreditation processes supported by neutral data repositories that companies can trust. Furthermore, established data protocols should facilitate efficient data exchange for emissions calculation, ensuring interoperability across transport operations. It is also vital that future tools, regulations, and initiatives align with existing standards like ISO 14083 and the GHG Protocol.

Moreover, reporting requirements (e.g., by CDP, ISSB, CSRD) must continue emphasising both total GHGs and emissions intensity values for a complete picture of emissions from transport operations. Reporting standards already requires transparency regarding data quality, assumptions, and omissions to ensure accountability and credibility and must continue to emphasise that companies include these.

What is needed next?

Awareness of the existing methodology standards is limited to a narrow group of stakeholders. This gap must be addressed by spreading information through governments and industry bodies. There is also a pressing need for further alignment between the GHG Protocol and the ISO 14000 series. Terminology clarity will prevent confusion and streamline organisations' use of these standards.

Improving data quality is critical. Key areas include the development of an ISO standard for data quality monitoring, reliable tools for sourcing primary data, and high-quality data repositories. These improvements would benefit from the co-operation of IT providers, industry, NGOs, and policy makers. Tools and repositories should prioritise user-friendliness and incentivise data sharing through quality labels (for example, as done in the US EPA SmartWay programme). Publicly accessible, secure, and neutral data platforms are needed to support this effort.

Communication of the emissions calculation results is key to achieving transparency, awareness of transport-related emissions, and hence their improvement. This clarity is currently insufficient and a major issue, both for freight and for passenger transport. Differentiated solutions are needed, as are platforms of data exchange, such as the EVE platform for freight in France.

Role of stakeholders

Industry

Transport companies and IT service providers must collaborate to ensure system compatibility for integrating GHG calculations into digital data transfer initiatives. Developing digital standards will ensure that GHG data can be transferred seamlessly across supply chain partners. The industry should train staff and subcontractors on primary data sourcing and reporting. Furthermore, industry organisations should offer sector-specific guidance for specialised sectors, as done for the RoRo and European chemical transport sectors.

NGOs, initiatives, and leading standardisation bodies

NGOs and organisations involved in standardisation should work together to fully align the ISO 14000 series and GHG Protocol. By jointly promoting the common elements in both frameworks and improving

communication to all stakeholders, they can spread awareness and facilitate the global uptake of GHG accounting and reporting standards.

Academia and training organisations

Training institutions, chambers of commerce, and regional offices should integrate emissions accounting and reporting into the curriculum for transport professionals. Training at all organisational levels (from senior management to operational staff) will reduce scepticism toward data sharing and help companies leverage reporting insights to improve operational efficiency.

Policy makers

Policy makers play a critical role in aligning existing and future regulations with existing standards like ISO 14083. They play a role in ensuring that emissions are calculated and reported transparently and consistently. Further they must support continued standardisation and harmonisation of accounting and reporting practices, and data collection. Next, they must provide support for SMEs that struggle with the cost and complexity of emissions reporting. National governments can also build awareness about GHG emissions from both freight and passenger transport and ensure educational institutions include GHG emissions awareness in their programmes.

To summarise, while significant progress has been made in GHG emissions accounting and reporting, particularly with the development of ISO 14083, there is still much to be done. Increased awareness, data quality improvements, and alignment of standards are key to advancing emissions reduction efforts. The active co-operation of all stakeholders – industry, policy makers, NGOs, and academia – is essential to achieving standardised, transparent, and actionable GHG reporting for the transport sector. Companies must also act urgently, i.e. embark on their sustainability journeys by undertaking GHG emissions accounting and reporting actions based on the clear guidance that is already available as well as making tangible emissions reductions. Stakeholders must also keep abreast of new developments in this area, which are occurring at a fast pace, some of which this report may not be able to capture at the time of publication.

Notes

1 For more information about the GHG Protocol see the GHG Protocol Corporate Accounting and Reporting Standard and the GHG Protocol Corporate Value Chain (Scope 3) Standard.

2 The Package also includes the following proposals: the Rail Capacity Regulation, the revision of the Weights and Dimensions Directive, and the revision of the Combined Transport Directive.

