LEARN

Logistics Emissions Accounting & Reduction Network

Deliverable 2.4

Guidelines for validation and reporting of emissions

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V2.7	13/3/2019	Advisory Board comments	AL	SFC	Chapter 4

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Executive Summary

GLEC Framework (SFC 2016) acts as an industry-defined standard for the calculation and reporting of logistics GHG emissions. It is important to emphasize that the GLEC Framework is not in competition with existing logistics emissions calculation tools (whether commercial or in-house) or the methods / standards that support them. In fact the GLEC Framework is built on the most respected, commonly used, and consistent of the existing tools or methods, bringing them together into a complete and consistent package with a defined set of boundaries to support business decision making on a holistic basis. This provides calculation tools with the opportunity to use the GLEC Framework as the basis for harmonizing their core methodological approach, so increasing transparency of the approach taken and comparability of the calculation results. Where existing tools are not aligned with the GLEC Framework there is generally no need to discard the existing calculation tool, merely make the necessary amendments to align the content with the approach set out in the Framework.

This document aims at **giving guidance for validation, assurance and final reporting of the environmental performance of logistics**. The terms 'validation' and 'assurance' are used as defined in the "SFC Assurance Guidance for GLEC Framework Implementation" (SFC 2018). As such, 'validation' refers to an "internal check" by the reporting company whether the implementation of the GLEC Framework meets the conformance criteria set in the Assurance Guidance (SFC 2018), whereas 'assurance' refers to an "independent assessment" by a third party.

Therefore, validation may not carry the same level of trust that would be inferred from the engagement of an independent assurer. However, the implementation and internal validation process will require in-depth analysis of organizational processes. This can often provide new perspectives on operations and past experience has shown that these processes will result in a continued build-up of expertise and even an entire mind shift regarding environmental assessment within an organization. As such, the validation supports the purpose of assurance of environmental accounting and subsequent reporting of assured information on environmental performance of logistics that is

- **Establishing trust** in the results and declaration of organizations dealing with environmental performance of logistics
- **Enabling** more informed and better **decision making**
- **Realizing comparability** between logistics systems, chains and organizations
- **Improving information and data** on environmental performance of logistics
- Finally **reducing environmental impact** of the logistics sector worldwide.

This report addresses business that is in the process of implementing the GLEC Framework. The SFC Assurance Guidance (SFC 2018) differentiates **three stages of implementing the GLEC Framework**: in an initial step, the company embarks on a process towards calculating and reporting its logistics emissions (i.e. adoption). In the second step, the company starts the progress towards implementing the GLEC Framework. To claim to be 'in conformance with the GLEC Framework', the company has to calculate and report its logistics emissions following the principles and practices set out in the GLEC Framework to a defined degree, and declare the calculation results using the GLEC Declaration.

In the frame of the **assurance process**, the assurance organisation has the task to obtain and examine sufficient and appropriate evidence in relation to the company's claims relating to the **GLEC Framework conformance criteria** (SFC 2018). This report discusses what kind of evidence the adopting or implementing company should provide and what it needs to consider and prepare, following recommended assurance procedures (SFC 2018). SFC's assurance guidance for the GLEC Framework (SFC 2018) refers, here, to two possible levels of detail that the assurer could be asked to provide, namely 'limited assurance' and 'reasonable assurance'.

For **calculating emissions** in line with the GLEC Framework, the total fuel and electricity consumption of all relevant operations during transport and at logistics sites are assessed, covering the life-cycle approach, i.e. WTW emissions of fuels. In addition, the leakage of refrigerants at sites with temperature controlled conditions is covered. The assessment is to cover all relevant greenhouse gases associated with fuel combustion and temperature control and total annual GHG emissions as well as key performance indicators, i.e. emission intensities, are calculated. These are expressed in carbon dioxide equivalents (CO_2e), in total or per transport service (e.g. per tonne-kilometre) or at activity level for logistics sites (e.g. per tonne throughput). The guide provides a short overview of which mode-specific **transport service categories (TSCs)** (SFC 2019) and which site-specific activity categories (Dobers et al. 2019a) are relevant.

Strong focus is laid on **data capture and data sharing** for logistics emissions accounting. Depending on the role of the reporting company within the logistics chain, i.e. shipper, logistics service provider (LSP) or carrier, different perspectives come into play, which result in a different definition of scopes / tiers as well as data availability refers to varying data sets or level of detail. As such, the emission calculation may be based on primary data, program data, modelled data or default data, relevant for energy used, amount of cargo transported or handled and (transport or handling) services provided.

Accessing good quality data that can be readily processed by and transferred between the different parties in the supply chain remains a significant problem.

SFC has taken a further step outside of the LEARN project to initiate an accreditation process for calculation tools and derived an accreditation scheme. The SFC Accreditation is designed to help:

- Organizations that provide calculation tools or calculate logistics emissions as a service that the underlying methodology has been independently checked and is correctly aligned with the GLEC Framework.
- Potential users to know which tools and programs have successfully embedded the GLEC Framework.

It is expected that this will play a part in providing market confidence leading to an increased uptake of accredited calculation tools and green freight programs resulting in increased market convergence and comparability of calculation outputs.

One of the main challenges in the calculation and reporting of emissions from logistics activities is the complex nature of the relationships between the various stakeholders involved. This is reflected in strong differences in natural data visibility to the carrier, logistics service provider (if there is one), and shipper. In order to take steps to answer questions on who should have responsibility for calculating and reporting what level of emissions information, what is needed to collect the necessary information or what mechanisms might facilitate the **necessary data transfer**, the existing situation has been analysed from different perspectives. Thus, remaining gaps and barriers have been identified, such as

- Aligned use of 'shipment' and 'consignment' and corresponding identification codes as suggested by e.g. GS1.
- Stakeholder data needs, commonly used data management systems and resulting potential data gaps depending on the starting point of the respective organisation
- Unclear or varying roles of data exchange platforms (company own or outsourced programs / tools) and ITS platforms used for pulling data together for emissions calculation
- Accreditation of such calculation tools, green freight programs or data exchange platforms as well as accreditation of 3rd party assurer or assurance organisations.

This report also provides - in an objective and neutral way - an overview description of seven **calculation tools** for emissions calculation related to transport and/or logistics sites activities to overcome the identified lack of knowledge and confusion among many potential users of emissions calculation tools as to their scope, data required, and the outputs that would be provided.

The logistics emissions results calculated using the GLEC Framework are intended to facilitate reporting, business decision making, and emissions reduction strategy formation and implementation. One of the barriers cited to widespread uptake of logistics emission calculation and reporting has been the many similar, yet subtly different formats and KPIs used by individual companies to request information from their transport providers. Therefore, the **GLEC Declaration** (SFC 2019) has been designed to address this issue, taking all the relevant factors into account, reflecting the role of each stakeholder, and the information that needs to be presented, both privately in communications from a company to its customers, and publicly to the broader set of organizations that have a role in reviewing progress towards overall climate goals. As such, the GLEC Declaration, based on the existing GLEC Framework to ensure a consistent approach by companies measuring their emissions, and feeds into existing green freight programs and carbon accounting tools already used by companies. This follows recommendations from various stakeholders (i.e. industry, green freight programs, policy, assurer) involved during the course of the LEARN project to favour an emission declaration over a new eco-label. The report closes with a short summary and recommendation for further reading with view to validation, assurance and final reporting of the environmental performance of logistics.

1. Introduction

This report aims at providing insight in the validation and assurance processes to enable consistent and comparable reporting of emissions associated with freight logistics supply chains. It addresses business that is in the process of implementing the Global Logistics Emission Council (GLEC) Framework (SFC 2016, SFC 2019) and plan to indicate their environmental performance of logistics operations, either from the perspective of a carrier, a logistics service provider (LSP) or a shipper. The GLEC Framework aims at harmonizing the way organizations account and report their emissions from their freight transport.

In turn, this will enable a recommendation to provide a declaration of the emissions:

1. Between supply chain partners related to logistics services provided, or
2. At corporate level to investors, civil society and 3rd party organizations involved in supporting emission reduction activities to indicate the overall GHG emissions performance of their logistics operations and/or extent of adoption of the Global Logistics Emission Council (GLEC) Framework.

Figure 1 shows the most relevant preliminary achievements of the project LEARN "Logistics Emissions and Accounting Network" that serve as basis and input for the report. Starting with the GLEC Framework (version 1.0) (SFC 2016) as well as the ISO International Workshop Agreement (IWA 16:2015), the WP 3 partners established a "Research and Development Agenda" to advance logistics emissions accounting and disclosure (LEARN D3.3 2019). The R&D Agenda was developed based on findings from a gap analysis (LEARN D3.1 2017), stakeholder workshops and feedback within WP 2 such as two international workshops in 2017 and 2019 or feedback from the LEARN's Advisory Board and Verification and Certification Reference Group. In addition, this report uses results from test cases from over 25 companies (WP 4) and training sessions with industry partners (WP 5) that were carried out under the LEARN project.

This report addresses the main findings of all LEARN work packages with view to the validation, assurance and reporting of environmental performance of logistics. In the rest of Chapter 1 "Definition of terms relevant for validation, assurance and reporting" as well as a summary of the "Status-quo on standardized logistics emission calculation, assurance and reporting" are given. After this, Chapter 2 provides an overview on how industry can implement the GLEC Framework and how assurance of the implementation process is structured. Relevant assurance issues on the methodology of calculating emissions, data capture and data exchange are summarized in chapters 3 and 3.3. Section 4.3 and the Annex provide an updated summary on selected main calculation tools in the field of logistics emissions calculation. This is accomplished with the Chapter 5 on "Reporting of emissions and emission intensities".

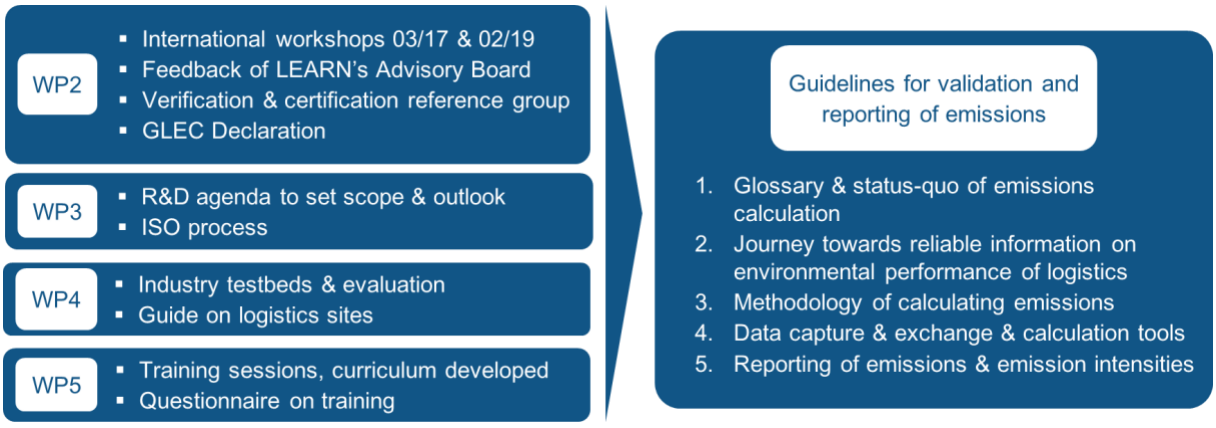

Figure 1: Overview of structure of the report

1.1 Definition of terms relevant for validation, assurance and reporting

This report uses a variety of terms that are defined as followed. The definitions are taken from the SFC Assurance Guidance (SFC 2018), or the drafted 2nd version of the GLEC Framework (SFC 2019).

Actual distance: The actual distance travelled by a shipment. Based on odometer readings or knowledge of the actual route, the true actual distance is generally only known by the carrier. In most cases a shipper or LSP does not have access to the actual distances travelled by its subcontracted carriers.

Adoption: The first step in the implementation process of the GLEC Framework by a company, as defined in the conformance criteria contained within this guidance. Characterised by a commitment to implement the GLEC Framework accompanied by evidence to back up this commitment, but without active implementation having started.

Assurance: A term used when a third party is engaged to provide an independent assessment with the aim of establishing confidence or trust around a process or declared output (declaration).

Carbon dioxide equivalent (CO_2e): Unit for comparing the radiative forcing of a greenhouse gas to carbon dioxide, calculated using the mass of a given greenhouse gas multiplied by its global warming potential.

Carrier: An entity which operates a vehicle or vehicles with the purpose of transporting goods. Vehicle could refer to any form of transport, e.g., truck, train, aircraft, waterborne vessel.

Certification: The process of providing someone or something (e.g. a person, organization, product or service) with an official document attesting to a status or level of achievement.

Compliance: Confirmation that a set of processes have been followed fully, and in particular that any associated criteria have been met fully in response to a formal request or legislative requirement.

Conformance: The degree to which a set of processes have been followed and any associated criteria have been met.

Consignment exists only for a single journey leg, meaning that for a multimodal transport chain consignments may be merged into larger consignments (consolidation) or split into smaller consignments (break bulk). See also section 4.2.1

Consumption factor (CF): A way to express the fuel efficiency of the useful work done when moving goods; expressed as the total fuel consumption divided by the total work done (expressed in tonne km); can also passed between supply chain partners (e.g. carrier to shipper) as verified data with an associated data type classification to support scope 3 calculations by customers.

Criteria: A set of indicators, potentially in the form of a checklist or numerical benchmarks, used to assess whether or not a process and the associated outputs are worthy of a given level of recognition.

Declaration: Statement of total company emissions and emission intensity for one or more transport service categories according to the GLEC Framework.

Default data or **defaults**: are used as a proxy for primary data when it is not available. The GLEC Framework includes default data for a range of consumption factors disaggregated by mode and service type and also for greenhouse gas emission factors.

Distance: The distance a shipment is transported is measured from the point where the shipper hands it over to the carrier, and ends with the hand-over of the shipment to the end receiver. See also actual distance, great circle distance (GCD), shortest feasible distance (SFD), planned distance, network distance

Empty running: Empty running is calculated as the percentage of total vehicle-kilometres that are run empty.

Fuel-based approach: Methodologies that use actual fuel consumption data to estimate emissions based on the content of the fuel and assumptions regarding its combustion.

Great circle distance (GCD): GCD is defined as the shortest distance between any two points on the surface of the earth, using the Vincenty distance formula associated with the World Geodesic System. Also known as direct distance or “as the

crow flies," GCD is an approach to distance measurement that is easily standardized and doesn't relate to actual transport network conditions. While this is a compelling option for harmonizing distance measurement, it is currently not widely known or accepted by industry and is therefore not currently used except in specific circumstances.

Greenhouse gas emissions: The greenhouse gases (GHGs) that have been emitted to the atmosphere or would have been emitted to the atmosphere had they not been captured or sunk. GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), nitrogen triflouride (NF_3) and sulphur hexafluoride (SF_6).

Greenhouse gas emission factor: A factor or ratio for converting the measure of an activity (for example, litres of fuel consumed) into an estimate of the quantity of GHGs associated with that activity.

Implementation: the staged process by which a company decides to, and then progressively uses, the GLEC Framework as the basis for its logistics GHG accounting and reporting.

Limited assurance engagement: An assurance engagement in which the assurance provider reduces engagement risk to a level that is acceptable in the circumstances of the engagement, but where that risk is greater than for a reasonable assurance engagement, as the basis for expressing a conclusion in a form that conveys whether, based on the procedures performed and evidence obtained, a matter has come to the assurance provider's attention to cause the assurance provider to believe the information is materially misstated. The nature, timing, and extent of procedures performed in a limited assurance engagement is limited compared with that necessary in a reasonable assurance engagement but is planned to obtain a level of assurance that is, in the assurance provider's professional judgment, meaningful.

Load factor: Ratio of the average load to total vehicle freight capacity (vans, lorries, train wagons, ships.

Logistics chain: Sequence of transport, warehousing and transhipment activities used to move goods from their origin to their destination.

Logistics Service Provider (LSP): A third party to which an organization outsources its logistics operations. Services provided by LSPs include transportation, freight forwarding, warehousing and inventory management.

Materiality: Materiality is a concept that used throughout an assurance engagement. When determining the extent of the assurance procedures to be carried out, the concept will be used to determine the sample size. Information is material if omitting, misstating or obscuring it could reasonably be expected to influence decisions of primary users of the report containing that information.

Modelled data: Tools combine available carrier and customer data about shipments, start, end and intermediate locations (logistics sites), modes and vehicles, blended with assumptions about e.g. routing to model fuel use and emissions (example: EcoTransIT)

Network distance: Effectively a variation of planned distance, network distance is used where the route options that can be taken are limited, for example rail or inland waterway networks

One way trip: Travel without a return trip.

Planned distance: Goods are traveling on shared transport assets, where shipments are consolidated to increase vehicle loading and hence efficiency, but may lead to longer distances being travelled than the most direct route for an individual shipment. Also found using route planning software, planned distance tends to be the shortest distance taking into account real operating conditions and typical operational choices such as avoiding congestion hotspots or unsuitable, restricted roads.

Primary data: Data specific to a particular organisation's operations (e.g. carriers or operator of logistics site) for a particular shipment or time period

Program data: Data from e.g. green freight programs such as SmartWay carrier performance data, Clean Cargo Working Group carrier data

Reasonable assurance engagement: An assurance engagement in which the assurance provider reduces engagement risk to an acceptably low level in the circumstances of the engagement, as the basis for a positive form of expression of the auditor's conclusion. Reasonable assurance means a high but not absolute level of assurance.

Round trip: A group of sequential journeys that start and end in the same place.

Scope 1 GHG emissions: Direct emissions from sources that are owned or controlled by the reporting organization, see also Figure 6.

Scope 2 GHG emissions: Indirect emissions that are associated with energy that is transferred to and consumed by the entity, see also Figure 6.

Scope 3 emissions: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, see also Figure 6.

Service level: Data or calculation output associated with a particular transport service category.

Shipment: refers to the goods in a commercial transaction between a seller and a buyer; hence the shipment Identification Key exists as a common element throughout the movement of the goods throughout the transport chain from original point of supply to ultimate point of demand. See also section 4.2.1

Shipper: Individual or entity that sends goods for transport.

Shortest feasible distance (SFD): Shortest feasible distance represents the shortest route between two places and is typically found using route planning software. SFD is not an optimal method because it does not reflect real operating conditions, such as the physical restrictions of a vehicle (e.g. weight and height), road type, topography, likely congestion or construction.

Source: A physical unit or process that releases GHGs into the atmosphere.

Transport Service Categories (TSCs): Groups of similar round trip journeys that are considered over a 12-month period to represent the way that freight transport services are procured and provided.

Validation: Used to refer to an internal check as to whether a process or product meets the requirement set out for it. As such validation does not carry the same level of trust that would be inferred from the engagement of an independent assurer.

Verification: A term used with more focused meaning, as a subset of an assurance process that focuses on a particular aspect; it is frequently used, particularly in the USA, in association with the verification of data.

1.2 Status-quo on standardized logistics emission calculation, assurance and reporting

Standardization of methodology

In 2012 the CEN working group TC/320 published **EN 16258** "Methodology for the Calculation and Declaration of Energy Consumption and GHG Emissions of Transport Services (Passengers and Freight)" (EN 16258:2012). At the time it was welcomed as the first standard of its type and played an important role in confirming some crucial principles in the calculation and reporting of GHG emissions from both passenger and freight transport.

Since the release of EN 16258 there have been many significant developments in the field of carbon footprinting of freight transport. One main step was the International Workshop Agreement **IWA 16:2015** "International harmonized method(s) for a coherent quantification of CO_2e emissions of freight transport", the results of which "[…] reflect the most pressing gaps that need to be addressed on the basis of existing emission calculation standards and tools" (IWA 16:2015, p. 25). A second main step was the release of the **GLEC Framework** with the following intense and productive discussions on implementation details as well as further improvement needed to be addressed in the revised second version of GLEC Framework. This revised version is currently under consultation and its publication is planned for June 2019. The GLEC Framework v1.0 has received the 'Built-on GHG Protocol' mark by WRI and WBCSD that adds weight to representing the global standard for the calculation and reporting of logistics GHG emissions.