3 A bill of lading (BL or BoL) is a legal document that's issued by a transportation company to a shipper. It details the type, quantity, and destination of the goods being carried. A bill of lading also serves as a shipment receipt when the carrier delivers the goods at a predetermined destination. This document must accompany the shipped products regardless of the form of transportation.

4 SLOCAT is the international, multi-stakeholder partnership powering systemic transformations and a just transition towards equitable, healthy, green and resilient transport and mobility systems for the people and the planet. They deliver on their mission through co-creation, co-leadership and co-delivery across knowledge, advocacy and dialogue activities in the intersection between transport, climate change and sustainability. https://slocat.net/

5 As from October 1, 2023, Regulation 2023/956 introduced the EU's Carbon Border Adjustment Mechanism (CBAM) with the objective to reduce carbon emissions, put a fair price on the carbon emitted during the production of carbon intensive goods imported into the EU and encourage a cleaner industrial production through a methodology for calculating embedded emissions according to the Paris Agreement and the EU Fit for 55 package. This mechanism will be implemented in phases and is aligned with the phase-out of the allocation of free allowances set in the EU Emissions Trading System (ETS).

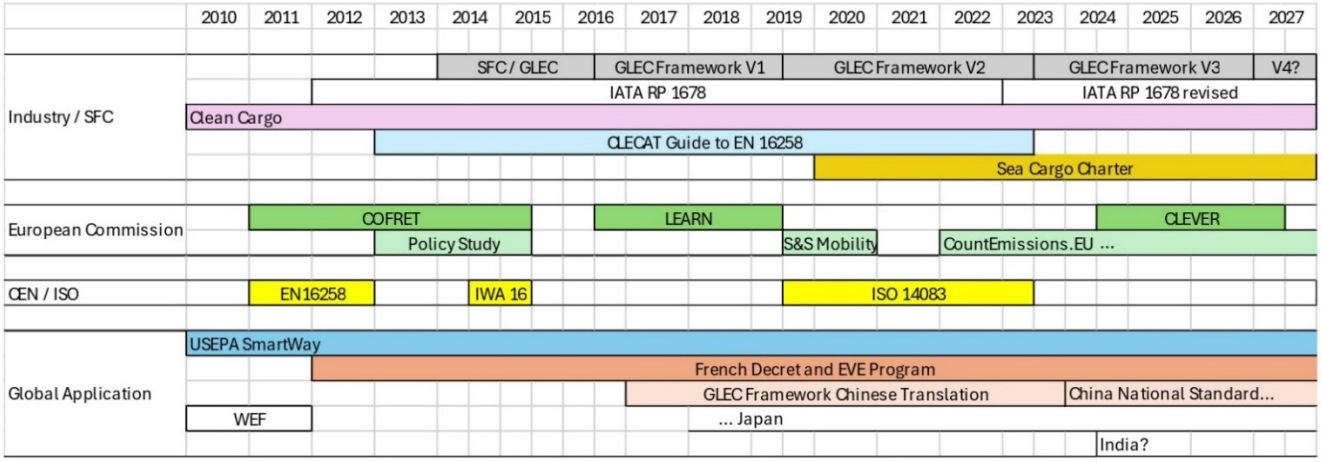
6 Catena-X is offering the first open and collaborative data space for the automotive industry to boost business processes using data driven value chains, https://catena-x.net/en/.

7 The PACT Methodology builds on existing frameworks and standards to provide guidance on accounting, verification, and exchange of cradle-to-gate PCFs with the aim of creating more accurate, granular, and comparable emissions data.

8 The next step in the successful application of Smart Freight Centre's (SFC) GLEC Framework and the related ISO Standard 14083 is to unlock the digital, automated exchange of high-quality logistics emission information on a global scale. To accomplish this, the iLEAP project aims to establish the "standard" for seamless connectivity in logistics emissions transparency. Ultimately, the iLEAP standard supports the creation of an ecosystem of solutions and the "Internet of Emissions Data" that is open to everyone, maintains data sovereignty, and is based on a sound emissions calculation approach: the GLEC Framework and ISO14083.

Annex A. Freight transport GHG methodology development timeline

Figure 10. Freight transport GHG methodology development timeline



Source: Smart Freight Centre (Lewis, 2024).

Annex B. List of Workshop participants

Luca BECCASTRINI, FS Italiane
Flore BOINOT-RAFFEGEAU, Valeo
Diego BOTERO, International Transport Forum (ITF)
David CAUBEL, Ministère de la Transition Ecologique et de la Cohésion des Territoires
Hiu-Yan CHENG, United Nations Environment Programme Finance Initiative (UNEP FI)
Mike CONROY, TotalEnergies
Sarah COOK, UN Global Compact Network UK
Marc COTTIGNIES, ADEME
François CUENOT, United Nations Economic Commission for Europe (UNECE)
Sophie DE RICHECOUR, TotalEnergies
Verena EHRLER, IÉSEG School of Management
Yoshihiro IKEDA, Honda Motor Co., Ltd
Arindam KHAN, Mott MacDonald
Usman KHAN, CDP
Takayuki KUSAJIMA, Toyota Motor Corporation
Benoit LEBOT, Ministère de la Transition Écologique et Solidaire
Alan LEWIS, Smart Freight Centre (SFC)
Marina LUSSICH, Amazon
Sharon MASTERSON, ITF
Mehdi MEDMOUN, Direction Générale des Infrastructures, des Transports et des Mobilités
Marisha NAZ, Amazon
Niccolò PIERI, European Commission, DG Mobility and Transport
Malo PIVET, Valeo
Buddy POLOVICK, US Environmental Protection Agency (EPA)
Parnika RAY, ITF
Aurore REMY, Mott MacDonald
Alexis ROCA, ExxonMobil Corporation
Amir SAFAEI, GHG Protocol
Hideaki SAITO, Toyota Motor Corporation
Maria TORTORELLA, Ministère de la Transition Écologique et Solidaire
Boyong WANG, Smart Freight Centre (SFC) China
Greg WATERS, International Financial Reporting Standards (IFRS) Foundation
Rolf WILLKRANS, AB Volvo
Donald WONG, Science Based Targets initiative (SBTi)

References

ADEME (2024a), Agence de la transition écologique, https://www.ademe.fr/ (accessed 13 September 2024).

ADEME (2024b), *Base Empreinte*, Agence de la transition écologique, https://base-empreinte.ademe.fr/ (accessed 13 September 2024).

ADEME (2010), *Guide des Facteurs d'Emissions Version 6.1*, Bilan Carbone® Entreprises et Collectivités, http://www.23dd.fr/images/stories/Documents/PV/Ademe_Metro_Chapitre_2_Energie.pdf (accessed 13 September 2024).

Bond, T. C. et al. (2013), "Bounding the role of black carbon in the climate system: A scientific assessment", *Journal of Geophysical Research Atmospheres*, Vol. 118, 5380–5552, https://doi.org/10.1002/jgrd.50171.

CDP (2024), "CDP Disclosure Insight Action", *Presentation at the April 2024 Project Workshop: GHG Emissions Accounting and Reporting for Transport of the International Transport Forum, Paris*, https://www.itf-oecd.org/sites/default/files/2.1._cdp.pdf.

CDP (2022), *CDP Technical Note: Relevance of Scope 3 Categories by Sector*, https://cdn.cdp.net/cdp-production/cms/guidance_docs/pdfs/000/003/504/original/CDP-technical-note-scope-3-relevance-by-sector.pdf (accessed 09 November 2024).

CDP and BCG (2023), *Scope 3 Upstream: Big Challenges, Simple Remedies*, https://www.cdp.net/en/supply-chain/cdp-bcg-scope-3-report (accessed 09 November 2024).

Cheng, H. (2024) *UNEP FI: Overview of assistance to financial institutions in navigating sustainability risks*, Presentation at the ITF Workshop: GHG Emissions Accounting and Reporting for Transport, 26 April, Paris, https://www.itf-oecd.org/sites/default/files/3.1._unep_fi.pdf.