LEARN has been tasked with researching, and if appropriate, developing a blueprint for an eco-label for logistics emissions. The premise was that such an eco-label would act as a key enabler in driving emissions reduction by providing a reward mechanism to incentivise improvement through supplier competition and from the credibility of receiving an independently assessed performance reward. Review of existing labelling schemes (further detail in LEARN D2.3 2017) combined with

feedback from the LEARN Expert Advisory Board and the LEARN International Conference (2017) forms the basis for the recommendation that a new eco-label, that may have to compete with existing schemes, is not produced. Instead, the approach recommended is to use a defined framework to feed into existing schemes and practices. It is recommended that the GLEC Framework should be used in the future to ensure a consistent approach by companies calculating their emissions and that the GLEC Framework's procedures for producing a verified GHG declaration should feed into the existing Green Freight programs and carbon accounting tools already used by companies. This would be used to define the relationship between the approaches taken by the various tools. (LEARN D.2.3 2017)

Reporting of emissions and emission intensities

One of the barriers cited to widespread uptake of logistics emission calculation and reporting has been the many similar, yet subtly different, formats and KPIs used by individual companies to request information from their transport providers. The **GLEC Declaration** (SFC 2019) has been designed to address this issue, reflecting the role of each stakeholder, and the information that needs to be presented, both privately in communications from a company to its customers, and publicly to the broader set of organizations that have a role in reviewing progress towards overall climate goals. Hence, the GLEC Declaration is a template for specifying the information to be included in company reports that will help to harmonize and add transparency to the reporting process. It is further discussed in Chapter 5 on reporting of emissions and emission intensities.

During 2017 and 2018 GLEC members and consultees developed the "SFC Assurance Guidance for GLEC Framework Implementation" (SFC 2018) that is designed to provide guidance for assurance providers in the steps required to assure claims made around the adoption, implementation of and calculation outputs from the GLEC Framework. It serves as a guide for assurance providers to ascertain and confirm the extent to which organizations have been able to apply the GLEC Framework. This Assurance Guidance is further discussed in Chapter 3.3 on assurance processes.

Given the success and relevance of formalised standards as well as the global nature of logistics supply chains, it is essential to establish global access to such a standard by means of ISO. During the course of LEARN (e.g. testbed in WP 4) the GLEC Framework has proved to be "[…] a workable methodology for carbon footprinting and carbon accountancy for logistics and transport chains, [and as such,] the GLEC Framework should concentrate on becoming a recognized standard" (LEARN D4.4 2019, p. 38). Therefore, it is recommended that such a **future ISO standard** should be based on the content of the GLEC Framework and to complement its current industry outreach. However, it is equally important that such a future ISO standard is also aligned with developments on the European level, i.e. an update of EN 16258.

Given the review needed to EN 16258 (e.g. referred to in IWA 15:2016), the LEARN partners together with GLEC and the German standards agency (DIN) developed jointly a proposal to develop a proposal for an ISO standard for calculation and declaration of energy consumption and GHG emissions of (freight and passenger) transport services under the Vienna Agreement, i.e. aligned with an update of EN 16258. The proposal is to develop the ISO standard such that it would fulfil the need to upgrade the existing CEN standard in this area through a single work stream at global level, so reflecting the global nature of modern logistics chains. In close cooperation with DIN it has been agreed that the technical specification ISO/TS 14067 "Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification and communication", which has been upgraded late 2018 into a full ISO standard (ISO 14067:2018), would be the most suitable anchor for such a norm within the ISO family. Findings of the LEARN project, in addition to the (revised) GLEC Framework, would provide the basis for such a transport chain emission calculation ISO norm, making the initiative to develop such a standard one of the focal points of the project to-date.

Given the status of standardized GHG emissions accounting and reporting described above, the guidance in this report refers to the implementation of the GLEC Framework. Here, reference is made to the published first version of the GLEC Framework (SFC 2016) as well as the drafted second version (SFC 2019). Any future development towards a new version or e.g. an ISO standard based on the GLEC Framework is most likely to be based on the same principles, with the guidance remaining valid.

2. Journey towards reliable information on environmental performance of logistics

The understanding and expertise of calculation of transport emissions varies dramatically between different organisations, today. This situation was also reflected within the pilots carried out within LEARN WP4: Whereas some organisations have developed their own guidelines, calculation tools and data basis over the recent decade and sometimes even further back in time, other organisations are new to the topic. The use of one harmonized methodological approach, the GLEC Framework, is a first step toward achieving comparable results and thus a basis for identification of best practice and emission reduction. As the LEARN pilots have also shown, the use of the same methodology by different people for the same transport chain does not always result in the same emission values calculated, not even if these people are all skilled emission calculators, let alone if they are new to the topic. The reason for this lies in the nature and reliability of the input data that is used and have a significant impact on the outputs. Next to the offering of training it is therefore important to support industry with the introduction of a validation and assurance process for the application of the GLEC Framework.

The terms 'validation' and 'assurance" are used as defined in the "SFC Assurance Guidance for GLEC Framework Implementation" (SFC 2018). As such, **validation** refers to an 'internal check' by the reporting company whether the implementation of the GLEC Framework meets the conformance criteria set in the Assurance Guidance (SFC 2018), whereas **assurance** refers to an 'independent assessment' by a third party.

The assurance of environmental accounting and subsequent reporting of assured information on environmental performance of logistics have the common purpose of

- **Establishing trust** in the results and declaration of organizations dealing with environmental performance of logistics
- **Enabling** more informed and better **decision making**
- **Realizing comparability** between logistics systems, chains and organizations
- **Improving information and data** on environmental performance of logistics
- Finally **reducing environmental impact** of the logistics sector worldwide.

From an **industry perspective**, the validation and assurance of emissions declarations that are based on objective evidence and transparent practices shall enhance the trust between the organisation issuing a declaration and the recipient using the declaration as a means to make informed decisions. By ensuring consistent and comparable declarations in a transparent manner will lead to the potential for comparability between transport service providers from a shipper perspective and the ability to determine what measures actually work in reducing costs and emissions and increase freight efficiency within carriers and LSPs. The resources to conduct adequate validation and assurance activity will vary according to the size and scale of operations being assessed. Large enterprises with significant scale have resource available and are prepared to invest in their corporate social responsibility agenda, however SME operators which tend to be in sectors such as road or inland waterways general have less resource available to conduct assurance activity on their declarations and will need to see a real financial benefit and business case in order to engage with an assurance program or regime.

For **regulators and policy makers** to set appropriate policy, then there needs to be a mechanism by which emissions declarations are recognised as truthful and reliable along with a level of transparency that identifies the coverage and sources of data used within calculations and declarations along with any underlying assumptions used. Any regulation associated to emissions declarations will require a high or higher level of assurance associated with it than maybe currently adopted or used within corporate and company reporting. Any discrepancies between reported and declared values and accompanying information and reality may have a detrimental impact on acceptance of policy and/ or regulation. CE Delft et al. (2014) recommended a voluntary reporting of GHG emissions, calculated by a mandatory methodology that uses real-world measured fuel consumption data (company-specific). "This option has the greatest potential for reducing GHG emissions, particularly in the long term, as it incentivises the full range of emission reduction measures and is the most accurate in estimating real-world emissions. […]" (CE Delft et al. 2014, p. 130). The (voluntary) reporting of assured emission values will add value to this option.

In respect to **green freight programs and initiatives** there is a need to demonstrate compliance with a method that leads to comparability of outputs. This is considered more trustworthy if conducted by an independent 3rd party organisation rather than wholly self-declared (see also Section 4.3).

From the **methodology** point of view, the validation and assurance process ensures that experiences of applying the GLEC Framework can be fed back to the GLEC and be included in the further optimization of the framework itself as well as of training material and guidelines.

2.1 How can industry implement the GLEC Framework and how does the assurance work?

The company that intends to report assured, thus, trusted information on environmental performance of logistics has to accomplish various processes first. Figure 2 outlines this "journey" towards assured information on environmental performance of logistics.

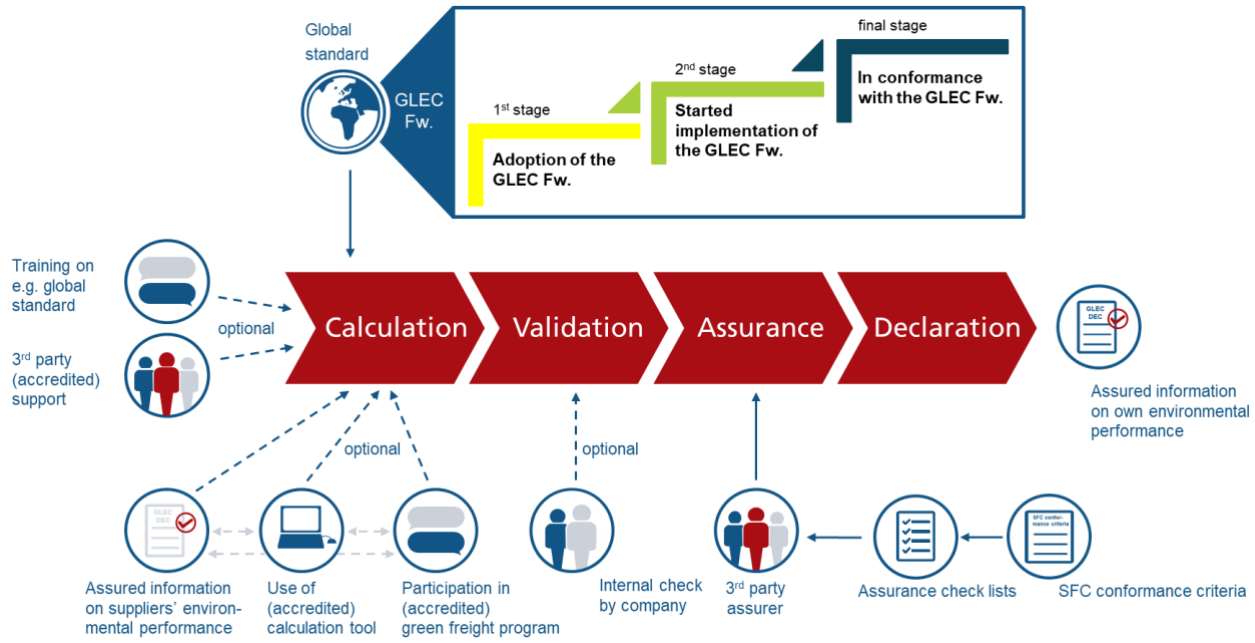

Figure 2: Overview of implementation of the GLEC Framework and its assurance (source: authors)

The SFC Assurance Guidance (SFC 2018, see also Info box 1) differentiates **three stages of implementing the GLEC Framework**. In an initial step, the company embarks on a process towards calculating and reporting its logistics emissions (i.e. adoption), see Section 2.1.1. In the second step, the company starts the progress towards implementing the GLEC Framework, see Section 2.1.2. To claim to be 'in conformance with the GLEC Framework', the company has to calculate and report its logistics emissions following the principles and practices set out in the GLEC Framework to a defined degree, i.e.

- For at least 90% of its scope 1 and 2 emissions using own fleet data, and
- For at least 90% of its total scope 1, 2 and 3 logistics chain,

and declare the calculation results using the GLEC Declaration, see Section 2.1.3.

During the implementation process of the GLEC Framework as well as the calculation of emissions itself, the company may decide whether it needs training on e.g. the global standard on emissions calculation or it requires 3rd party support by an (accredited) organization being expert in this field. In addition, the company may require data input by logistics service providers or carriers (see also section 3.3) that could be gathered e.g. using 3rd parties' GLEC Declarations. Also the use of (accredited) calculation tools (see section 4.3) or participation in (accredited) green freight programs may help during the calculation process but is optional.

The company may install an internal validation process for each of the three stages. However, the validation may not carry the same level of trust that would be inferred from the engagement of an independent assurer. In the frame of the **assurance process**, the assurance organisation, therefore, has the task to obtain and examine sufficient and appropriate evidence in relation to the company's claims relating to the **GLEC Framework conformance criteria** (SFC 2018). What

kind of evidence the adopting or implementing company should provide and what it needs to consider and prepare, is further elaborated in the following chapters, following recommended assurance procedures (SFC 2018).

Info box 1: SFC Assurance Guidance (SCF 2018)

The purpose of the SFC Assurance Guidance is "to provide guidance for assurance providers in the steps required to assure claims made around the adoption, implementation of and calculation outputs from the GLEC Framework. It serves as a guide for assurance providers to ascertain and confirm the extent to which organizations have been able to apply the GLEC Framework." (SFC 2018 p. 2)

"The assurance guidance document has been through two rounds of consultation between August and November 2017 and again between January and March 2018. The first draft was shared with GLEC members and consultees whilst circulation of the second draft included selected organisations of the assurance community through both direct contact and via the Assurance Reference Group initiated via the LEARN European project. Significant one-to-one consultation with individual organisations has also taken place." (SFC 2018 p. 2)

2.1.1 Adoption of the GLEC Framework

In the initial stage where a company claims to having adopted the GLEC Framework, 3rd party assurance has the objective to understand the scope as well as organizational and operational boundary of the company's claims.

The tasks by the adopting company may cover the following (SFC 2018):

- Internal decisions to adopt the GLEC Framework (e.g. documented by meeting minutes or other form of internal communication
- Consideration of pathway to implementation including the steps, costs and resources to achieve it (e.g. draft and approval of implementation plan, including financial, personnel and other resource allocation, timetable and procedure for assessing progress)
- Communication of decision to adopt the GLEC Framework externally (e.g. statement on website or in public reporting)
- Interaction with SFC, either directly or through a SFC-accredited green freight program, calculation tool, or advisor based on the conformance of their services with the GLEC Framework

Table 1: Link to other sections of the guideline

Relevant aspect	See section
Assessment scope & boundary	3.1
Key performance indicators	3.2
Self-assessment	3.3

2.1.2 Started to implement the GLEC Framework

In the second step, the company started the progress towards implementing the GLEC Framework and 3rd party assurance has the objective to understand, how this implementation has been realised. To support the assurance process the company should transparently document following aspects (SFC 2018):

- Company's GHG reporting guidance (for alignment with the GLEC Framework); e.g. the company may use the GLEC Gap Analysis Tool to complete self-assessment to guide the development of a GLEC Framework implementation plan (see also section 3.3)
- Emission sources identified (see also Figure 6)
- Procedures for data measurement and collection: relating to transport service categories (TSCs)
- Procedures for data measurement and collection: relating to fuel and transport activity
- Data sources, and related systems and control procedures
- Procedures for quality assurance and control (QA/QC): relating to the data collected
- Methodology for calculating GHG emissions for alignment with the GLEC Framework
- Sources of emissions factors or global warming potentials (GWPs) used in calculating GHG emissions
- GLEC Framework implementation plan including milestones, roles and responsibilities, timeline, deadlines (within 3 years of the award of 'GLEC adopter' status)

Table 2: Link to other sections of the guideline

Relevant aspect	See section
Emission sources identified	3.1
Transport service categories (TSCs)	3.2.1
Site's activity categories	3.2.2
Self-assessment	3.3
Data capture, data quality	4.1
Data sharing	4.2

2.1.3 In conformance with the GLEC Framework

To claim to be 'in conformance with the GLEC Framework', the company has to calculate and report its logistics emissions following the principles and practices set out in the GLEC Framework to a defined degree, i.e.

- For at least 90% of its scope 1 and 2 emissions using own fleet data, and
- For at least 90% of its total scope 1, 2 and 3 logistics chain,

and declare the calculation results using the GLEC Declaration.

To support 3rd party assurance process the company should prepare for the review of following aspects (SFC 2018):

- Calculations and assertions relating to the data type (own fleet, carrier direct, carrier data from programs, models / tools, default factors) (see also section 4.1 and 4.2)
- Declaration of total logistics GHG emissions (Scope 1, 2 and 3) (see also section 5)
- Emission intensity data

In addition, the assurer will carry out tests of detail to confirm the accuracy of the calculated emissions and intensities (see also section 4.1.5).

2.2 Institutional framework of assurance

Accreditation of calculation tools and green freight programs

Another aspect that may be relevant during the company's journey towards reliable information on environmental performance of logistics is its decision whether to use calculation tools, which have already implemented the GLEC Framework. The same holds true for the participation of the company in one of the existing green freight programs. Smart Freight Centre is currently offering the **GLEC accreditation for calculation tools and green freight programs** to show how they align with the GLEC Framework. The use of such a tool or participation in a program may influence the assurance process in the view to what extent evidence is needed to provide. Examples are given in the relevant chapters, a detailed description, however, is beyond the scope of this report.

Accreditation of assurance providers

The concept of accreditation of assurance providers is to ensure assurance engagements are conducted in a consistent manner and the outputs generated and assurance statements can be compared with trust. Generally organisations engaged in conducting 3rd party assurance services are themselves subject to meeting set criteria and are assessed that their procedures and processes ensure as fair as practically possible consistent assessments and statements. In the area of GHG verification under ISO standards such as ISO 14063, those bodies are assessed by a national accreditation body and accredited to conduct verification. In essence this is a means for "checking the checkers". A similar approach is taken under the assurance provision by organisations under accountancy based auditing processes and procedures.

The principles applied to GHG verifiers (or validators) under ISO 14065:2013 are as follows.

Figure 3: Principles applied to GHG verifiers (or validators) under ISO14065:2013

Assurance providers or verification bodies can be affiliated to various bodies and conduct their assurance engagements to similar standards set by different standard setting bodies.

GHG verification bodies conducting GHG verification under the ISO 14064 standards are accredited by their national accreditation bodies under ISO 14065. Whereas auditors that are members of the International Federation of Accountants (IFAC) conduct assurance engagements under the ISAE 3000 and 3410 standards set by the International Auditing and Assurance Standards Board (IAASB). Both use similar processes and terminology within their procedures.

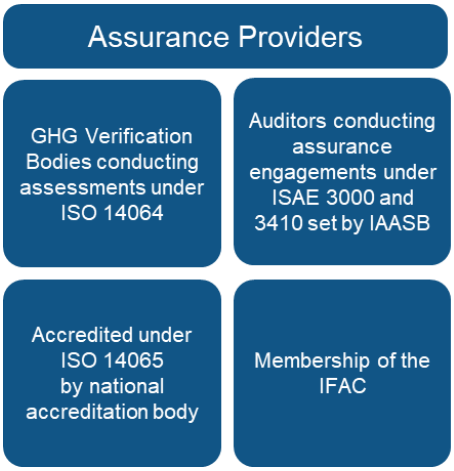

Figure 4: Assurance providers

One aspect that needs to be considered is the level of assurance statement provided. This can be referred to as **limited assurance** or **reasonable assurance**. "The objective of an engagement under ISAE 3410 is to obtain either limited or reasonable assurance, as applicable, about whether the GHG statement is free from material misstatement, whether due to fraud or error" (ISAE 3410).

Table 3: Differentiation of limited or reasonable assurance

Limited assurance engagement
• The level of assurance engagement risk is higher with a limited assurance due to the nature and extent of evidence gathered and procedures undertaken which leads to a negative form of expression within the assurance providers conclusion statement. • A limited assurance engagement is at least sufficient to be able to enhance the intended user's confidence in the information communicated to a degree that is clearly higher than inconsequential. • Limited assurance engagements generally conduct less procedures than would have been performed in a reasonable assurance engagement.
Reasonable assurance engagement
• The assurance provider seeks to reduce assurance engagement risk to an acceptably low level in order to be able to give a positive form of expression within the assurance providers' conclusion statement. • A reasonable assurance report will include the procedures that are always performed within a reasonable assurance engagement.

Accreditation vs. certification

Within the standardisation sector the terms certification and accreditation can get interchanged, however accreditation is usually used by a national government appointed body that oversees and accredits certification bodies who in turn conduct certification and or verification activities.