CLEPA (2022), *CLEPA Inputs for a CO_2-LCA Workshop at GRPE, Geneva, 31st May 2022*, European Association for Automotive Suppliers, https://unece.org/sites/default/files/2022-05/14_CLEPA_2022_05_29_%20CLEPA%20Draft%20Presentation%20for%20a%20CO2-LCA%20Workshop%20at%20GRPE.pdf (accessed 13 September 2024).

CLEVER (2024), https://emissionfactors.eu/about-us/ (accessed 13 September 2024).

COFRET (2015), Periodic Report Summary 2 – CORFET, Carbon footprint of freight transport | COFRET | Project | News & Multimedia | FP7 | CORDIS | European Commission (europa.eu) (accessed 2 October 2024).

Cottignies, M. (2024), *Country perspectives: France*, Presentation at the ITF Workshop: GHG Emissions Accounting and Reporting for Transport, 26 April, Paris, https://www.itf-oecd.org/sites/default/files/2.5._ademe.pdf.

EFRAG and IFRS (2024), *IFRS Foundation and EFRAG publish interoperability guidance*, https://efrag.org/news/public-515/IFRS-Foundation-and-EFRAG-publish-interoperability-guidance (accessed 13 September 2024).

EPA (2024), Participate in SmartWay, *United States Environmental Protection Agency*, https://www.epa.gov/smartway/participate-smartway (accessed 13 September 2024).

EpE (2005), *Protocole de quantification, reporting et vérification des émissions de GES des transports engendrés par les activités d'une entité*, Entreprises pour l'Environnement, https://www.epe-asso.org/module-ges-transports-module-de-quantification-des-emissions-de-gaz-a-effet-de-serre-des-transports-de-personnes-et-de-marchandises-engendres-par-les-activites-des-entreprises-et-des-organismes-oc/ (accessed 13 September 2024).

EpE and ADEME (2005), *Module Transports de quantification des émissions de gaz à effet de serre*, https://www.epe-asso.org/module-ges-transports-module-de-quantification-des-emissions-de-gaz-a-effet-de-serre-des-transports-de-personnes-et-de-marchandises-engendres-par-les-activites-des-entreprises-et-des-organismes-oc/ (accessed 13 September 2024).

European Commission (2024a), *Emissions Database for Global Atmospheric Research (EDGAR)*, Joint Research Centre Data Catalogue, https://data.jrc.ec.europa.eu/collection/edgar (accessed on 13 September 2024).

European Commission (2024b), *Corporate sustainability reporting*, https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en (accessed on 13 September 2024).

European Commission, (2023a), "Proposal for a Regulation on the Accounting of GHG Emissions of Transport Services", *Official Journal of the European Union*, EUR-Lex, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023PC0441

European Commission (2023b), *Carbon Border Adjustment Mechanism (CBAM), 17 October 2023,* https://trade.ec.europa.eu/access-to-markets/en/news/carbon-border-adjustment-mechanism-cbam (accessed 2 October 2024).

European Commission (2023c), "Commission Delegated Regulation (EU) 2023/2772"*, Official Journal of the European Union*, EUR-Lex, https://eur-lex.europa.eu/eli/reg_del/2023/2772/oj.European Commission (2022), "Directive (EU) 2022/2464 of the European Parliament and of the Council", *Official Journal of the European Union,* EUR-Lex, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022L2464.

European Commission (2011), *White paper on transport: Roadmap to a single European transport area – Towards a competitive and resource efficient transport system*, Publications Office of the European Union, https://data.europa.eu/doi/10.2832/30955 (accessed on 13 September 2024).

European Standards (2013), *EN16258:2012 Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers) (Withdrawn)*, https://www.en-standard.eu/csn-en-16258-methodology-for-calculation-and-declaration-of-energy-consumption-and-ghg-emissions-of-transport-services-freight-and-passengers/?srsltid=AfmBOooe0RgOH2bS-K-0VvJvSLrNSRtARnELWh4GOWOY3kwiH64k1bQP.

European Parliament (2024), *CountEmissionsEU Measuring emissions from transport services*, BRIEFING EU Legislation in Progress, European Parliamentary Research Service (EPRC), https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/757562/EPRS_BRI(2023)757562_EN.pdf.