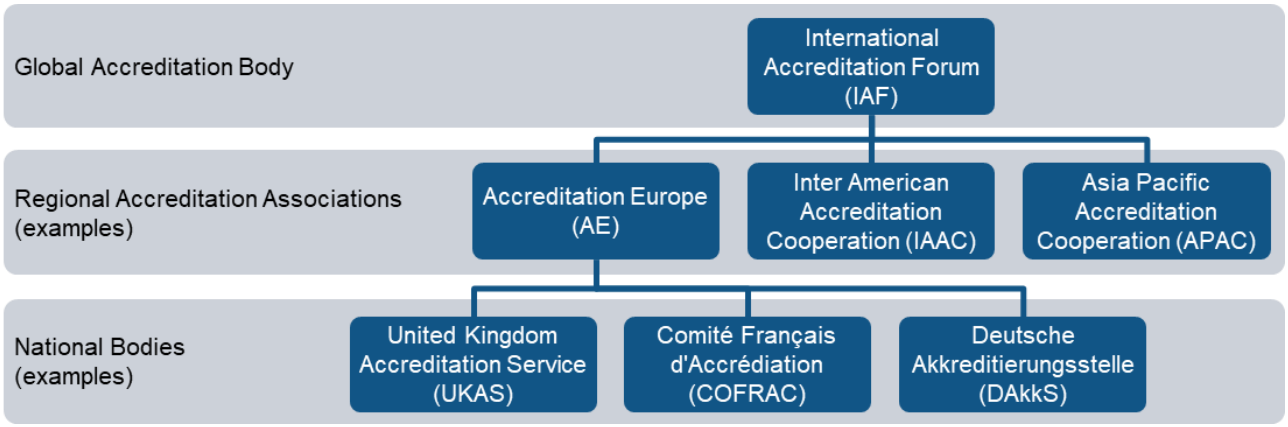

Figure 5: Levels of accreditation bodies

Competence building within assurance providers organizations

For establishing an institutional framework as described above, competence building within assurance providers on applying the GLEC Framework and knowledge of logistics sector knowing the limitations and benefit of moving to a more informed GHG verification is essential.

Assurance of GHG emissions statements, declarations and reporting currently centres around sustainability reporting and overall GHG emissions at an organisational level. Companies where the main activities are in the provision of freight transport services tend to have the required data available for their Scope 1 and 2 absolute GHG emissions and are able to get assurance providers to provide assurance to a reasonable level of assurance. However for services where subcontracting takes place and Scope 3 GHG emissions are to be assessed and verified by an independent assurance provider then certain assumptions are made and where data can be difficult to obtain which leads to limited levels of assurance being provided. The assumptions made and the tests conducted by assurance providers in order to verify emissions reports can be varied and not always in a harmonised and comparable manner therefore a degree of familiarisation with the GLEC Framework is needed within the assurance provider community when a GLEC Declaration is to be granted an assured status.

One reason for calculating freight logistics emissions is to identify trends and areas for improvement and this requires a measure of freight activity in order to measure freight efficiency. This requires another level of detail not always covered within GHG emission reporting and assurance, so again the assurance provider community need to understand the fundamentals of the GLEC Framework, the data required and how this is reported to be able to assure against it and create value added assessments,

Where it comes to Scope 3 GHG emissions, particularly in the case of shippers where all their freight transport can fall within Scope 3, then the emission statements are based on high levels of assumptions and only limited assurance can be provided, if the Scope 3 emissions are reported at all. The aspiration should be to move towards lower levels of assumption and increasing levels of reasonable assurance to enhance confidence and trust in the declarations and better understanding of environmental impact associated with freight transport activity. With better quality data then better decision making is possible.

There is a need to build more capacity and competence within the assurance providers in an area that could be considered niche and a small part of the overall environmental impact of an organisation.

The following aspects should be addressed within the assurance provider community regardless of whether the assurance provider is operating within either the ISO 14064 GHG verification or ISAE 3000/3410 space:

- General familiarisation of the GLEC Framework approach
- The GLEC Declaration format and interpretation of outputs linked to assessment of materiality
- The interactions between the supply chain stakeholders and data requirements, availability and exchange mechanisms.

3. Methodology of calculating emissions

3.1 Scope of emissions calculation

For calculating emissions in line with the GLEC Framework (SFC 2016 & 2019), the total fuel and electricity consumption of all relevant operations during transport and at logistics sites are assessed, covering the life-cycle approach, i.e. WTW emissions of fuels. Adding the leakage of refrigerants at sites with temperature controlled conditions, the assessment boundaries are as shown in Figure 6.

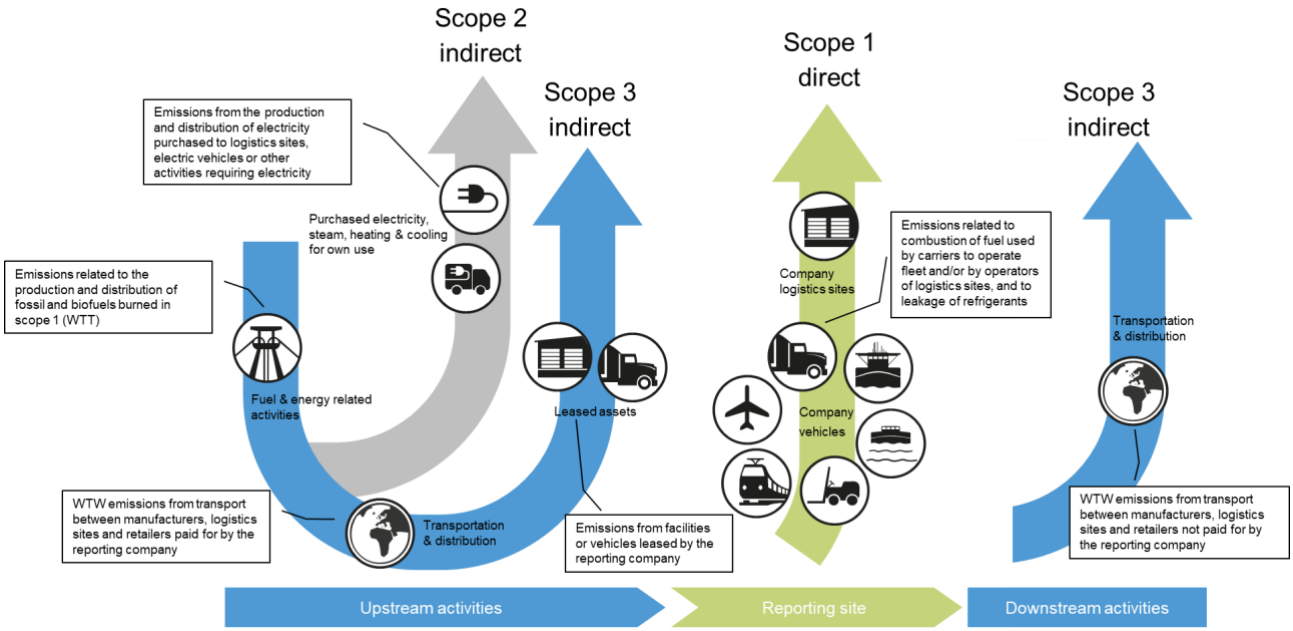

Figure 6: Scopes of emissions calculation (source: Fraunhofer IML basing on WRI & WBCSD 2004)

Depending on the role of the reporting company, the transport sector's tiers and scopes is relevant as shown in Figure 8 (page 25).

The **full life-cycle of energy** covers the total energy chain of production and consumption including the following processes (SFC 2016):

- Final energy consumption and vehicles emissions (i.e. operation; tank-to-wheel TTW)
- Upstream energy consumption and upstream processes (i.e. energy provision, production and distribution; well-to-tank WTT)
- Total energy consumption and total emissions (i.e. sum of operation and upstream figures; well-to-wheel WTW)

The assessment is to cover **all relevant greenhouse gases** (GHG) associated with fuel combustion and refrigeration, i.e. carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), nitrogen trifluoride (NF_3), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) (SFC 2019).

3.2 Key performance indicators (KPIs)

3.2.1 Transport

For the purpose of tracking and analysing transport emissions, total transport emissions can be divided or allocated into emission intensity metrics, providing emission intensity values, as shown below.

$$em = \frac{EM_{transport}}{transport\ service}$$

em	Emission intensity value [kg CO_2e per base unit]
$EM_{transport}$	Annual transport emissions [kg CO_2e]
$transport\ service$	Annual transport services, expressed e.g. [tonne-kilometer], [TEU-kilometer], [tonne], [kilometer], [shipment], [revenue] etc.

Transport service categories (TSCs)

The concept of transport service categories (TSCs) has been developed "to aggregate the data collected from individual journeys into more representative values […]. TSCs are groups of similar round trip journeys that are considered over a 12-month period to represent the way that freight transport services are procured and provided." (SFC 2016 p. 20)

TSCs are defined for each mode individually, see The GLEC Framework (SFC 2019) recommends the following transport service categories

Table 4: Transport service categories (TSCs) as recommended by (SFC 2019)

Transport mode	Transport Service Categories (TSCs)	
Air	Origin-destination pair	
	Contract type	Shared freighter, fully contracted freighter, belly cargo
Inland Waterways	Cargo type	Bulk, containers, pallets, mass-limited cargo, volume-limited cargo
	Condition	Ambient, temperature controlled
	Contract type	Shared, dedicated
Rail	Cargo type	Bulk, containers, pallets, mass-limited cargo, volume-limited cargo
	Cargo density	Light, medium, heavy
	Journey type	Domestic, international
Road	Cargo type	Mail & parcel, bulk, containers, pallets, mass-limited cargo, volume-limited cargo
	Condition	Ambient, temperature controlled
	Journey type	Point-to-point (long haul), multiple collection & delivery
	Contract type	Shared (LTL), dedicated (FTL)
Sea	Cargo type	Bulk, containers, pallets, mass-limited cargo, volume-limited cargo
	Condition	Ambient, temperature controlled
	Journey type	Trade lane, other route
	Contract type	Shared, dedicated

3.2.2 Logistics sites

Classification scheme providing activity categories

The purpose of a classification scheme of logistics sites shall be ease to use, flexible and adjustable to various settings, since there is a large variety of logistics sites and operations, as well as provide sufficient transparency to serve the decision-making needs or reporting requirements of users.

The proposed scheme classifies logistics sites with regard to the presence or absence of three different types of requirements based on their underlying characteristics as shown in the following table (following Rüdiger et al. 2016, Arnold et al. 2008, p. 571).

Table 5: Classification scheme for logistics sites (source: Dobers et al. 2019a)

	Requirement regarding..		
	Time (stock-keeping)	**Temperature**	**Order picking**
Characteristics	**No storage** i.e. transhipment	**Ambient** above +8°C	**Without order picking**
	With storage • short-term • medium-term • long-term	**Refrigerated** • fresh (+4°C to +7°C) • sensitive (0°C to +2°C) • pharmaceutical product (+2°C to +8°C) • frozen (< 0°C) in case of food < -18°C	**With order picking**

Dobers et al. specify this as follows.

Info box 2: Classification scheme for logistics sites (source: Dobers et al. 2019a, p. 17)

At transhipment sites no stock-keeping occurs and shipments are transhipped virtually instantly (less than ~24 hours). Typical examples are intermodal (container) terminals, cross-docking sites as well as distribution centres, delivery sites or micro-depots of CEP service providers. Warehouses offer short, medium and/ or long-term storage depending on the market sector.

Both types, transhipment sites as well as warehouses, may be ambient, refrigerated or mixed sites (i.e. covering ambient and refrigerated areas, or offering reefer stations in case of container terminals). Here, refrigerated sites can be further subdivided regarding relevant temperature levels (zones) required for fresh, sensitive or frozen goods.

In addition [and more relevant for logistics building than for terminals], consignments may leave the logistics site with or without prior order picking or order preparation operation. Here, order picking activities are required to satisfy customers' orders and consist of the collection and compilation of articles in a specified quantity. Supplementary activities may include counting, weighing, packing (e.g. retail promo displays), labelling, confectioning, customizing (e.g. installing software on computer) or adding a cable or plug to electrical appliances) or other value added services (VAS), to name a number of examples.

Key performance indicators (KPIs) with view to GHG emissions

Carbon accounting aims at enhancing transparency of GHG emissions caused at a logistics sites and enable tracking of emissions as well as reduction measures over time. Therefore, there is a need for a consistent unit of activity that enables a comparison over the years. Feport (2017) and Dobers et al. (2019a) refer to the amount of outgoing cargo in [boxes] or [tonnes]. ‘Cargo’ refers to any quantity of goods, without any packaging (e.g. bulk cargo) or of loose items of unpacked goods, containers [TEU], packages (parcels), or unitised goods (e.g. on pallets) including packaging (receptacle, container, wrapping) (DIN EN 14943). For converting from one unit to another (e.g. from box or TEU to tonnes), conversion factors can be used, that need to be documented transparently.

Comparable to Transport Service Categories (TSCs) introduced by the GLEC Framework, activity categories are used to link annual consumption and emissions information to relevant services provided at the sites and hence may require different resources. Using the classification scheme as introduced before, in total eight activity categories are defined as general framework, see below.

Table 6: General activity categories for logistics sites

Activity category	Relevant for…		Examples
	Logistics buildings	Terminals	
Ambient unit transhipped (without order picking)	yes	yes	Ambient cross-docking site; maritime container terminal
Refrigerated unit transhipped (without order picking)	yes	yes	Cross-docking site for food retail, container terminal with reefer station
Ambient unit stored (without order picking)	yes	yes	Ambient warehouse, container terminal with intermediate storage
Refrigerated unit stored (without order picking)	yes	yes	Refrigerated warehouse, container terminal with intermediate reefer storage
Ambient unit transhipped with order picking	yes	no	Ambient distribution centre
Refrigerated unit transhipped with order picking	yes	no	Refrigerated distribution centre
Ambient unit stored with order picking	yes	no	Ambient warehouse with VAS
Refrigerated unit stored with order picking	yes	no	Refrigerated warehouse with VAS

For the calculation of emission intensity values, the annual emissions are divided by the annual amount of outgoing cargo as follows.

$$em = \frac{EM}{Q_{units}} = \frac{\sum(Q_i \times EF_i)}{Q_{units}}$$

em	Emission intensity value [kg CO_2e/tonne]
EM	Annual emissions [kg CO_2e]
Q_{units}	Annual amount of cargo outbound [tonne]
Q_i	Amount used or refilled [kWh, l, kg]
EF_i	Relevant emissions factor [kg CO_2e per unit]
i	Source of emissions, i.e. electricity, fuel type, refrigerant type

Although the general framework provides eight different activity categories, at some logistics sites, all logistics units may be similar and are processed/ handled in a comparable manner. In this case, it is reasonable to calculate one average emission intensity value (i.e. kg CO_2e per logistics unit) for the site. A second reason may be that more detailed data for calculating partial emissions (i.e. partial energy consumption of dedicated operations such as the reefer station at terminals or refrigerating unit in warehouses) is not available (yet). For example, the company has only one electricity meter on-site and cannot allocate electricity consumption to relevant activities. Another reason may be that the company simply prefers to calculate an initial emission intensity value to start with.

By doing so, one should be aware of the variety of factors that influence the consumption of activities and processes at logistics sites. Interpretation of the results is limited as many assumptions have been made. For instance, no differentiation is made between:

- Types and sizes of logistics units handled at the site, i.e. between sizes of boxes (e.g. TEU, FEU) or pallets (standard pallet, half pallet), as well as between heavy or light goods
- The specifics of how each individual unit is moved and stored.
- Ambient and refrigerated cargo
- Types and management of lighting at the facility's areas (e.g. motion sensors in less frequented areas)
- Variability of different order picking requirements and operations

When calculating emission intensity values at an activity-level, allocation of energy consumption to relevant activities come into play. Dobers et al. provide detailed guidance on how to allocate emissions and calculate activity-related emission intensities (Dobers et al. 2019a). Figure 7 gives an example for an allocation procedure that is relevant for both logistics buildings and terminals. It refers to the consideration of temperature requirements of logistics units, i.e. to sites that handle units, some of which are ambient and some of which have to be refrigerated (e.g. reefer containers).

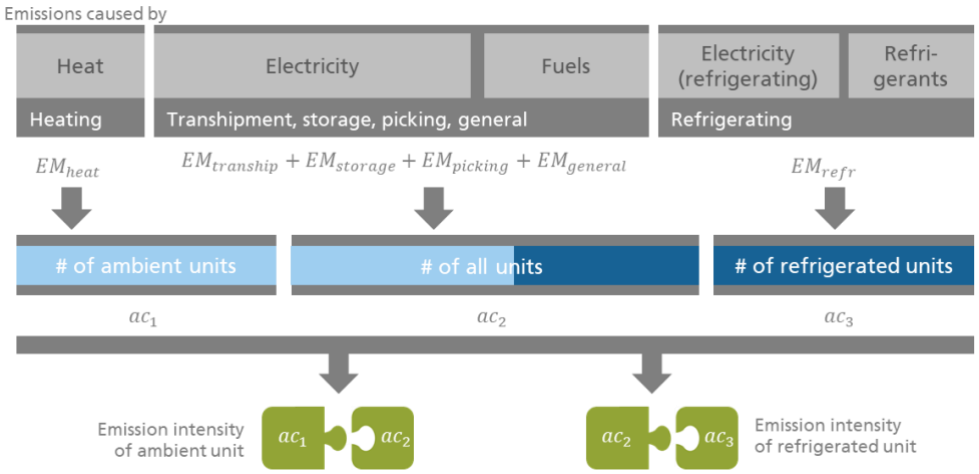

Figure 7: Allocation procedure for activity-related emission intensities per ambient and refrigerated unit (source: Dobers et al. 2019a, p. 41)

The recommended metric for the emission intensity of logistics sites is kg CO_2e emissions per tonne cargo outbound, which is motivated by the objective to provide a performance indicator that can be used within logistics chain calculations. However, depending on the type of logistics site and the activities provided by the operator, this indicator might not reflect the full picture. An alternative to weight-based indicators are the use of volume-based indicators (i.e. kg CO_2e emissions per m³ cargo outbound or consignment-based indicators (i.e. kg CO_2e emission per pallet or parcel outbound). Among other things, this reflects the fact that light/ voluminous goods may need the same activities and as such consume the same amount of energy as heavy goods, e.g. pallets of toilet paper compared to pallets of beverages. In this case, the weight-based allocation results in an underestimated or overestimated emission intensity for the respective pallet. Furthermore, refrigerated sites may require additional alternatives to show improvement in the warehouse's environmental performance. The temperature level of inbound goods as well as their dwell time in a warehouse may affect the electricity use of refrigerated warehouses. For this reason, square-based indicators (i.e. kg CO_2e emissions per m² of floor space) or cubic content-based indicators (i.e. kg CO_2e emissions per m³ of warehouse) could become relevant. Other metrics may cover full-time equivalents (FTE) employee, operational hours of the warehouse or transhipment site, or unit revenue. Here, further research is required e.g. on the question as to whether emissions of selected logistics sites correlate better with a weight or volume metric.

3.3 Self-assessment

A first step is for companies to examine the potential benefits of the GLEC Framework for their own logistics emission calculation, reporting and reduction activities. SFC developed a "GLEC Framework Gap Analysis" to

- Analyse a company's current logistics GHG emission calculation and reporting practices against the GLEC Framework
- Recommend concrete actions to address any inconsistencies or gaps
- Assess the feasibility of switching to the GLEC Framework by a given reporting year

The analysis of a company's current logistics GHG emission calculation and reporting practices against the GLEC Framework could be presented using the example template below. It covers key issues to be clarified, such as the scope, data sources or calculated KPI's. Assessing the current status per mode and using the suggested color scheme provides a transparent picture of readiness and the fields where further effort is needed.

Table 7: Example template for self-assessment

Step	GLEC Fw. (SCF 2016 & 2019)	Air	IWW	Rail	Road	Sea	Sites
Period	**One year**						
Choice of emission factors	**WTW**						
	CO_2e						
	Specify source:						
Unit of allocation	**Transport: tonne-kilometre[1]** **Logistics sites: tonne**						
KPIs	**Transport service categories[2]** **Site's activity categories[3]**						
Shipment information	**Shipment weight**						
Distance	**Planned or network distance**						n/a
	Specify source (e.g. tool):						
Fuel use	**Empty running included**						
	Type of data[4]						
	Specify source (e.g. tool):						

Specify company's approach and indicate compliance with GLEC Framework by using easy symbols e.g. colors

	Not applicable
	Not covered
	Under preparation
	Ready

[1] There may be other allocation units for specific sectors, e.g. mail and parcels
[2] See Table 4
[3] See Table 6
[4] E.g. primary data (detailed or aggregated), program data, modelled data, default data

4. Data for emissions calculation

The quality of calculated emissions and emission intensities as well as their subsequent use in business reporting and decision making concerning logistics emission reduction depends on availability, specification, quality and exchange of data. A reliable calculation rests on sourcing good quality data as input to the calculation, i.e. own consumption data, suppliers' data or default vehicle consumption or emission factors or fuel emission factors that are embedded within the GLEC Framework or ISO standard documentation.

Standards can provide guidance on how collect and verify data quality, but in the logistics sector the actual data quality will ultimately rest with the information collected and stored by the transport operator and their customer. This chapter summarises relevant issues identified and recommendations derived during the course of LEARN as regards data capture and data sharing protocols for logistics chain emissions calculation.

4.1 Data capture

4.1.1 Transport

The calculation of total GHG emissions depends on knowledge of the energy (generally referred to as fuel in transportation) used to perform the transport service and the emissions associated with the energy use. However, in order to develop more sophisticated KPIs around emission intensity, it is important to capture other information that characterizes the transport service (see also section 3.2). Transport activity measured in tonne-kilometres is the most widely used metric, although other additional alternatives that reflect the way in which goods are transported, such as TEUs, pallets and measure of volume are also possible.

In this context it is important to differentiate between

- The scope 1 and 2 emissions of a transport operator, where it is realistic for them to have accurate records of total fuel (e.g. invoices), as well as the potential to have more detailed fuel data stored within their system (e.g. refuelling information at vehicle level from fuel cards or internal fuelling systems or at trip level from on board vehicle systems or fleet management software)
- The scope 3 emissions of a customer that has outsourced their transportation, where currently they most likely do not have access to their subcontractor's actual fuel use and so need to rely on one of several approximations that can be used to provide an estimated value of fuel and hence emissions.

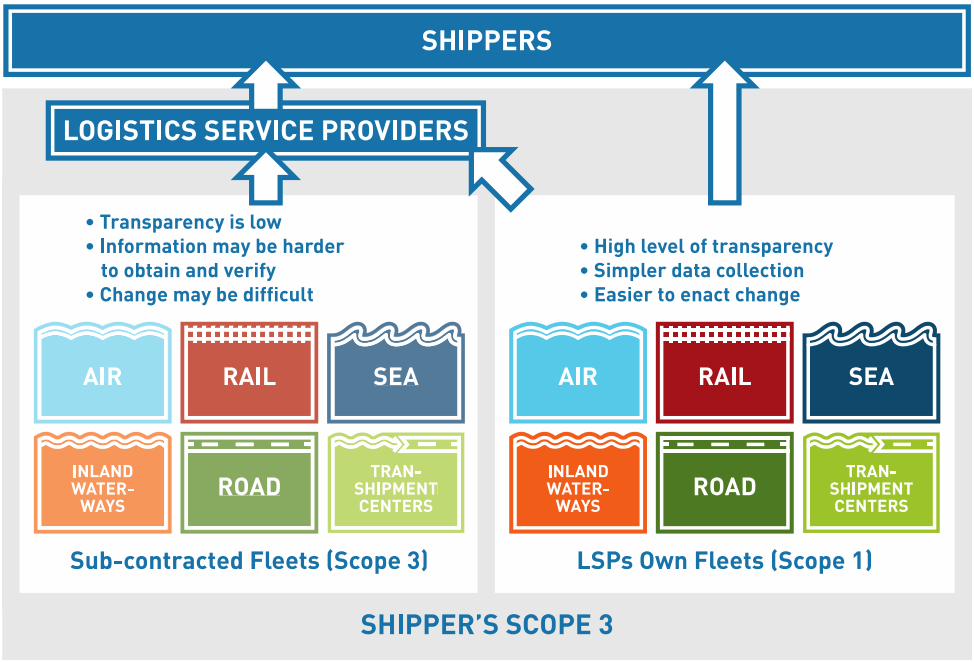

Figure 8: Difference in visibility between directly operated and subcontracted fleets (source: GLEC Framework, SFC 2019)

The GLEC Framework (SFC 2019) provides more detail on the processes to be followed to collect data and the calculations needed to report both total emissions expressed in CO_2e and emission intensity as CO_2e/tkm (see also section 3.2). The processes are largely the same irrespective of which data type is used, the main difference being that the uncertainty is greater as you move from actual data, through detailed modelling to the use of default values.

4.1.2 Types of input data

Primary data (detailed or aggregated), also referred to as actual data, is what should be used by a transport or logistics site operator to calculate its own carbon emissions. Where possible transport buyers should aim to use information based on primary data for their supply chain emissions accounting. **Primary data** can range from highly precise information, such as the fuel used for a particular trip, to aggregated values that reflect fuel efficiency for a year's worth of vehicle movements.

Program data: Green freight programs play an important part in acting as a neutral platform to collect and share reliable data between transport operators and their customers in a neutral, managed environment. For example, over 3,500 carriers report fuel and transport activity data to US EPA's SmartWay for conversion to indicative emissions intensity values. Program data can guide carrier selection and identify potential energy, cost and emission saving strategies.

Unless there is an arrangement in place to share information either directly or through a neutral data platform, which are the main focus of the rest of this chapter, it is likely that the customer will need to use a form of estimation to calculate their scope 3 emissions. In this case, two types of data can be used for scope 3 calculations:

- **Modelled data**.
  Companies can use whatever information they have access to about goods types, consignment sizes, journey origin, destination and intermediate handling locations (logistics sites), and any information about the vehicles used, typical load factors etc., to build a model of how fuel and transport activity are related. The robustness of the outputs will depend on the level of detail that is available about the transport operation (the more assumptions made, the lower the reliability of the output), as well as the model's algorithms.
- **Default data**.
  Another approach is to use data representative of standard industry operating practices. Default data can come from a variety of sources, such as industry averages, academic studies, modelling exercises, and life-cycle databases. Default data are by definition an approximation, because they will have a wide range of assumptions in-built (e.g. load factor or size of vehicle used). As a result, default data can be presented at a wide range of levels of detail to match the input data available.

To ensure consistency of calculation outputs it is important to ensure that the methods and default data embedded into tools align with the GLEC Framework.

4.1.3 Transport activity

As mentioned above, transport activity is commonly expressed in tonne-kilometres (tkm) although additional alternatives are possible (see also section 3.2.1). Therefore tonne-kilometres are often used as the basis to assess the fuel and emission intensity of a transport operation; however, in cases where primary fuel data are not available, combining the transport activity with an appropriate energy or CO_2e intensity factor (for example an appropriate default factor) can be used to estimate the fuel use.

Clearly capture and combination of both distance and weight information is necessary in order to calculate tonne-kilometres. The GLEC Framework (SFC 2019) provides guidance as to the possible approaches.

One key thing to note is that tonne-kilometres are most accurately calculated bottom-up working with detailed trip by trip records. This can be a challenge because in some, possibly many, situations:

- accurate distance information is only held by the transport operator;
- shipment weight is only held by the customer

The result is that an accurate value can only be derived if they share the necessary information. More often than not the alternative options of the customer estimating the distance or the transport operator measuring or estimating the weight, or using an alternative metric are what actually happens.

Info box 3: Calculation of tonne-kilometres for a shipment (SFC 2019 p. 24)

To calculate tonne-kilometres for a shipment, weight and distance are multiplied together.

$$tkm = tonnes \times kilometres$$

For multiple journeys, the weight and loaded distance are multiplied together for each journey and then the tkm values for each journey are added together.

$$\sum_{trip=1}^{n} tkm = tonne_{\ trip\ 1} \times kilometer_{\ trip\ 1} + tonne_{\ \ldots} \times kilometer_{\ \ldots} + tonne_{\ trip\ n} \times kilometer_{\ trip\ n}$$

Whenever possible, calculating tonne-kilometres separately for different transport services and for each fuel type will add detail and improve the accuracy of the calculation.

Calculating tonne-kilometres accurately can be a challenge for companies who are not used to the concept. The LEARN testbeds identified a common mistake which was to multiply total tonnes transported by total kilometres driven rather than following the correct, more detailed process.

4.1.4 Logistics sites

The calculation of emission intensity values of logistics sites at activity level, can usually only be performed by the operator of the site. The relevant consumption data should be available for any logistics site directly from the bill / service invoice. Nevertheless, there might be some obstacles to overcome in the early stages of emissions accounting; examples are (Dobers et al. 2019a):

- Data might be collected and stored by different departments or at different locations (e.g. central procurement) within an organisation, not at the site for which emissions are being calculated
- Data may be stored in formats (e.g. scanned invoices) that require manual processing
- Information may not be equivalent to the assessment boundaries at hand (e.g. purchased amount for various sites, different balance years, etc.)
- Leased assets where the cost of energy consumption is included in the rental

Although the challenges outlined above may apply, most logistics sites are very much aware of the resources purchased and consumed and the warehouse management systems (WMS) offer sufficient information access.

In addition to consumption and logistics information, emission factors are required, that are used for converting the amount of e.g. fuels used into GHG emissions. Examples are:

- Electricity:
  - The GLEC Framework refers to the location-based approach that considers the national electricity production mix (SFC 2016).
  - In addition, companies may consider site specific green-tariffs, as some companies purchase particular electricity products to support renewable electricity generation and thus reduce the environmental impact of their electricity consumption.
- Fuels: There is a variety of fuels that may be consumed for logistics sites' infrastructure and equipment (e.g. diesel, petrol, LNG, CNG, LPG, hydrogen) as well as for heating purposes (e.g. natural gas, heating oil, district heating, geothermal energy, wood chips or pellets).
- Refrigerants: Direct emissions caused by leakage of refrigerants are published by the Intergovernmental Panel on Climate Change (IPCC 2007, IPCC 2013) and are summarised in Dobers et al. (2019a, p. 64)

It is necessary to provide companies access to a uniform database offering relevant emission factors for electricity, fuels and refrigerants worldwide.

4.1.5 Assurance of input data

As explained before, accessing good quality data that can be readily processed by and transferred between the different parties in the supply chain remains a significant problem. SFC's assurance guidance for the GLEC Framework (SFC 2018) refers to two possible levels of detail that the assurer could be asked to provide, namely 'limited assurance' and 'reasonable assurance' (see also Table 3, p. 17). These are terms commonly used in the assurance industry, so the meaning will be known to the target audience of the assurance guidelines; the type of any assurance engagement should be quoted alongside any assurance statement so that the user knows the likely reliability of any outcomes. Given the large volume of

data required for a calculation of logistics emissions in a typical, modern, multimodal logistics chain, it seems unlikely that substantive data verification would form part of a limited assurance engagement.

For the benefit of an operator or organisation unfamiliar with the **process of an assurance engagement** or validation or verification of a declaration the following diagram outlines the various phases used by verification bodies.

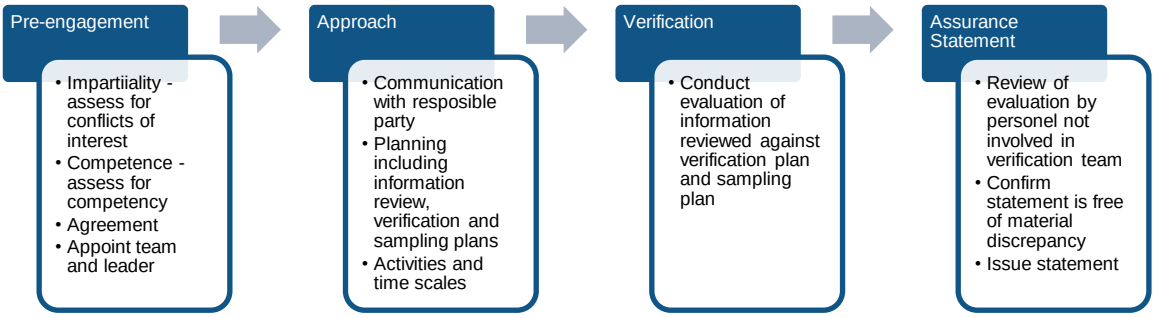

Figure 9: Process of an assurance engagement (source: Smith)

4.1.6 Assurance activities on GLEC Declarations

The key activities in conducting a 3rd party verification or assurance engagement of an organisation's GHG assertion or GLEC Declaration are as follows:

- Gaining a good understanding of the information recorded and the environment it is used, sometimes referred to as subject matter, within an organisation, its characteristics and means of recording such information is required. This will help the assurance provider to plan verification tests and procedures that can identify if any material misstatements are present. This activity is generally conducted prior to the assurance engagement starting.
- Identifying and establishing the scope and boundaries that have been reported will help establish the people and systems that need to be engaged with in order to obtain the necessary objective evidence that supports the assertion and the assurance statement of the assurance provider.
- The planning and subsequent delivery of an engagement will take the size and complexity of the entity into account and help direct effort and resource to the areas of concern that potential misstatement can occur. Examples of size and complexity can be related to a road vehicle fleet, the number of and type of vehicles and their geographical operation. Along with the services provided such as bulk cargo, liquid tankers or parcel delivery.
- An assurance provider will need to acquire information of fuel and energy use and freight activity data. Depending whether GHG assertions have been derived from fuel based or activity based approaches, this will involve information being made available from fleet management systems, fuel management systems or fuel card providers (fuel credit accounts) in the form of transaction reports and accounting systems. Also vehicle or vessel maintenance records and log books. In terms of activity based information transport management systems or any manufacturing material resource planning system and order books systems used to record such data and the procedures implemented to enhance quality control and assurance may also need to be assessed along with any emissions factors used and their relevance and source.
- Access to production or logistics facility records and energy systems including metering and billing systems may also be required.
- Where an organisation being evaluated has an internal audit function then the assurance provider will need to gain an understanding of the effectiveness of the internal audit function in terms of reducing the risk of material misstatement either by fraud or error.
- Assurance providers will investigate where measured data and values have been used and where estimations have been conducted. Where estimations are used the assessor will try and determine where there are potential errors, these can be due to an incorrect application of a quantification method, the complexity of the method and where trend over a time period are being assessed any changes in the method will be evaluated for potential errors leading to misstatement. Use of any tools or experts used by the declaring organisation and the assumptions made and type of data will be assessed with a view to reduce the risk of uncertainty in any calculations.

With regard to logistics sites such as warehouses and distribution centres, the EN 16247 Energy Audits standard may be used as a means to give some assurance around energy use in a building or facility. This standard has four parts with general requirements (EN 16247-1:2012) and requirements for buildings (EN 16247-2:2014) being most relevant for logistics sites.

4.1.7 Data management

Reference has already been made to different sources of data, such as fuel invoices, fuel cards and fuel management systems. Many other relevant data sources also exist including fleet management and vehicle telematics systems used by transport operators and customer procurement and transport management systems. Combining this information into a single calculation output can be challenging both for technical reasons – e.g. data compatibility and commercial sensitivity.

The technical and commercial barriers to improving access to good quality data remain a challenge. Much development and education work remains to be done if the best possible quality of available data held across all stakeholders in the logistics chain is to be combined in order to deliver high accuracy calculations at a detailed level. The following section sets out some of the future development work that will be required if this type of data sharing among logistics chain partners is to be achieved.

The use of Quality and Environmental Management Systems to the recognised ISO 9001 and ISO 14001 standards are now fairly common within the manufacturing and logistics sectors. The holding of these standards is sometimes a requirement to supply products or be awarded transport contracts and therefore are recognised as beneficial for a company to hold. However some companies do not use the prescribed management procedures and controls in respect to energy efficiency and emissions accounting. With an increase in customers demanding sustainability and environmental credentials to be disclosed there is the potential to include the procedures, document control and the control of records aspects included in such management systems to be adapted to help record the information required for freight logistics emissions accounting. Similarly the more recent ISO 50001 Energy Management System standard can help organisations understand their energy use and energy efficiency. This standard is not so well established within logistics operators but could actually help develop the processes around data collation and recording that will help in emissions accounting.

4.2 Data sharing and related protocols

One of the main challenges in the calculation and reporting of emissions from logistics activities is the complex nature of the relationships between the various stakeholders involved. This is reflected in strong differences in natural data visibility to the carrier, logistics service provider (if there is one), and shipper.

As reflected in section 4.1 and previous LEARN Deliverables (LEARN D.2.2 (2017), LEARN D.2.3 (2017)), the result is often incomplete data availability to any one organization that is trying to perform a calculation. The result is a need to address at least three separate questions:

- Who should have responsibility for calculating and reporting what level of emissions information?
- What is needed to collect the necessary information?
- What mechanisms might facilitate the necessary data transfer?

In order to take steps to answer these questions, it has been necessary to analyse the existing situation from a number of different perspectives in order to identify where gaps and barriers remain before considering the potential next steps to overcome them.

4.2.1 Supply chain roles and existing data transfer protocols

The challenge caused by the common (but not universal) separation of the roles of owner of the goods, organization of the transport and operation of the transport, which lies at the heart of the data sharing question is not unique to emissions accounting and reporting. This has led us to consider the existing arrangements used in other aspects of logistics data transfer.

At the heart of this lies the **Logistics Interoperability Model (LIM)** developed by GS1. The LIM contains a number of definitions that potentially help clarify the approach to be taken in terms of where responsibility should rest for calculating and reporting and for some of the mechanisms that might help facilitate data transfer.

In particular the LIM clarifies two scenarios where:

1. The shipper of the goods prepares the goods for transportation
2. The transporter prepares the goods for transportation

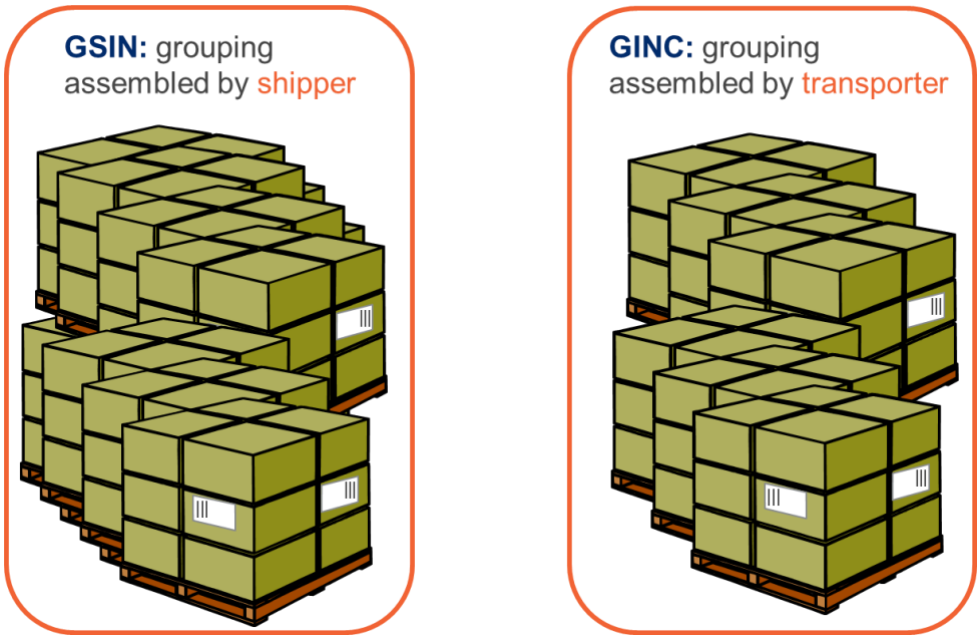

Figure 10: Transport Management Overview (source: GS1 2015)

This differentiation is associated with two different types of identification code:

- GSIN is the GS1 Identification Key used to identify a logical grouping of logistic or transport units that are assembled by the consignor (seller) for a transport shipment.
- GINC is the GS1 Identification Key used to identify a logical grouping of logistic units during a specific journey.