EU ETS (n.d.), EU Emissions Trading System (ETS), https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en (accessed 2 October 2024).

EVE (2021), *Guide charte « Objectif CO2 : les transporteurs s'engagent »*, Engagements Volontaires pour l'Environnement (EVE), https://www.objectifco2.fr/docs/upload/41/Guide_Charte_VEVE_13012022.pdf (accessed 13 September 2024).

FM 6 (2024), *Air et Climat – Bilan Carbone et Compensation Volontaire Carbone*, Mohammed VI Foundation for Environmental Protection, https://fm6e.org/programme/bilan-carbone-et-compensation-volontaire-carbone/ (accessed 13 September 2024).

GHG Protocol (2023), *Survey on Need and Scope for Updates or Additional Guidance; Greenhouse Gas Protocol*, Greenhouse Gas Protocol, https://ghgprotocol.org/survey-need-ghg-protocol-corporate-standards-and-guidance-updates (accessed 13 September 2024).

GHG Protocol (2013), *Technical Guidance for Calculating Scope 3 Emissions (Version 1.0)*, https://ghgprotocol.org/scope-3-calculation-guidance-2.

GHG Protocol (2011a), *Corporate Value Chain (Scope 3) Accounting and Reporting Standard*, https://ghgprotocol.org/corporate-value-chain-scope-3-standard.

GHG Protocol (2011b), *Product Life Cycle Accounting and Reporting Standard*, https://ghgprotocol.org/sites/default/files/standards/Product-Life-Cycle-Accounting-Reporting-Standard_041613.pdf.

GHG Protocol (2004), *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*, https://ghgprotocol.org/corporate-standard.

GLEC (2024), *The Glec Framework*, https://www.smartfreightcentre.org/en/our-programs/global-logistics-emissions-council/calculate-report-glec-framework/.

GOV.UK (2024a), *Greenhouse Gas Conversion Factors for Company Reporting*, Department for Energy Security and Net Zero, The Government of the United Kingdom,https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2024 (accessed 13 September 2024).

GOV.UK (2024b), *Streamlined Energy and Carbon Reporting (SECR) for academy trusts*, Education and Skills Funding Agency The Government of the United Kingdom, https://www.gov.uk/government/publications/academy-trust-financial-management-good-practice-guides/streamlined-energy-and-carbon-reporting (accessed 13 September 2024).

GOV.UK (2023), *Digest of UK Energy Statistics (DUKES)*, Department for Energy Security and Net Zero, The Government of the United Kingdom (GOV.UK), https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2023 (accessed 13 September 2024).

GOV.UK (2019), *Continuing Survey of Road Goods Transport*, Department for Transport, The Government of the United Kingdom, https://www.gov.uk/government/statistics/continuing-survey-of-road-goods-transport-gb-respondents-section (accessed 13 September 2024).

Handbook Emission Factors for Road Transport (HBEFA) https://www.hbefa.net/

IATA (2022), *Cargo CO2 Emissions Measurement*, International Air Transport Association (IATA), https://www.iata.org/en/programs/cargo/sustainability/carbon-footprint/ (accessed 13 September 2024).

ICCT (2024), *Official fuel efficiency and CO2 emission data sources*, The International Council on Clean Transportation, https://theicct.org/tools-fuel-efficiency-co2-data/ (accessed on 2 October 2024).

International Energy Agency, https://www.iea.org/energy-system/transport/aviation (accessed 15 November 2024)

IFRS (2023a), *IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information*, International Financial Reporting Standards (IFRS®), https://www.ifrs.org/issued-standards/ifrs-sustainability-standards-navigator/ifrs-s1-general-requirements/ (accessed 13 September 2024).

IFRS (2023b), *IFRS S2 Climate-related Disclosures*, International Financial Reporting Standards (IFRS®), https://www.ifrs.org/issued-standards/ifrs-sustainability-standards-navigator/ifrs-s2-climate-related-disclosures/ (accessed 13 September 2024).