The relationship between these identification codes is inherent in the definition of two terms that in common use are often, incorrectly, used interchangeably:

- **Shipment** refers to the goods in a commercial transaction between a seller and a buyer; hence the shipment Identification Key (GSIN) exists as a common element throughout the movement of the goods throughout the transport chain from original point of supply to ultimate point of demand.
- **Consignment** exists only for a single journey leg, meaning that for a multimodal transport chain consignments may be merged into larger consignments (consolidation) or split into smaller consignments (break bulk).

Depending on the size of the shipment, the individual items within it, the nature of the transportation activities undertaken (e.g. mode used and single or multiple transport operators) and whether there are single points of origin and destination shipments may be transported individually (i.e. shipment = consignment), may result in more than one consignment, or may be grouped together with other shipments into consignments.

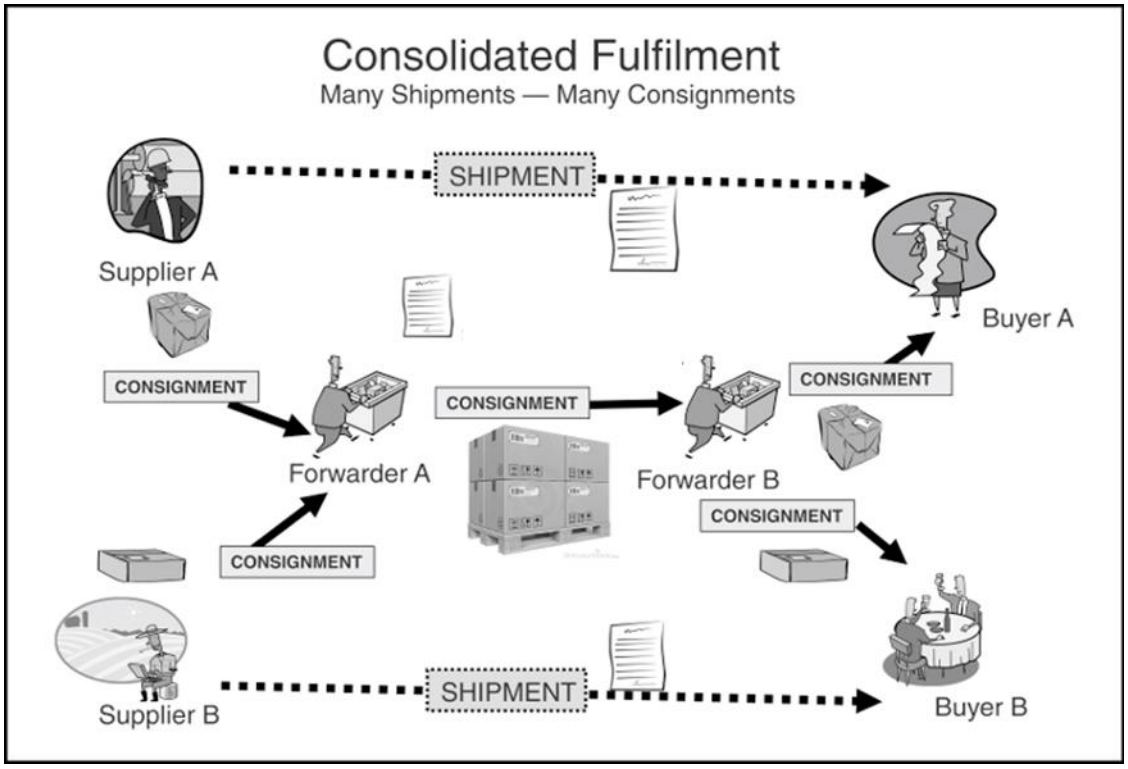

Figure 11: Transport Management Overview (source: GS1 2015)

Although apparently complex this is important when differentiating between the nature of dedicated and shared transport services which is one of the determining factors identified in the GLEC Framework for considering how to disaggregate emission calculation and reporting.

4.2.2 Stakeholder data needs

Building on the information presented in sections 4.1 and 4.2.1 it is clear that the relationship between the shipper, LSP and transport operator is complex, but that there is a structure upon which to build.

Transport Operator

From the perspective of a transport operator the situation can appear relatively simple. The generally accepted reporting requirement is for a total corporate GHG emissions figure, expressed in CO_2 equivalents and an intensity figure expressed in CO_2 equivalents per tonne-kilometre for each service provided.

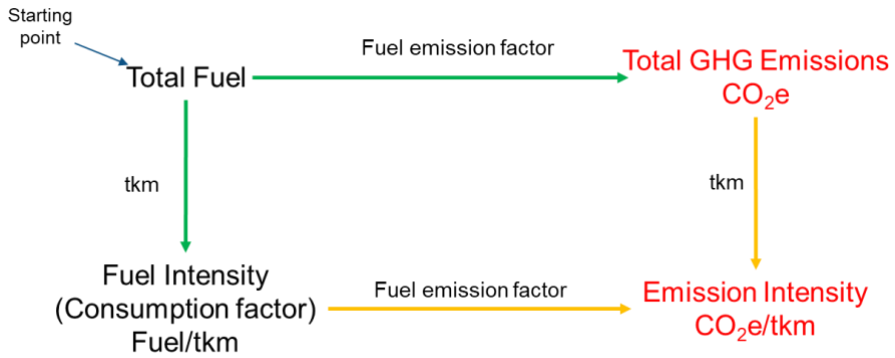

Figure 12: From total fuel to emission intensity value from the transport operator's perspective (SFC 2019)

The data requirement to calculate corporate emissions is merely fuel, whereas to relate this to intensity values for each service provided requires distance and consignment weight plus a cross reference between the consignment and shipment identification keys.

Potential data gaps begin to appear here:

- Transport operator should know total consignment weight to be sure that the operation is safe and legal although it appears that the information is often not communicated clearly by the customer, or stored by the transport operator is a separate system to operational data like fuel use and distance travelled; also for a consignment consisting of multiple shipments may not necessarily know the weight breakdown for each shipment, depending on the information provided by the customer.
- In order to fully cross reference the consignment and shipment there needs to be a reference to the journey that in turn links to the mode of transport, vehicle type, distance travelled and fuel type and amount used. For sophisticated systems this may be possible at a disaggregated level (i.e. bottom up), but for many this may actually rely on applying averaged values aggregated across groups of similar services. This latter approach is currently considered to be adequate within the GLEC Framework, although there is pressure from some shippers and researchers to move towards greater levels of detail.

Customer (shipper or LSP)

The perspective of the customer of transport services, who would report scope 3 emissions from contracted transport services[5] is somewhat different. Currently their knowledge is often extremely limited because they have information at shipment level (origin, destination, shipment weight, transport mode, logistics unit[6] and lead logistics provider), but do not know how this relates to the consignment and hence the necessary detail (e.g. fuel, distance, vehicle type, vehicle load level) to perform an accurate calculation themselves.

It is for this reason that, if they choose to take ownership of the calculation, they often have to resort to the use of either default intensity data (represented in Figure 13) or modelling (Figure 14).

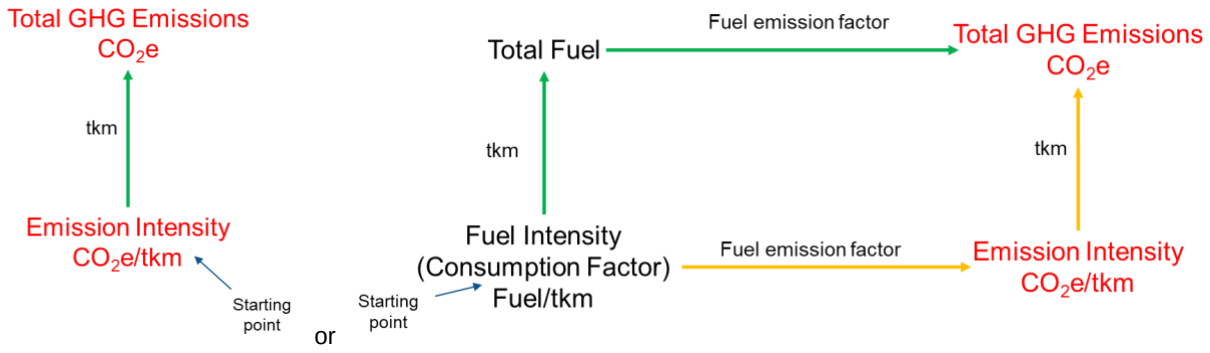

Figure 13: Use of emission intensity values as starting point for customer calculation (SFC 2019)

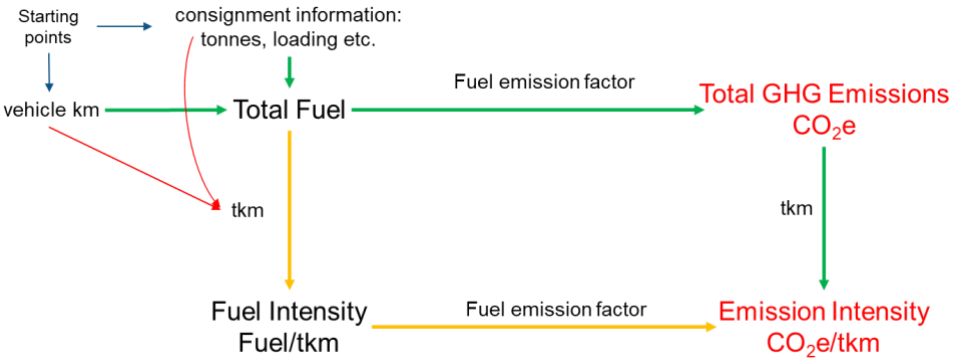

Figure 14: Use of detailed emissions modelling for customer calculation (SFC 2019)

Potential data gaps:

- The challenge of using these approaches is to maximize the amount and accuracy of input information. The closer the match between the calculation of tonne-kilometres by the customer and reality when using intensity

[5] Upstream transportation in the terminology of the GHG protocol (see also Figure 6)
[6] This is also a GS1 identification key.

values the lower the uncertainty in the outcome. Given that the shipper knows the shipment weight it is generally the distance that causes most concern. As noted in the GLEC Framework: “The route a shipment takes may involve multiple transport legs between its origin and eventual destination, often travelling by different transport modes. Sometimes there will be intermediate stopovers in locations that reflect a carrier’s transport network rather than the most direct route. This is also complicated by goods traveling on shared transport assets, where shipments are consolidated to increase vehicle loading and hence efficiency, but may lead to longer distances being travelled than the most direct route for an individual shipment. Distance information should be collected for each transport leg, either through direct measurement or estimation.” (SFC 2019)

- Addressing the above relies on information that is generally unknown to the shipper unless they have a direct contract and strong element of control via the contract terms. It is for this reason that detailed emissions modelling is appealing to many shippers, because this allows them to use sophisticated routing and optimization algorithms to replicate the transport system as far as possible, including as many parameters about the vehicle, its loading and the journey as possible.

In cases where the shipper has delegated full responsibility to a lead logistics provider (3PL or 4PL) then this organization often finds itself in a similar situation. The amount of knowledge and control they have over operations and efficiency depends on how strict their client’s instruction is – the more flexibility they are allowed the more opportunity there is to increase overall efficiency through use of consolidation with other shipments, use of spare capacity, use of more efficient modes etc.

4.2.3 Company data management systems and their role in collecting / calculating GHG emissions

There are many variations of the software system available to transport operators, LSPs and shippers, both developed internally and available on the open market. The scope of these data management systems naturally reflects the role of the organization in the supply chain and the data that they generally have at their disposal. It is not the purpose of this report to review or document these systems, particularly as the market is highly fragmented.

Carrier systems tend to focus on vehicle operation aspects, including trip planning and routing, fuel management, load optimization, driver performance (safety and efficiency), traffic conditions and customer invoicing. These systems are increasingly including dynamic (real-time) functionality to track estimated time of arrival (ETA) vs schedule in case of risk of missing booked slots. Emissions are generally linked only to overall fuel use and a fuel / distance KPI (i.e. litres per 100 km or miles per gallon) due to the previously note lack of information on individual consignment weights.

Shipper systems tend to focus on more commercial aspects related to the shipment, its origin and destination and the parameters that the transport operator needs to abide by. Where the shipper has tight specification of the transport specification, or direct control of the transport contract (i.e. no LSP as intermediary) then they may also have information on origin, destination and intermediate handling locations, routing, vehicle type and loading.

In recent years attempts have been made to incorporate GHG calculation modules into shipper tools; however, it is only where there is a high level of information about the transportation activities that this has been successful. This has tended to be in in-house systems rather than commercial systems. In absence of such detailed information it is necessary to rely on default data to fill gaps in knowledge, to rely on the lead LSP to perform the calculation as they have better access to information about the transportation, or to use 3rd party GHG calculation tools.

With the increasing awareness of climate change and the ongoing rise in GHG emissions from the logistics sector, pressure is steadily growing to address this gap and integrate reliable GHG calculations into shipper systems. The jury is still out as whether this is the correct approach, or whether it would be better to enable transport operators to calculate and report emissions for the services provided (through better education, data collection software and the appropriate reporting mechanisms). This is the approach that has been taken according to the French logistics reporting legislation for the past five years. In the short term it is likely that shipper systems can be enhanced to provide adequate calculations, but in the longer term developments in IT are expected to support a move to the collection and compilation of actual data. One of the purposes of this section is to identify some of the barriers that remain to be overcome.

Potential data gaps:

- Regarding **carrier systems** the main gaps are education and awareness of the need to report GHG emissions in a more comprehensive way at service level. As yet these demands have generally not been expressed by their customers and are not therefore reflected in commercial fleet management systems due to lack of customer demand. The key element would be to add knowledge of shipment weight, which they most likely have in order to manage booking and for invoicing purposes, into a single place (most likely the fleet management system) so that accurate calculation of tonne-kilometres could then be matched with fuel use to produce a ‘fuel per tonne-kilometre’ KPI for each transport service category. The starting point would be

average values per category, although the potential would exist to develop this into more detail (e.g. per customer, per route, per shipment) over time if there is sufficient customer demand (or legislation) and available computing power or data storage. (See Table 8 and Table 9.)

- A subsidiary challenge exists for micro businesses, common in this sector, which have not invested in even basic FMS of TMS systems.
- For **shippers** the data gap will always be that they will need to receive a full set of information about the transportation if they are to calculate emissions accurately and there are well-known commercial barriers why this will remain. The situation where direct contracts are in place gives best chance of accurate data being available in the sense that the data chain is at its shortest, but this is also where the commercial risk to the transport operator might be highest. Even here there are two situations to consider:
    - Direct purchase of transport on the spot market is almost always going to be based on price, and the operator is highly unlikely to then provide information that could allow the customer to cross check that price.
    - Long term contracts where there is the opportunity to build trust and a form of gain sharing between shipper and carrier so that both parties can benefit from longer term emission reduction and efficiency investments.
- Where shippers make use of a lead LSP it will be very difficult for them to make a good calculation without having information from the LSP; i.e. in some way bypassing the LSP and using only carrier data.
- LSPs, as professional transport management organisations with large networks, have a significant challenge due to the sheer size and diversity of their transport networks the differing nature of the transport services they offer and the large number and varying sophistication[7] of the thousands of subcontractors used.

Table 8: Carrier data collection template required to calculate fuel and hence emission intensity per tonne-kilometre. Currently, this level of data is not usually programmed into carrier fleet management systems.

Leg no.	Vehicle ID	Load capacity [tonne]	Customer ID	Origin	Desti-nation	Planned distance [km]	Fuel type	Fuel used [litre]	Load [tonne]
1		26		A	B	200	Diesel	72	18
2		26		B	C	40	Diesel	13	0
3		26		C	D	150	Diesel	55	14
4		26		D	A	25	Diesel	8	0
5		26		A	B	200	Diesel	72.5	19
6		26		B	E	220	Diesel	73	12
7		26		E	A	35	Diesel	12	0

Table 9: Conversion of carrier data to fuel intensity per tonne-km. Conversion to GHG emissions requires use of the correct fuel emission factor.

Leg no.	Planned distance [km]	Fuel used [litre]	Load [tonne]	[tonne-kilometre]
1	200	72	18	3,600
2	40	13	0	0
3	150	55	14	2,100
4	25	8	0	0
5	200	72.5	19	3,800
6	220	73	12	2,640
7	35	12	0	0
	870	**305.5**		**12,140**

$$Consumption\ factor = \frac{305.5\ l}{12{,}140\ tkm} = 0.0252\ l/tkm$$

$$Empty\ running = \frac{100\ km}{870\ km} = 11.5\%$$

$$Load\ factor\ (when\ loaded) = \frac{12{,}140\ tkm}{770\ km}/26\ t = 60.6\%$$

4.2.4 Existing calculation tools and programs

Section 5.3 contains more information about the differentiation between calculation tools, methodologies, tools and programs and reference to the capability of some of the tools that are commercially available. Here, we focus on the role that calculation tools in particular and also to a certain extent green freight programs play in the exchange of data and GHG calculation results between stakeholders.

[7] In terms of GHG calculation

The previous sections have shown that there is currently no single clear pattern of how or by whom GHG emissions are being calculated. The following diagram has been developed to show how the various possibilities relate to each other.

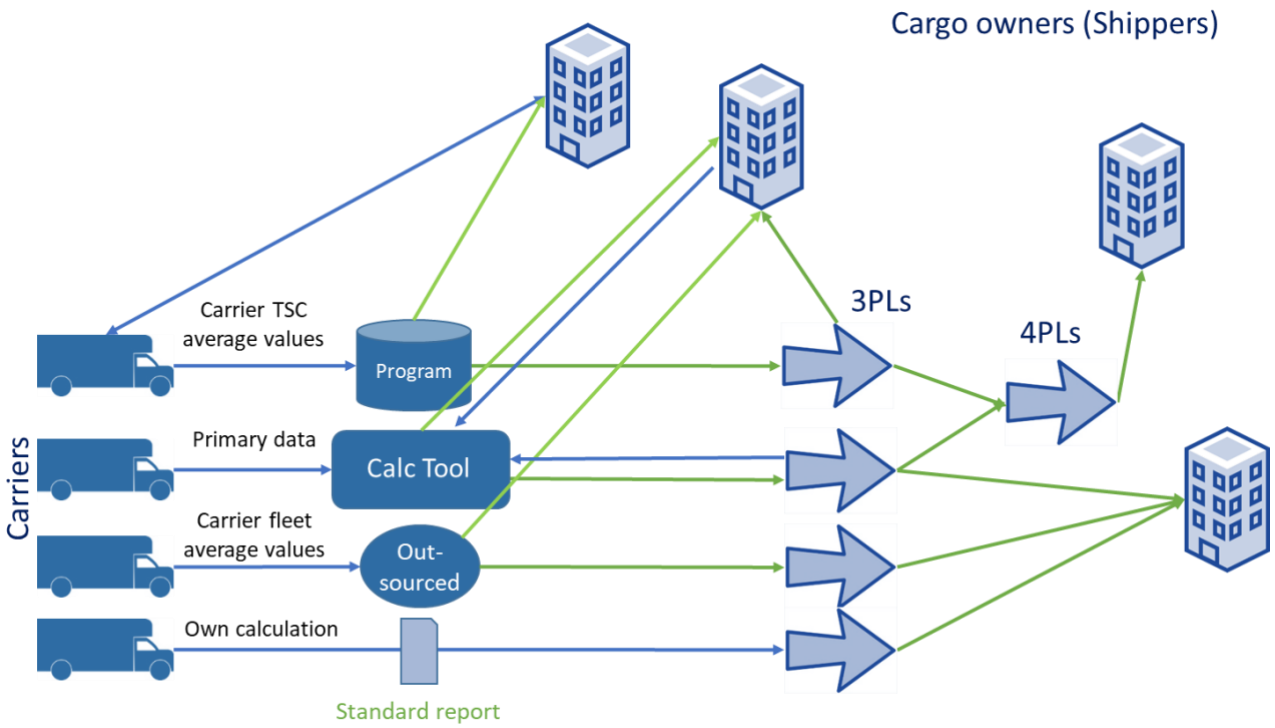

Figure 15: Selection of possible relations of calculation tools, methodologies, tools and programs within GHG calculation (not exhaustive, other options may also exist) (source: SFC)

Providing sufficient information and competence is available there is no real reason why any one of these should be considered as 'better than' or preferable to another. However, as the previous discussion has shown the route taken generally influences the nature of the outcome because each has certain data restrictions associated with it.