IFRS (2024), International Financial Reporting Standards (IFRS®), https://www.ifrs.org/news-and-events/news/2024/05/jurisdictions-representing-over-half-the-global-economy-by-gdp-take-steps-towards-issb-standards/ (accessed 13 September 2024).

International Maritime Organization, IMO framework on life cycle GHG intensity of marine fuels (LCA) (accessed 15 November 2024)

IPCC (2023), *Climate Change 2021 – The Physical Science Basis*, Cambridge University Press, Intergovernmental Panel on Climate Change (IPCC), https://doi.org/10.1017/9781009157896.

ISO (2023), *EN ISO 14083:2023, Greenhouse gases, Quantification and reporting of greenhouse gas emissions arising from transport chain operations GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard*, International Organization for Standardization, https://www.iso.org/obp/ui/en/#iso:std:iso:14083:ed-1:v1:en.

ISO (2018), *ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification*, International Organization for Standardization, https://www.iso.org/standard/71206.html.

ISO (2015), *IWA 16:2015, International harmonized method(s) for a coherent quantification of CO2e emissions of freight transport*, International Organization for Standardization, https://www.iso.org/standard/67844.html.

ITF (2024), *Transport System Resilience: Summary and Conclusions*, ITF Roundtable Reports, No. 194, OECD Publishing, Paris, https://doi.org/10.1787/d90b86ac-en.

ITF CPB Workshop (2024), GHG Emissions Accounting and Reporting for Transport- CPB Workshop, https://www.itf-oecd.org/repository/ghg-emissions-accounting-and-reporting-transport-cpb-project-workshop

ITF Presentation (2024), *GHG Emissions Accounting and Reporting for Transport*, Presentation at the ITF Workshop: GHG Emissions Accounting and Reporting for Transport, 26 April, Paris, https://www.itf-oecd.org/sites/default/files/1.1_ghg_emissions_reporting_in_transport_pr_itf_0.pdf.

ITF (2023), *ITF Transport Outlook 2023*, OECD Publishing, Paris, https://doi.org/10.1787/b6cc9ad5-en

Integrating Logistics Emissions and PCFs (iLEAP), https://www.smartfreightcentre.org/en/our-programs/global-logistics-emissions-council/digitalization-program/ileap-integrating-logistics-emissions-and-pcfs/ (accessed 15 November 2024)

Légifrance (2015), *Code des transports – Chapitre 1er : Principes (Articles L1431-1 à L1452-4)*, https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000031066016 (accessed 13 September 2024).

Lewis, A. (2024), *Transport GHG Accounting: Methodology Timeline*, Presentation at the ITF Workshop: GHG Emissions Accounting and Reporting for Transport, 26 April, Paris, https://www.itf-oecd.org/sites/default/files/1.4._smart_freight_centre.pdf.

NTM (n.d.), Network for Transport Measures, https://www.transportmeasures.org/en/ (accessed 2 October 2024).

Pieri, N. (2024), *Proposal for a Regulation on the accounting of GHG emissions of transport services CountEmissions EU*, Presentation at the ITF Workshop: GHG Emissions Accounting and Reporting for Transport, 26 April, Paris, https://www.itf-oecd.org/sites/default/files/1.3._countemissionseu.pdf.

Poseidon Principles (n.d.), https://www.poseidonprinciples.org/finance/#home (accessed 10 November 2024).

Partnership for Carbon Transparency (PACT), https://www.carbon-transparency.org/

SB-261 (2023), *Senate Bill No. 261: Greenhouse gases: climate-related financial risk*, California legislative information, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB261 (accessed 13 September 2024).

SB-253 (2023), *Senate Bill No. 253: Climate Corporate Data Accountability Act,* California legislative information, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB253 (accessed 13 September 2024).

SBTi (2024), *Land Transport Science-Based Target-Setting Guidance (Version 1.0)*, Science Based Targets Initiative, https://sciencebasedtargets.org/sectors/land-transport.

SBTi (2023a), *Science-Based Target Setting for the Maritime Transport Sector*, Science Based Targets Initiative, https://sciencebasedtargets.org/sectors/maritime-sector.