- Transfer of primary data directly between carriers and customers that would allow the customer to perform a detailed calculation is currently rare due to commercial and trust issues.
- Detailed emissions modelling, as generally carried out by calculation tools (Figure 14 in section 4.2.2) generally requires information that is held by both the carrier and the customer, hence inputs are shown from two directions. This reflects the different level (shipment vs. consignment) and hence type of information held by the two entities.
- The use of a standardized report (GLEC Declaration, see 5.1) has potential to help simplify and harmonize the expected format of outputs of a carrier's own calculation of emissions. However, this may in itself be insufficient for the customer's needs without assurance of the calculation methodology and the input data. Currently it may also be difficult for carriers to fulfil given the gap in the service available from carrier fleet management software.
- The GLEC Declaration format would also apply for the other routes between carrier and LSP, carrier and shipper and LSP and shipper where the calculation is performed by a third party. (This is not shown to avoid Figure 15 becoming too cluttered.)
- Acceptance and widespread uptake of the GLEC Declaration would be an extremely useful intermediate step towards harmonized data transfer because it would allow testing and refinement of the KPIs and any associated data key / explanatory notes that could subsequently be digitized.

4.2.5 The role of data exchange platforms in pulling data together

Whilst the previous discussions have shown that there are currently various technical, commercial and structural challenges in pulling together the necessary information into a single structure for the calculation of GHG emissions that meet the needs of all stakeholders, by pulling the various threads together the remaining barriers and the relationship between them begin to become clear.

Given the fragmentation of the road freight market, as well as the many carrier, shipper and calculation tool systems on the market, and the role of individual national authorities in its regulation, it seems unlikely that it will be possible or even advisable to have one single platform for Europe in the way that SmartWay exists for the US, Canada and Mexico. However, building on the KPI definition of the GLEC Declaration and translating that into the specification of a standardized

data transfer protocol would have the potential to act as a building block for a network of interoperable data platforms fed by tools and fleet management systems with standard API interfaces and would also enable consistent, direct reporting from carrier to customer where appropriate. These could be organized at national, sector, company or any other level which meets market needs, and by following the standard format allow carriers and customers to communicate the required data without having to manipulate the data in different ways for different purposes.

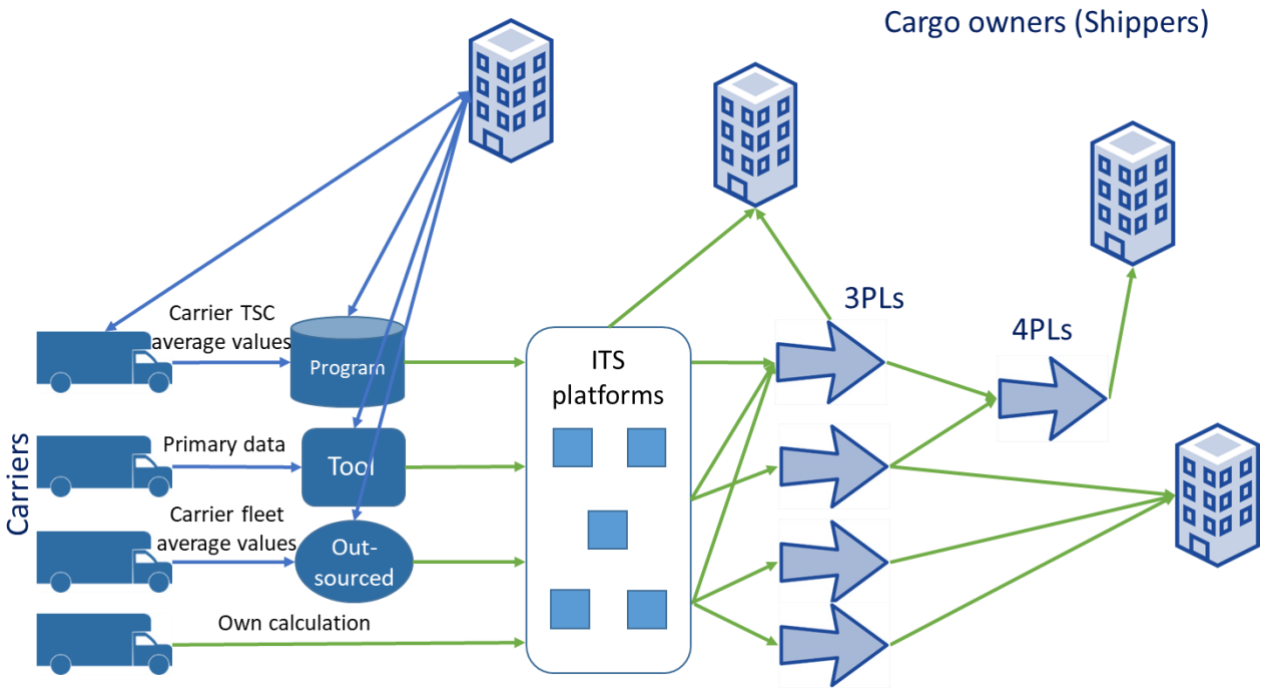

Figure 16: The role of data exchange platforms in pulling data together (source: SFC)

Clearly there is still some way before this becomes a reality.

- Consistency checks between different primary data sources such as vehicle CanBus or mobile GPS systems.
- Carrier fleet management systems need to be upgraded in order to facilitate this.
- Consideration should be given as to whether carrier fleet management system outputs should be published automatically; would the benefit of not requiring the carrier to input scare time and resources outweigh any risk to their commercial position, or not?
- The inclusion of a journey and / or transport service category identification key to the GS1 set would need to be explored so that an accurate relationship between shipment and consignment information could be established.
- The market and national governments will need to decide collectively whether multiple, interoperable platforms or an even more broadly distributed system based around blockchain technology will meet the joint needs of business and society in mitigating the contribution of logistics to climate change.
- Other aspects such as security, standardization approach and the commercial model, among many others, still need to be explored

4.3 Calculation tools

Early in the process of developing the GLEC Framework (SFC 2016) a paper was produced by Prof. Edgar Blanco (Blanco 2014), then of MIT, which usefully set out the relationship between emissions calculation tools, methodology, databases and green freight programs. That paper is still relevant when setting the scene as to the role of emissions calculation tools (see info box below).

Info box 4: Adapted from input to GLEC Strategy Annex, provided by E. Blanco, 2014

In order to effectively discuss the "state-of" freight emissions, we first need to introduce a hierarchy of four different levels: Programs, Methodologies, Calculation tools and Databases.

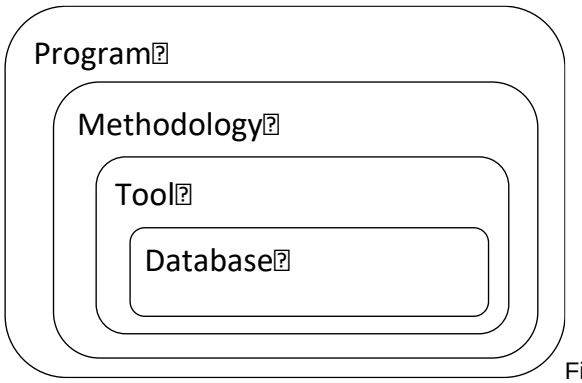

Figure: A hierarchy to discuss freight environmental emissions

- Programs represent the highest level of the hierarchy, and consist of guidelines describing what activities should be accounted, which emissions to track, as well as how they should be reported and what actions could be taken to reduce them. A program need not specify the actual method used to perform the calculations, but may provide one or more approved methodologies. The "Corporate Accounting and Reporting Standard" published by the GHG Protocol or the US EPA SmartWay Program are good examples.
- Methodologies represents the next level in the hierarchy, and specify the processes by which emissions should be calculated. A single program might have a number of appropriate methodologies that could be used, and conversely a single methodology could be appropriate to use in a number of different programs. The GHG Protocol, for example, allows for two different methodologies to calculate emissions from mobile sources: fuel-based and activity based. The fuel-based methodology is, in turn, shared with the IPCC methodology guidelines.
- Calculation tools represent the next level of the hierarchy and represent a specific implementation of a methodology. A calculation tool provides the ability to produce an actual quantifiable value for emissions by implementing a methodology, by encoding well-defined inputs, calculations and external data sources, such as emission factors databases or distance calculations. The GHG Protocol, for example, provides a series of spreadsheets that allow data inputs that are then combined with emission factors from the US EPA, Defra or the IPCC, among others.
- Databases represent the final level of the hierarchy and consist of repositories of information such as emissions factors or reference values that are expected to be used within a tool or methodology. Although databases are usually developed and technically specified alongside a specific tool, they often also include a set of standard values (e.g. emission factors) or default assumptions that are provided by third parties such as the US EPA, HBEFA and Defra.

It is often the case that a "tool" and a "methodology" are intimately linked together since entities working in methodology development (unless academic in nature) are interested in providing tools that help their intended audience apply the methodology. The NTM and EcoTransIT tools are examples. Also, using common databases of emission factors across tools, methodologies and programs is an effective way to achieve harmonization.

Based on the above, it is important to emphasize that the GLEC Framework is not in competition with existing logistics emissions calculation tools (whether commercial or in-house) or the methods / standards that support them. In fact the GLEC Framework is built on the most respected, commonly used, and consistent of the existing tools, bringing them together into a complete and consistent package with a defined set of boundaries to support business decision making on a holistic basis.

As such, the GLEC Framework acts as an industry-defined standard that calculation tools should aim to use as the basis for harmonizing their approach, so increasing transparency of the approach taken and comparability of the calculation

results. Where existing tools are not aligned with the GLEC Framework there is generally no need to discard the existing calculation tool, merely make the necessary amendments to align the content with the approach set out in the Framework.

The survey conducted in summer 2018 by SFC, IRU, Clecat and ESC as part of LEARN (WP 5) indicated that there was a clear lack of knowledge and confusion among many potential users of emissions calculation tools as to their scope, data required, and the outputs that would be provided. As a result of this the LEARN partners have placed specific emphasis on developing, for the first time, a web page[8] that presents in one place, in an objective and neutral way, an overview description of as many calculation tools as possible (see also Chapter 9 "Annex on calculation tools"). The format of the information presented was developed in conjunction with some of the leading tools in order to provide information that addresses key issues such as:

- Transportation modes covered
- Geographical limitations
- Data input formats accepted
- Types of data that can be used in the calculations
- Indication of external reference data sources used
- Data verification processes employed
- Any external assurance or verification obtained

The website provides context around this resource,

- Emphasizing the role that such calculation tools can play in raising the profile given to logistics emission calculation and reporting as a step towards tracking emission reductions
- Explaining the decisions that can be made using different types of data
- Noting the role that different stakeholders have in the process of calculating, reporting and reducing logistics emissions

Accredited calculation tools and green freight programs

There is a large and increasing number of calculation tools aimed at the logistics sector. Linked to this, and the increasing emphasis being placed on logistics emissions in fighting climate change, companies are increasingly using these third party calculation tools and joining green freight programs to help calculate, report (and ultimately reduce) the emissions arising from their logistics supply chain. Providing transparent information about these tools to potential users in a neutral and consistent format is a useful step in terms of helping potential users of calculation tools to make an informed choice.

However, SFC has taken a further step outside of the LEARN project to initiate an accreditation process for calculation tools and derived an accreditation scheme. The SFC Accreditation is designed to help:

- Organizations that provide calculation tools or calculate logistics emissions as a service that the underlying methodology has been independently checked and is correctly aligned with the GLEC Framework (with reference to the version number). The SFC Accreditation is a sign to their customers – or other businesses – that they care about the robustness and reliability of the calculation methods offered.
- Potential users to know which tools and programs have successfully embedded the GLEC Framework. This provides companies with the confidence that the accredited calculation tools and green freight programs they work with are aligned with the GLEC Framework (in its current version) and the approach that has been taken. Furthermore, this will increase a company's ability to combine data from different tools and programs, as well as easing the assurance process and data reporting to schemes such as CDP.

It is expected that this will play a part in providing market confidence leading to an increased uptake of accredited calculation tools and green freight programs resulting in increased market convergence and comparability of calculation outputs.

[8] See http://www.learnproject.net

5. Reporting of emissions and emission intensities

During the course of LEARN, ecolabels to reward business have been analysed and discussed at various levels. “Feedback from the LEARN Expert Advisory Board and the LEARN International Conference (2016) identified potential additional problems with recognition of a new eco-label in the logistics sector given the large number already in existence, especially as certain schemes (such as Green Freight Asia, SmartWay, Objectif CO_2, Lean & Green and ECO Stars) have gained significant market penetration and brand recognition in recent years. It is therefore recommended that a new eco-label, that may have to compete with existing schemes, is not produced. Instead the approach recommended is to use a defined framework to feed into existing schemes and practices. It is recommended that the GLEC Framework should be used in the future to ensure a consistent approach by companies measuring their emissions and that the GLEC Framework’s procedures for producing a verified GHG declaration should feed into the existing Green Freight programs and carbon accounting tools already used by companies. This would be used to define the relationship between the approaches taken by the various tools.” (LEARN D.2.3 2017, p. 19ff)

5.1 GLEC Declaration

As explained in earlier sections of this report, the logistics emissions results calculated using the GLEC Framework are intended to facilitate reporting, business decision making, and emissions reduction strategy formation and implementation. Furthermore the importance of dramatically reducing both total logistics emissions and logistics emission intensity (as the way to ensuring a reduction in total emissions in the context of increasing global GDP and trade) has also been emphasized; hence, the reported emissions also provide evidence of the contribution of efforts made by businesses towards meeting climate goals. The role of the different stakeholders in the logistics chain (i.e. transport operators, logistics service providers and shippers), both in terms of providing the logistics service and in contributing to the associated emission calculation, has also been explained.

One of the barriers cited to widespread uptake of logistics emission calculation and reporting has been the many similar, yet subtly different formats and KPIs used by individual companies to request information from their transport providers.

The GLEC Declaration (SFC 2019) has been designed to address this issue, taking all the aforementioned factors into account, reflecting the role of each stakeholder, and the information that needs to be presented, both privately in communications from a company to its customers, and publicly to the broader set of organizations that have a role in reviewing progress towards overall climate goals.

Hence, the GLEC Declaration is a template for defining the information to be included in company reports that will help to harmonize and add transparency to the reporting process. The template standardizes the options of what should be reported to increase consistency in the information requested/reported by different parties, while continuing to reflect that what is actually reported depends on what information the reporting company and the recipient actually need.

Two distinct types of report have been identified based on two sets of audience and their needs:

- **B2B customers**, where the scope of reporting is the service provided to that customer, which is tied to the contract and invoice.
- **External stakeholders** other than customers (e.g. in CSR or annual reports, to governments, carbon reporting initiatives such as CDP, GRI, etc.), where the scope of reporting is the total only of logistics services (provided directly or purchased) as defined in the GLEC Framework.

The GLEC Declaration includes two main parts:

- A general section containing information on the company, its activities and other relevant information:
- A specific emissions data/information targeted per audience, which is referred as “Options menu of reported information”, including:
    - Detailed information and data disclosure.
    - Details on completeness and relevance of the Declaration.

The overall structure is presented in the following table. This content has been developed following initial discussions with a small group of GLEC company members, followed by consultation with:

- The wider community of GLEC members and consultees, consisting of
- The LEARN consortium partners
- The LEARN Advisory Board
- The European Commission

Table 10: Overall structure of the GLEC Declaration (SFC 2019)

Content Options	Description
Information about the company	Brief company description similar to what is on websites, e.g. mission, size, geographic coverage, services…
Logistics information	Brief description of how freight and logistics is organized, e.g. type of freight (bulk shipping, road…) and owned transport/outsourced
Commitment	Brief statement of commitment to disclosure of logistics emissions in a consistent/accurate manner aiming to make use of credible and appropriate input data from different sources
Specific information and data disclosure per target audience	See next section
Completeness and relevance of the Declaration per target audience	See next section
Disclaimer/References	Relevant disclaimers and reference to audit statement by assurance provider

The GLEC Declaration 'Options menu' content for the two audiences is detailed below, always considering that in the end the reporter determines what is appropriate to report depending on the reporting purpose or user needs.

The 'Options menu' can be slightly different for shippers, LSPs and carriers; for example, the unit used for reporting emission intensity will largely be determined by the company's interests and business model. Specific targeted examples of GLEC Declarations to customers and to the public will be developed for the various kinds of companies (e.g. carriers, LSPs and shippers).

5.1.1 GLEC Declaration to B2B customers (service level)

The scope of reporting to the customer is the SERVICE provided by the company to the specific customer. The service provided is tied to the contract & invoice.
Main aspects of the GLEC Declaration B2B Options Menu are the following:

- Breakdown of total GHG and of tkm data should be provided only by mode (and not company as a whole) because they vary enormously between modes. Furthermore, it has to be considered that the customers tend to focus on modes when looking for improvement areas, so this approach still would meet their needs.
- "Input data sources" are disclosed as % breakdown by mode (% own fleet data, % carrier direct data, % carrier data from programs, % models/tools, % default factor-based).

Table 11: GLEC Declaration to B2B customers (service level) (SFC 2019)

	Minimum	Other potentially useful information
Services	Service level	Shipment level, trade lane, business unit, geography, product…
Year	Reporting year	Multi-year overviews, quarterly reports…
Unit of measurement	Total emissions, Emissions per tkm	Additional intensity factors, e.g. emission per tonne, TEU, pallets, service units…
WTW	WTW	Breakdown WTT & TTW
Scope 1, 2, 3	Total figure	Breakdown into individual scopes

	Minimum	Other potentially useful information
Modes / nodes	Customer specific: breakdown of total emissions and emission intensity by transport modes and logistics sites	Inclusion of logistics sites, especially if material (i.e. >5%) Modal breakdown of pre- and on-carriage
Business units		
Coverage		
Input data sources (for each mode)	% own fleet data % carrier direct data % carrier data from programs % models / tools % default factor-based	-
Data verification	Statement whether input data has been independently verified	

5.1.2 GLEC Declaration to external stakeholders other than customers (company level)

The scope of reporting to stakeholders other than customers is the total of logistics services (provided or purchased) as defined in the GLEC Framework.

It is recommended for companies with logistics emissions of 5% or more of their total GHG footprint.

Table 12: GLEC Declaration to external stakeholders (SFC 2019)

	Minimum	Best practice under 'Smart Freight Leadership'
Services	n/a, i.e. fully aggregated	
Year	Reporting year	Past year(s)
Unit of measurement	Total CO_2e emissions By shippers: CO_2e per tonne (or suitable unit of production)	Emission intensity, e.g. for • LSP or carrier: CO_2e per tonne-km for each mode • Shippers: CO_2e per tonne-km
WTW	WTW	Breakdown WTT & TTW at a global level
Scope 1, 2, 3	Breakdown by scopes 1, 2 and 3	-
Modes / nodes	Breakdown of total by modes / nodes used by the company, i.e. % air, % sea, % IWW, % road, % rail, % logistics sites	-
Business units	-	Yes
Coverage	% coverage	-
Input data sources (for each mode)	-	% own fleet data % carrier direct data % carrier data from programs % models / tools % default factor-based
Data verification	Statement whether input data has been independently verified	Confirmation that input data has been independently verified

6. Summary and recommendations

During recent years, significant progress towards the establishment and implementation of an international standard for transport chain emissions calculation was made by the Global Logistics Emissions Council (GLEC). With the GLEC Framework, first published in 2016 (SFC 2016) and currently under review (SFC 2019) a useful methodology was established. LEARN activities have confirmed, that the GLEC Framework is a tool suitable as a basis for a global standard for transport chain emission calculation.

As industry is taking the GLEC Framework into its CSR and emissions accounting schemes it has proved to be essential that claims regarding the 'implementation of the GLEC Framework' and 'emissions accounted according to the GLEC Framework' have to be assured by external parties to establishing trust in the results, realise comparability between logistics systems and solutions and enabling more informed and better decision making. Therefore, this report summarises the general institutional framework of assurance as well as assurance processes with view to implementing the GLEC Framework as published in (SFC 2018). In addition, an overview on relevant methodological topics is given along with a discussion on data capture and sharing for emissions calculation and reporting.