SBTi (2023b), *Technical Report: The SBTi Interim 1.5°C Sector Pathway for Aviation*, Science Based Targets Initiative, https://sciencebasedtargets.org/news/the-sbtis-new-interim-1-5-c-aviation-pathway.

Schroten, A. et. al. (2023), *Study supporting the Impact Assessment of the CountEmissions EU initiative*, European Commission: Directorate-General for Mobility and Transport, Publications office of the European Union, https://data.europa.eu/doi/10.2832/553011.

SLOCAT (2023), *Global Status Report on Transport, Climate and Sustainability – 3rd edition*, Sustainable, Low Carbon Transport Partnership, www.tcc-gsr.com.

Smart Freight Centre and CDP (2020), *Closing the Logistics Emissions Disclosure Gap: An analysis of emissions disclosure to CDP by corporations worldwide*, White Paper, https://smartfreightcentre.org/en/about-sfc/news/closing-the-logistics-emissions-disclosure-gap-an-analysis-of-carbon-disclosure-to-cdp-by-multinationals-worldwide/ (accessed 13 September 2024).

Smart Freight Centre (2024), *SFC Conformity Assessment Scheme*, https://www.smartfreightcentre.org/en/our-programs/global-logistics-emissions-council/smart-freight-centre-conformity-assessment-scheme/ (accessed 13 September 2024).

Smart Freight Centre (2023), *GLEC Framework v3.1: Global Logistics Emissions Council Framework for Logistics Emissions Accounting and Reporting, ISBN 978-90-833629-0-8*, https://smart-freight-centre-media.s3.amazonaws.com/documents/GLEC_FRAMEWORK_v3_23_10_24_B.pdf.

Smart Freight Centre (2019), Global Logistics Emissions Council Framework for Logistics Emissions Accounting and Reporting, ISBN 978-90-82-68790-3, Smart Freight Centre, https://smart-freight-centre-media.s3.amazonaws.com/documents/2019_GLEC_Framework_July_2022.pdf.

SmartWay (2024), *SmartWay Overview*, Presentation at the ITF Workshop: GHG Emissions Accounting and Reporting for Transport, 26 April, Paris, https://www.itf-oecd.org/sites/default/files/2.6._epa.pdf.

UN Global Compact (2024), *Scope 3 Emissions*, Global Compact Network UK, https://www.unglobalcompact.org.uk/scope-3-emissions/ (accessed on 13 September 2024).

UNECE (2023), *Transport Data Commons*, United Nations Economic Commission for Europe, https://tdc.unece.org/ (accessed 04 April 2024).

Wang, B. (2024), *Smart Freight Centre- GLEC adoption to China market*, Presentation at the ITF Workshop: GHG Emissions Accounting and Reporting for Transport, 26 April, Paris, https://www.itf-oecd.org/sites/default/files/2.7._sfc-china.pdf

Waters, G. (2024), *ISSB Standards – Communicating sustainability-related financial information to investors*, Presentation at the ITF Workshop: GHG Emissions Accounting and Reporting for Transport, 26 April, Paris, https://www.itf-oecd.org/sites/default/files/2.3._issb.pdf

International Transport Forum

GHG Emissions Accounting and Reporting for Transport

The transport sector is a significant contributor to global greenhouse gas (GHG) emissions, posing substantial risks to both the environment and the economy. With the growing number of commitments to achieve net-zero carbon emissions, more robust tracking and reporting of GHG emissions is crucial.

The accounting and reporting landscape for GHG emissions is rapidly evolving, not just within the transport sector but across all areas of sustainability. This report aims to demystify the complex landscape of emissions calculation and reporting for transport, often characterised by plethora of methodologies, standards, and regulations. It evaluates the current state of GHG accounting and reporting practices in the transport sector, identifies key challenges, and how to overcome those. By doing so, it provides a roadmap to improve transparency and consistency in emissions accounting and reporting, ultimately helping the industry to reduce its environmental impact and move towards sustainable practices.

International Transport Forum
2 rue André Pascal
F-75775 Paris Cedex 16
+33 (0)1 73 31 25 00
contact@itf-oecd.org
www.itf-oecd.org

OECD

Published: 11/2024 | Photo credit: Chay_Tee/Shutterstock