While the assurance is – in this document - by definition a 3rd party review, the reporting organisation itself can establish transparent procedures to enhance this process. For this, the company should train the persons responsible with view to emissions calculation, verification, reporting and assurance. Examples for relevant topics are given in the training materials developed in LEARN work package 5 (LEARN D5.3 2019) or recommendations for further reading is given in Table 13. In addition, a procedure for self-assessment provides insight into the company's current logistics GHG emission calculation and reporting practices against the GLEC Framework (see section 3.3) and outlines necessary steps still to be taken.

Table 13: Recommendation for further reading & relevant reports

Topic	Title	Access via …
Calculation of emissions	GLEC Framework (version 1.0)	Smart Freight Centre http://www.smartfreightcentre.org/glec/what-is-glec
	GLEC Framework (version 2.0)	Smart Freight Centre It is expected to be released in June 2019: see http://www.smartfreightcentre.org
	Guide for greenhouse gas emission accounting at logistics sites. Focus on transhipment sites, warehouses and distribution centers	Fraunhofer IML http://publica.fraunhofer.de/documents/N-532019.html
	Guidance for Greenhouse Gas Emission Footprinting for Container Terminals	Feport https://www.feport.eu/images/downloads/EEEG_GHG_Footprinting_Guidance_Version_2.0.pdf
Assurance	Assurance Guidance	Available from Smart Freight Centre
Reporting	GLEC Declaration	Smart Freight Centre, part of GLEC Fw. v2.0

A reliable calculation rests on sourcing good quality data as input to the calculation. LEARN's activities outlined at various stages that barriers still exist in the field of sourcing of data, data communication between the partners of the chain and the data quality. Clear guidance and alignment with the GLEC Framework is needed as regards the use of primary or actual data collected by companies or program, modelled or default data used and/or provided by green freight programs and calculation tools. Future alignment and assurance effort should also address the complex nature of the relationships between the various stakeholders involved, i.e. carrier, logistics service provider, and shipper, as well as (if used) green freight programs or calculation tool providers. There are currently various technical, commercial and structural challenges in pulling together the necessary information into a single structure for the calculation of GHG emissions that meet the needs of all stakeholders. However, it is expected that assurance of overarching structures such as green freight programs or calculation tools as covered by the SFC Assurance Guidance (SFC 2018) will play a part in providing market confidence leading to an increased uptake of accredited calculation tools and green freight programs resulting in increased market convergence and comparability of calculation outputs.

7. Abbreviations

3PL	Third party logistics service provider
4PL	Fourth party logistics service provider
API	Application programming interface
B2B	Business to business
CDP	Carbon disclosure project
CEN	Comité Européen de Normalisation
CEP	Courier, express and parcel
CF	Consumption factor
CNG	Compressed natural gas
CO_2e	Carbon dioxide equivalent
CSR	Corporate social responsibility
DIN	Deutsches Institut für Normung
EN	European norm
EPA	Environmental Protection Agency
ETA	Estimated Time of Arrival
FEU	Forty foot equivalent
FTE	Full-time equivalents
FTL	Full truck load
GCD	Great circle distance
GDP	Gross domestic product
GHG	Greenhouse gas
GLEC	Global Logistics Emissions Council
GRI	Global reporting initiative
GWP	Global warming potential
HBEFA	Handbook emission factors for road transport
IFAC	International Federation of Accountants
IPCC	Intergovernmental panel on climate change
ISAE	International Standard on Assurance Engagements
ISO	International Standardization Organisation
ITS	Information technology system
IWW	Inland waterways
KPI	Key performance indicator
LEARN	Logistics emissions accounting and reduction network
LIM	Logistics Interoperability Model
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
LSP	Logistics service provider
LTL	Less than truck load
N/A	not applicable
NGO	Non-governmental organisation
QA/QC	quality assurance and control
SFC	Smart Freight Centre
SFD	Shortest feasible distance
T&D	Transportation and distribution
TC	Technical Committee
TEU	Twenty foot equivalent
TS	Technical Specification
TSC	Transport service category
TTW	Tank to wheel
US	United States
VAS	Value added services
WMS	Warehouse management system
WP	Work package
WTT	Well to tank
WTW	Well to wheel

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9. Annex on calculation tools

The following calculation tools are described in tabular form in alphabetic order. The information for each tool was given by the calculation tool provider themselves and was supervised by Smart Freight Center from January to February 2019.

No validation of the information given was performed.

Calculation tool	Provider	Section
BigMile	Connekt	9.1
EcoTransIT World	IVE mbH, Germany	9.2
Greenrouter	GreenRouter S.r.l.	9.3
LogEC	BearingPoint Business Services B.V. NL	9.4
REff Assessment Tool: Resource efficiency at logistics sites	Fraunhofer Institute for Material Flow and Logistics IML, Germany	9.5
TK'Blue Agency – GHG Calculator	TK'Blue Agency	9.6
VIA Green Program	Via Green Institute	9.7

9.1 BigMile

Available via: www.bigmile.eu

General description
BigMile is a method and tool to extract business intelligence from actual transport data. The added value of goods transported/crossdocked/stored is related to energy inputs, time spent and resources used. Ready for use , from simple transport up to complex international supply chains with a great variety of inputs or even lack of data, and multiple layers of subcontracting. The online available intelligence allows individuals companies or collective supply chains to analyze their performance in detail, showing direct potential for operational improvement. One of the audited outputs is a certified footprint statement, available for various formats or standards.

Tool Scope	
Geographic application	• Global
Industry Sectors	• All
Targeted Customers	• Shipper • Freight Forwarder / Logistic Service Providers • Carrier / Transport Operator • Transportation Management System Provider • Retailer
Modes	• All

Logistics sites	• Yes
	  ○ Transhipment center, cross docking etc.
	  ○ Container terminals
	  ○ Warehouses
	  ○ Any desired

Energy & emissions	• CO_2 emissions • GHG emissions, as CO_2e • Energy consumption
Other impacts	• Time spent, costs, infrastructure use (bundling effectiveness), warehouse use

Tool Governance / Owner	
Provider / Governance / Owner / Program (EU))	• Non profit: Connekt
Access	• Open access for any customer
Fee structure / Price range	• Limited free module • Once-only cost • Pay-per-use fee (e.g. pay per calculation, contingents) • Negotiated fee • Subscription

Data Input Options	

Interface types / Support	• Online data entry: website, CSV file, Excel
	• Batch data processing: Excel /CSV upload
	• 3rd party service (added values):
	  ○ Consultancy (Supported Calculation)
	  ○ Consultancy to reduce emissions, decision making
	  ○ Link to program labelling
	• Input Data Quality : check and improvement

Tool methodology general	
General calculation methodologies	• GLEC Framework (including core mode methodologies, e.g. CCWG, EcoTransIT) • EN16258 • Extended EN16258, Data maturity definition • COFRET adapted, CO_2 objectif, Smartways, Lean & Green
Methodology published?	• Yes: www.lean-green.eu, www.bigmile.eu • Level of detail: Summary of approach
Accreditation / Compliance / Certification	• Not SFC accredited • EN16258 compliant • Certificates: ISAE3000. Certification of output is done by accountants

Input data	Fuel based approach
	• Primary carrier fuel data by trip
	• Aggregated carrier fuel data by transport chain element
	• Aggregated carrier fuel data by transport service
	• Aggregated carrier fuel data by vehicle type
	• Aggregated carrier fuel data for overall fleet
	• Fuel use calculated by tool using routing provided by customer
	
	Fuel use calculated by tool using internal routing parameters
	• Fuel use estimated using manufacturer data
	• Fuel use estimated using generic, vehicle or mode based approach
	
	Transport Activity (tkm) calculation
	• Transport activity provided by customer
	• Transport activity calculated based on consignment and routing info provided by customer
	
	Activity based approach
	• Combines transport activity with
	  ○ fuel / emission intensity value provided by carrier
	  ○ fuel / emission intensity from green freight program
	  ○ GLEC default fuel / emission intensity value for transport service or specific vehicle type
	  ○ Other default fuel / emission intensity value, National database as applicable, tools available

Tool methodology general	

Geographical data	• Routing sources by mode: none used, no routing, no modelling
	• Location information
	  ○ Zip codes
	  ○ UN-/ Locodes
	  ○ IATA codes
	  ○ City names
	  ○ Long/ Lat coordinates
	• No routing: calculations are not based on models but real input data.

Fossil fuel emission data	• General fuel types considered
	  ○ Diesel
	  ○ Diesel with variable biodiesel component
	  ○ CNG
	  ○ LNG
	  ○ LPG
	  ○ HFO
	  ○ Gasoline
	  ○ Gasoline with variable bioethanol component
	  ○ Aviation fuel
	(For other mode-specific fuels see detailed description sheet)
	
	• Emission factor sources:
	  ○ GLEC Framework
	  ○ EN 16258: Appendix A
	  ○ Handbook of Emission factors
	  ○ JRC (EU)
	  ○ Greet (USA)
	  ○ French regulation
	  ○ UK BEIS (formerly Defra)

Renewable Energy Considerations	• Pure biofuels included
	• Biofuel feedstocks differentiated
	• Flexible application by
	  ○ Transport mode
	  ○ Transport activity
	  ○ Geography (e.g. per country, region, continent)

Electricity generating mix options	• Single global electricity mix (base, year) • Country based production electricity mix (source(s), year(s)) • Customer specific electricity mix (source, year)

Outputs, Reporting and Use	
Output data	• Total emissions • Emission per transport chain element • Differentiation according to GHG Protocol scopes • Emission intensity per tkm • Emission intensity, other • Compatible with GLEC Declaration • Statement of assumptions • Statement of data type(s) used
Typical use(s) of tool outputs	• Public reporting of total company logistics emissions • Reporting to customers, e.g. general per timeframe or carbon footprint on invoice • Internal performance metrics • Informing emission reduction decision making • Informing corporate policy & advocacy response • Input to corporate marketing & CSR actions • Collective (shipper with LSP and subcontractors) improvement of supply chain • Operational performance feedback of collective performance

9.2 EcoTransIT World

Available via: http://www.ecotransit.org

General description
EcoTransIT World is a tool to calculate the energy consumption and the emissions of any global intermodal freight transport. A large amount of data, invisible to the front-end user, allow precise calculations based on relatively simple transport definitions. The tool is based on a massive database of basic emission factors and vehicle consumption characteristics which forms the basis to calculate the emissions in combination with the transport parameters. To calculate transport distances, ETW provides a global routing which is unique in this way. A global traffic network has been recorded for each type of traffic to allow an accurate calculation of transport routes. Based on the published and publically available methodology, ETW applies formulae for each individual leg of a transport chain (e. g. different road categories, ferry transfers, energy mixes in different countries etc.) to calculate the energy consumption and emission values for each transport type used, adding up every section to a total for the complete transport chain. ETW has over 40 users calculating annually over 180 million transport services within the Business Solutions of EcoTransIT World.

Tool Scope	
Geographic application	• Worldwide global coverage
Industry Sectors	• All kinds of industry sectors
Targeted Customers	• Shipper • Freight Forwarder / LSP • Carrier / Transport Operator • TMS Provider • Other, please state: consulting companies, NGOs, tool providers
Modes	• all

Logistics sites	• Yes
	  ○ Warehouses
	  ○ Transhipment center, cross docking etc.
	  ○ Container terminals

Energy & emissions	• CO_2 emissions • GHG emissions, as CO_2e • Energy consumption • Air pollutants, please state: NOx, SOx, NMHC, PM10 • If needed separated per leg, country, transport mode, type of fuel used

Tool Governance / Owner	
Provider / Governance / Owner / Program (EU))	• IVE mbH, Lützerodestraße 10, 30161 Hannover, Germany, contact info@ecotransit.org • The tool is steered by all users of the tool within the EcoTransIT World Initiative
Access	• Open access for any customer ○ at http://www.ecotransit.org for free (single calculation) • Features of Business Solution via annual license or consulting projects
Fee structure / Price range	• Single calculation free at: http://www.ecotransit.org • Flat rate and price-per-calculation license models (Business Solutions) • Consulting projects for supported calculations of customer provided transport lists

Data Input Options	

Interface types / Support	• Online data entry: website, CSV file
	• Batch data processing
	  ○ Soap XML web service
	  ○ sFTP based file upload (CSV or XML based)
	• 3rd party service (added values)
	  ○ Consultancy (Supported Calculation)
	• Additional tools to improve the overall calculation performance, like LocationEditior and LogViewer

Tool methodology general	

General calculation methodologies	• GLEC Framework (including core mode methodologies, e.g. CCWG)
	• EN16258
	• Own methodology
	• Third party data integration:
	  ○ OAG: Flight number to plane type analyses & stop-over identification
	  ○ CCWG public trade lane factor (for all users)
	  ○ CCWG Carrier trade lane factor-based calculations (only for CCWG members)
	  ○ GIS-data for word wide street, ocean, inland waterway and railway networks, locations as UN-/Locode, postal codes, city names, IATA codes, UIC codes, Long/Lat coordinate

Methodology published?	• Yes: https://www.ecotransit.org/basis.en.html as long and short version • Level of detail: Very comprehensive (Over 130 pages)
Accreditation / Compliance / Certification	• SFC accredited • EN16258 compliant, see https://www.ecotransit.org/calculation.en.html (after calculation) • Methodology confirmation letter from IVE, ifeu and Infras • Certificates: ISAE 3402 (in the flow) via PWC, Certified process within IVE for the project EcoTransIT World

Input data	Fuel based approach
	• Fuel use calculated by tool using routing provided by customer
	• **Fuel use calculated by tool using internal routing parameters**
	• Fuel use estimated using manufacturer data
	• **Fuel use estimated using generic, vehicle of mode-based approach**
	  ○ Truck: Handbook of Emission Factors, Motor Vehicles Emissions Simulator (MOVES)
	  ○ Train: Own methodology from Ifeu Heidelberg based on determined fuel/electricity consumption curves from European railway companies
	  ○ Airplane: Small Emitters Tool of Eurocontrol
	  ○ Barge: Own methodology (compare methodology report)
	  ○ Sea ship: Own methodology (compare methodology report), sea container transports GHG based on CCWG methodology
	  ○ Ferry: Average of applied ferry types (compare methodology report)
	
	Transport Activity (tkm) calculation
	• Transport activity provided by customer
	• Transport activity calculated based on consignment and routing info provided by customer
	• **Transport activity calculated based on consignment info provided by customer and tool's internal routing parameters**
	
	Activity based approach: not applicable

Tool methodology general	
Geographical data	Routing sources by mode: • Road: GIS-data Europe Teleatlas, outside OpenStreetMap and other • Rail: GIS-data Europe Teleatlas, outside OpenStreetMap and other • Sea: Own created network, validated by sea carriers • Air: EN 16258 Great circle distance calculation plus start- and landing surcharge • Inland waterway: Own created network based on OpenStreetMap data Location information: • Zip codes (global coverage, annually actualized) • UN-/ Locodes (Harbor and inland locations, over 95.000) • IATA codes (All existing IATA codes from the OAG timetable and more) • City names (Over 900.000 city names plus 8 Mio postal codes and locodes) • Long/ Lat coordinates Features, please state: • Automatic identification of the relevant harbor, airport or railway station, including classification for short, medium or long-haul transports • For street transport automatically, inclusion of car and railway ferries • Optional modeling of RoRo shipments in different scenarios (with truck, only trailer, etc.)
Fossil fuel emission data	General fuel types considered • Diesel • Diesel with variable biodiesel component (automatically selected per country or as percentage) • CNG • LNG • LNG/Diesel Hybrid • Battery vehicles • HFO • MDO • Aviation fuel • Electrification on the base of national electricity production mixes Emission factor sources • GLEC Framework • EN 16258: Appendix A • Handbook of Emission factors • Motor Vehicle Emission Simulator (MOVES) • IMO report • And many others (compare methodology report)

Renewable Energy Considerations	• Biofuel feedstocks differentiated (per country or individual)
	• Flexible application by
	  ○ Transport mode
	  ○ Transport activity
	  ○ Geography (e.g. per country, region, continent)

Electricity generating mix options	• Country based production electricity mix (Eurostat, update every second year) • Customer specific electricity mix possible

Outputs, Reporting and Use	
Output data	• Total emissions • Emission per transport chain element • Differentiation of WTT and TTW emissions • Emission intensity per tkm • Compatible with GLEC Declaration • Statement of assumptions • Statement of data type(s) used
Typical use(s) of tool outputs	• **Reporting to customers, e.g. general per timeframe or carbon footprint on invoice** • **Internal performance metrics** • Input to corporate marketing & CSR actions • Public reporting of total company logistics emissions • Informing emission reduction decision making • Informing corporate policy & advocacy response • **All kinds of usage are possible**

9.3 Greenrouter

Available via: https://www.greenrouter.it/?ln=en

General description
GreenRouter, encourages the introduction of environmental aspects in logistics activities, and supports managers in their daily decision-making processes. This thanks to a user-friendly interface, a full set of “environmental KPIs”, and advanced features such as emissions forecasting and projection. Beside from being a managerial tool, GreenRouter provides a valid support to the formalization of GHG emissions calculation processes, thanks to its reliable but flexible data structure. GreenRouter is also ready for ESG reporting and communication, as its calculation and reporting engine is fully compliant with well known standards in both transportation and logistic buildings GHG emissions calculation.

Tool Scope	
Geographic application	• Global • Note: Road Vehicle categories are based on European emission standards (ex. euro 5)
Industry Sectors	• All • Restriction: Bulk shipments are not supported
Targeted Customers	• Shipper • Freight Forwarder / Logistic Service Providers • Carrier / Transport Operator • Transportation Management System Provider
Modes	• Road, rail, sea, air • Not inland waterways

Logistics sites	• Yes: CLECAT guidelines – compliance
	  ○ Transhipment center, cross docking etc.
	  ○ Container terminals
	  ○ Warehouses
	  ○ Other: Point of sales

Energy & emissions	• GHG emissions, as CO_2e • Energy consumption • Air pollutants, please state: Particulate matter (PM)
Other impacts	• Logistic Costs (expected release date: 2020)

Tool Governance / Owner	
Provider / Governance / Owner / Program (EU))	• Private Company: GreenRouter S.r.l.
Access	• Open access for any customer (modular licensing)
Fee structure / Price range	• Negotiated fee

Data Input Options	

Interface types / Support	• Online data entry: website, CSV file
	• Batch data processing
	  ○ REST web service (Expected Release Q2 2019)
	  ○ Excel /CSV Upload
	  ○ Other, please state: TMS/ERP custom interfaces, FTP/SFTP server
	• 3rd party service (added values)
	  ○ Consultancy (Supported Calculation)
	  ○ Consultancy to reduce emissions, decision making
	Other:
	• 3rd party service (added values):
	  ○ CSR/ESG/Non-Financial Report: full support up to text editing

Data Input Options	
	○ Logistics modelling ○ Scenario simulations, custom reporting, … • Batch data processing: ○ flexible format data collection and data quality report/score

Tool methodology general	
General calculation methodologies	• EN16258 • Other, please state: CLECAT guidelines on GHG emission calculation (logistic buildings)
Methodology published?	• No: available for customers upon written request and NdA
Accreditation / Compliance / Certification	• Not SFC accredited, but in discussion • EN16258 compliant => see below • Certificates: **Calculation methodology for GHG emissions/energy, Reporting and Declaration compliance with EN16258** https://www.greenrouter.it/public/templates/cert_via_16258.pdf • Other: **Calculation methodology for GHG emissions, Reporting and Declaration compliance with CLECAT guidelines chapter 11: "Calculating GHG emissions for freight forwarding and logistics services"** https://www.greenrouter.it/public/templates/cert_mag_CLECAT.pdf
Input data	Note: Each single shipment is fully detailed (routing, transport modes, vehicle type, …) and singularly calculated by GreenRouter Fuel based approach • **Fuel use calculated by tool using routing provided by customer** • Fuel use calculated by tool using internal routing parameters • Fuel use estimated using manufacturer data Transport Activity (tkm) calculation • Transport activity provided by customer • **Transport activity calculated based on consignment and routing info provided by customer** • Transport activity calculated based on consignment info provided by customer and tool's internal routing parameters Activity based approach • Combines transport activity with fuel intensity value provided by carrier Note: fuel consumption parameters could be customized if customer's specific data is available
Geographical data	Routing sources by mode: • Road - please state: Real data from customer / Here Maps (Truck specific routing) • Rail - please state: Real data from customer / Internal engine: GIS • Sea - please state: Real data from customer / Internal engine: GIS • Air - please state: Real data from customer / EN16258 standard method Location information: • Zip codes • UN-/ Locodes => Ports • IATA codes => Airports • City names (addresses, etc) • Long/ Lat coordinates Features, please state: (e.g. automatic determination of transfer points, (harbors, airports, stations) or transport lines (e.g. ferries)…… Network-based automated global Express shipment routing is possible

Tool methodology general	

Fossil fuel emission data	General fuel types considered
	• Diesel
	• Diesel with variable biodiesel component
	• CNG
	• LNG
	• LPG
	• HFO
	• Gasoline
	• Gasoline with variable bioethanol component
	• Aviation fuel
	• Electricity (for electric trucks/trains)
	(For other mode-specific fuels see detailed description sheet)
	
	Emission factor sources
	• EN 16258: Appendix A
	• Handbook of Emission factors
	• UK BEIS (formerly Defra)
	• Other, please specify:
	  ○ IEA electricity emission factors
	  ○ (Many others)

Renewable Energy Considerations	Pure biofuels included • Available upon customer request Flexible application by • Transport mode • Transport activity • Geography (e.g. per country, region, continent)
Electricity generating mix options	• Single global electricity mix (base, year) ○ For intercontinental electric travel, + continental average for country to country travel • Country based production electricity mix (source(s), year(s)) • Customer specific electricity mix (source, year)

Outputs, Reporting and Use	
Output data	• Total emissions • Emission per transport chain element • Differentiation of WTT and TTW emissions • Differentiation according to GHG Protocol scopes • Emission intensity per tkm • Emission intensity, other • Statement of assumptions • Statement of data type(s) used • Fully customizable emission segmentation and comparison (date, lanes, transported sku, suppliers, …) • Downstream emission allocation along the supply chain
Typical use(s) of tool outputs	• Public reporting of total company logistics emissions • Reporting to customers, e.g. general per timeframe or carbon footprint on invoice • Internal performance metrics • Informing emission reduction decision making • Input to corporate marketing & CSR actions

9.4 LogEC

Available via: www.logec.net

General description
LogEC is an emissions calculator that is certified according to EN 16258 and French decree. It covers all modes of transportation on a global scale. The general idea of LogEC to supply an integrated and fully automated accounting system for emissions along the supply chain. To support this the SAP Cloud Platform (SCP) was chosen as the technical backbone to allow quick and easy interfaces to ERP and TMS-Systems. Architecture is designed to process complex transport chains and billions of shipments/products per month. LogEC can handle different data granularities from track & trace level to transport invoice level. For shipper LogEC provides proven work arounds for missing data, e.g. 3PL networks, trade lanes and routing engines. Furthermore, allocation can drill-down to single products and or customers. Various default values e.g. from EN16258, French decree, HBEFA, CCWG and OEM's are embedded. Pre-configured dashboards are available to fulfill typical reporting requirements from the beginning in conjunction with customizable reports. Sophisticated business support for calculation and reduction topics. Technical support 24/7 via ticket system and hotline.

Tool Scope	
Geographic application	• Global
Industry Sectors	• All, but with strong features especially for shippers
Targeted Customers	• Shipper • Freight Forwarder / Logistic Service Providers • Carrier / Transport Operator • Transportation Management System Provider • Other: TMS Provider, Transport Market places, NGOs, Governments, Municipalities/ cities…
Modes	• Yes: road, rail, inland waterways, sea • Yes No: air

Logistics sites	• Yes:
	  ○ Transhipment center, cross docking etc.
	  ○ Container terminals
	  ○ Warehouses
	  ○ Other: Emissions, Waste, Water, Energy Consumption + Production

Energy & emissions	• CO_2 emissions • GHG emissions, as CO_2e • Energy consumption • Air pollutants: C_6H_6, CH_4, CO, HC, N_2O, NH_3, NMHC, NO_2, NOx, Pb, PM, PN, SO_2
Other impacts	• Costs for off-setting, lead-times, costs….

Tool Governance / Owner	
Provider / Governance / Owner / Program (EU))	• Private company: BearingPoint Business Services B.V.. NL
Access	• Open for members only
Fee structure / Price range	• Pay-per-use fee (e.g. pay per calculation, contingents) • Other: Transactions based flat rates, project rates…

Data Input Options	

Interface types / Support	• Online data entry: website, CSV file, idoc, OData, Rest
	• Batch data processing
	  ○ Soap XML web service
	  ○ REST web service
	  ○ Excel /CSV Upload
	• 3rd party service (added values)
	  ○ Consultancy (Supported Calculation)
	  ○ Consultancy to reduce emissions, decision making
	  ○ Link to program labelling
	• Other: data quality indicator or location editor, Data validation incl. valid range check,-Data transformation and Mapping (ETL)…

Tool methodology general	
General calculation methodologies	• (GLEC Framework (including core mode methodologies, e.g. CCWG, EcoTransIT)) • EN16258 • (Own methodology) • Other: Handbook of Emission Factors, CCWG public and members, IEA, Google API for worldwide road, ocean, barge and railway, distances networks, locations as UN-/Locode, postal codes, city names, IATA codes, UIC codes, Long/Lat coordinate.
Methodology published?	• Yes, but only for members (IP) • Level of detail: Comprehensive

Accreditation / Compliance / Certification	• Not SFC accredited, but in discussion
	• EN16258 compliant, see certification by Bureau veritas
	• Certificates:
	  ○ Certified by Bureau Veritas for DIN EN16258 and French decree,
	  ○ Certified by SAP for IT

Input data	Fuel based approach
	• Primary carrier fuel data by trip
	• Aggregated carrier fuel data by transport chain element
	• Aggregated carrier fuel data by transport service
	• Aggregated carrier fuel data by vehicle type
	• Aggregated carrier fuel data for overall fleet
	• Fuel use calculated by tool using routing provided by customer
	• Fuel use calculated by tool using internal routing parameters
	• Fuel use estimated using manufacturer data
	• Fuel use estimated using generic, vehicle or mode based approach, please state (e.g. GHG Protocol generic truck fuel consumption): OEM data on fuel consumptions
	
	Transport Activity (tkm) calculation
	• Transport activity provided by customer
	• Transport activity calculated based on consignment and routing info provided by customer
	• Transport activity calculated based on consignment info provided by customer and tool's internal routing parameters
	
	Activity based approach
	• Combines transport activity with
	  ○ fuel / emission intensity value provided by carrier
	  ○ fuel / emission intensity from green freight program
	  ○ GLEC default fuel / emission intensity value for transport service or specific vehicle type
	  ○ Other default fuel / emission intensity value, please state (e.g. national database value)….

Tool methodology general	
Geographical data	Routing sources by mode: • Road: API OpenStreetMap, Google Map • Rail: BNSF for US, by data provided by KombiVerkehr, plus various sources • Sea: linescape, vesseltracker plus various other sources • Air: Great Circle plus 95km, API to flightaware • Inland waterway: ELVIS plus various other sources Location information: • Zip codes • UN-/ Locodes • IATA codes • City names • Long/ Lat coordinates Features: routing engine /automatic determination of transfer points, (harbors, airports, stations) or transport lines (e.g. ferries) and 3PL networks.
Fossil fuel emission data	General fuel types considered • Diesel • Diesel with variable biodiesel component • CNG • LNG • LPG • HFO • Gasoline • Gasoline with variable bioethanol component • Aviation fuel (For other mode-specific fuels see detailed description sheet) Emission factor sources • GLEC Framework • EN 16258: Appendix A • Handbook of Emission factors • (JRC (EU) -> LNG) • (Greet (USA)) • French regulation • (UK BEIS (formerly Defra)) • (Other: IEA)
Renewable Energy Considerations	• Pure biofuels included • Biofuel feedstocks differentiated Flexible application by • Transport mode • Transport activity • Geography (e.g. per country, region, continent) • Other information: e-trucks, LNG
Electricity generating mix options	• Single global electricity mix (base, year) • Country based production electricity mix (source(s), year(s)) IEA, updates upon availability/ each year • Customer specific electricity mix (source, year)

Outputs, Reporting and Use	
Output data	• Total emissions • Emission per transport chain element • Differentiation of WTT and TTW emissions • Differentiation according to GHG Protocol scopes • Emission intensity per tkm • Emission intensity, other • (Compatible with GLEC Declaration) • Statement of assumptions • Statement of data type(s) used
Typical use(s) of tool outputs	• Public reporting of total company logistics emissions • Reporting to customers, e.g. general per timeframe or carbon footprint on invoice • Internal performance metrics • Informing emission reduction decision making • Informing corporate policy & advocacy response • Input to corporate marketing & CSR actions • Other: per product (PCF), product engine, tradeline, service, supplier, source region, demand region etc.

9.5 REff Assessment Tool: Resource efficiency at logistics sites

Available via: https://s.fhg.de/reff

General description
The REff Tool focuses the GHG assessment of logistics sites using the methodology described in the "Guide for GHG emissions accounting for logistics sites", which was developed as a supplement to the GLEC Framework. It enables online data collection for the subsequent calculation of GHG emissions of one or more sites [tonnes CO_2e/a] and an average emission intensity values per site [kg CO_2e/tonne]. The results are presented for direct use in the GLEC Declaration and companies get the possibility to monitor the company's resource efficiency over the years. The REff tool also aims at supporting the further development of environmental KPIs in the storage and transhipment sector.

Tool Scope	
Geographic application	• Global
Industry Sectors	• All industry sectors
Targeted Customers	• Shipper • Freight Forwarder / Logistic Service Providers • Operators of logistics sites (e.g. warehouses, transhipment sites, distribution centers)
Modes	• No transport covered

Logistics sites	• Yes
	  ○ Transhipment center, cross docking etc.
	  ○ Warehouses

Energy & emissions	• GHG emissions, as CO_2e • Energy consumption

Tool Governance / Owner	
Provider / Governance / Owner / Program (EU))	• Non-profit research organization : Fraunhofer Institute for Material Flow and Logistics IML, Germany https://s.fhg.de/reff
Access	• Open access for any customer, registration required
Fee structure / Price range	• Free to registered users

Data Input Options	

Interface types / Support	• Online data entry: website
	• 3rd party service (added values)
	  ○ Consultancy (Supported Calculation): negotiable bilaterally
	  ○ Consultancy to reduce emissions, decision making: negotiable bilaterally

Tool methodology general	
General calculation methodologies	• GLEC Framework (core methodology for logistics sites)
Methodology published?	• http://publica.fraunhofer.de/documents/N-532019.html • Level of detail: Comprehensive
Accreditation / Compliance / Certification	• Not SFC accredited: but in preparation • Not EN 16258 compliant, as sites are excluded by EN
Input data	• Fuel based approach ○ Primary operator energy data by site • Transport Activity (tkm) calculation: not relevant for logistics sites

Tool methodology general	

Geographical data	• Routing sources by mode: not relevant for logistics sites
	• Location information of the logistics site:
	  ○ Zip codes
	  ○ City names
	  ○ Long/ Lat coordinates
	• Additional features: Automatic determination of Long/ Lat coordinates using specified Zip codes / city names or vice versa

Fossil fuel emission data	• General fuel types considered
	  ○ Diesel
	  ○ Diesel with variable biodiesel component
	  ○ CNG
	  ○ LNG
	  ○ LPG
	  ○ Gasoline
	  ○ Gasoline with variable bioethanol component
	  ○ Hydrogen
	  ○ Heating energy, i.e. natural gas, heating oil, district heating, geothermal energy, wood chips, wood pellets
	• Leakage of refrigerants
	• Emission factor sources
	  ○ GLEC Framework
	  ○ EN 16258: Appendix A
	  ○ IPCC for leakage of refrigerants, ecoinvent/PROBAS for additional energy sources

Renewable Energy Considerations	• Pure biofuels included • Flexible application by Geography (e.g. per country, region, continent)
Electricity generating mix options	• Single global electricity mix (base, year) • Country based production electricity mix (source(s), year(s)) • Customer specific electricity mix (source, year)

Outputs, Reporting and Use	

Output data	• Total emissions
	• Differentiation according to GHG Protocol scopes
	• Emission intensity:
	  ○ GHG per tonne or
	  ○ GHG per base unit selected by user (e.g. pallet, box, container)
	• Compatible with GLEC Declaration
	• Statement of assumptions
	• Statement of data type(s) used

Typical use(s) of tool outputs	• Public reporting of total company logistics emissions • Reporting to customers, e.g. general per timeframe or carbon footprint on invoice • Internal performance metrics • Informing emission reduction decision making • Informing corporate policy & advocacy response • Input to corporate marketing & CSR actions

9.6 TK'Blue Agency – GHG Calculator

Available via: www.tkblueagency.com

General description
The TK'Blue GHG calculator is a service offered by TK'Blue Agency in the scope of its environmental rating activities which includes a large range of externalities evaluation. GHG calculator is conformant with EN 16258 standard and the French regulation.

Tool Scope	
Geographic application	• Global
Industry Sectors	• All
Targeted Customers	• Shipper • Freight Forwarder / LSP • Carrier / Transport Operator • TMS Provider • Other: Transport Market places
Modes	• All • Road: with urban logistic and inter-urban differentiation • Sea: with short and deep sea differentiation

Logistics sites	• Yes
	  ○ Transhipment center, cross docking etc.
	  ○ Container terminals
	  ○ Warehouses

Energy & emissions	• GHG emissions, as CO_2e • Energy consumption • Air pollutants and particulates: NOx PM 2.5 (exhaust and non-exhaust) SOx NMVOC
Other impacts	• Social cost of climate change, pollutants, noise, accident, congestion and upstream

Tool Governance / Owner	
Provider / Governance / Owner / Program (EU))	• Private company with independent scientific councils and supervisory board
Access	• Open for members only
Fee structure / Price range	• Free to members : free for carriers • Percentage of logistics budget or company turn-over: < 0,1% of the transport budget

Data Input Options	

Interface types / Support	• Online data entry: website, CSV file, Excel
	• Batch data processing
	  ○ Soap XML web service
	  ○ Excel /CSV Upload
	  ○ FTP/SFTP server
	• 3rd party service (added values)
	  ○ Consultancy to reduce emissions, decision making
	  ○ Link to program labelling
	• Other:
	  ○ Input data quality indicator
	  ○ Carrier labelling
	  ○ Road carrier CSR tool (ISO 26000)

Tool methodology general	
General calculation methodologies	• GLEC Framework (including core mode methodologies, e.g. CCWG, EcoTransIT) • EN16258 • Other: French regulation

Methodology published?	• Yes: https://dev-tracking.tkblueagency.eu
	access to methodology requests the creation of an account and declaration of a transport service operation. Then, information concerning methodology applied for this operation are available.
	
	• Level of detail
	  ○ Comprehensive
	  ○ Summary of approach

Accreditation / Compliance / Certification	• Not SFC accredited, but in discussion • EN16258 compliant: compliance to French Regulation delivered by Bureau Veritas • French Regulation: Certificate of compliance delivered by Bureau Veritas Certification. The scope of certification is the compliance of the GHG calculator to the French regulation

Input data	Fuel based approach
	• Primary carrier fuel data by trip
	• Aggregated carrier fuel data by transport chain element
	• Aggregated carrier fuel data by transport service
	• Aggregated carrier fuel data by vehicle type
	• Aggregated carrier fuel data for overall fleet
	• Fuel use estimated using generic, vehicle of mode based approach
	
	Transport Activity (tkm) calculation
	• Transport activity provided by customer
	• Transport activity calculated based on consignment and routing info provided by customer
	• Transport activity calculated based on consignment info provided by customer and tool's internal routing parameters
	
	Activity based approach
	• Combines transport activity with
	  ○ fuel intensity value provided by carrier
	  ○ National database (French decree)

Geographical data	Routing sources by mode: • Road: here, google map • Rail: • Sea: Portworld, Searoute • Air: openflights.org • Inland waterway: VNF, Searoute Location information: • Zip codes • UN-/ Locodes • IATA codes • City names • Long/ Lat coordinates
Fossil fuel emission data	General fuel types considered • Diesel • Diesel with variable biodiesel component • CNG • LNG • LPG • HFO + MDO + MGO • Gasoline

Tool methodology general	
	• Aviation fuel (Jet-A, Jet-B, AvGas) Emission factor sources • GLEC Framework TK'Blue uses the recommended sources for emission factors defined in module 2 of the Framework. • EN 16258: Appendix A • French regulation • CCWG

Renewable Energy Considerations	• Pure biofuels included
	• Flexible application by
	  ○ Transport mode
	  ○ Transport activity
	  ○ Geography (e.g. per country, region, continent)

Electricity generating mix options	• Country based production electricity mix (source(s), year(s))

Outputs, Reporting and Use	
Output data	• Total emissions • Emission per transport chain element • Differentiation of WTT and TTW emissions • Differentiation according to GHG Protocol scopes • Emission intensity per tkm • Emission intensity, other • Compatible with GLEC Declaration • Statement of assumptions • Statement of data type(s) used
Typical use(s) of tool outputs	• Public reporting of total company logistics emissions • Reporting to customers, e.g. general per timeframe or carbon footprint on invoice • Internal performance metrics • Informing emission reduction decision making • Informing corporate policy & advocacy response • Input to corporate marketing & CSR actions • Rating report of societal and environmental performances

9.7 VIA Green Program

Available via: http://www.viagreen.org.br/eng/

General description
VGP was conceived by Via Green Institute with the objective of promoting Environmental Management in organizations that work in the various sectors of the economy; stimulating them for monitoring of its environmental aspects and adopting good practices for sustainability. The VGP's Emission module has a tool for atmospheric pollutants management from cargo and passenger transportation sector, integrating all supply chain. It is an innovative tool offers a set of initiatives for the complete management of emissions of greenhouse gases from the transport operations of member organizations.

Tool Scope	
Geographic application	• Global
Industry Sectors	• All
Targeted Customers	• Shipper • Freight Forwarder / Logistic Service Providers • Carrier / Transport Operator • Transportation Management System Provider
Modes	• All

Logistics sites	• Yes
	  ○ Transhipment center, cross docking etc.
	  ○ Container terminals

Energy & emissions	• CO_2 emissions • GHG emissions, as CO_2e
Other impacts	Mapping all GHG emission from supply chain of members.

Tool Governance / Owner	
Provider / Governance / Owner / Program (EU))	• Private company, NGO, please state: Via Green Institute • Green Freight Program, please state: VGP – Environmental Program
Access	• Open for members only
Fee structure / Price range	• Free to members

Data Input Options	
Interface types / Support	• Online data entry • Batch data processing • 3rd party service (added values)

Tool methodology general	
General calculation methodologies	• GLEC Framework (including core mode methodologies, e.g. CCWG, EcoTransIT) • EN16258 • Own methodology
Methodology published?	• Yes, only request by email contato@viagreen.org.br
Accreditation / Compliance / Certification	• Not SFC accredited • EN16258 compliant

Tool methodology general	

Input data	Fuel based approach
	• Primary carrier fuel data by trip
	• Aggregated carrier fuel data by transport chain element
	• Aggregated carrier fuel data by transport service
	• Aggregated carrier fuel data by vehicle type
	
	Aggregated carrier fuel data for overall fleet
	• Fuel use calculated by tool using routing provided by customer
	• Fuel use calculated by tool using internal routing parameters
	• Fuel use estimated using manufacturer data
	• Fuel use estimated using generic, vehicle or mode based approach
	
	Transport Activity (tkm) calculation
	• Transport activity provided by customer
	• Transport activity calculated based on consignment and routing info provided by customer
	• Transport activity calculated based on consignment info provided by customer and tool's internal routing parameters
	
	Activity based approach
	• Combines transport activity with
	  ○ Fuel / emission intensity value provided by carrier o fuel / emission intensity from green freight program
	  ○ GLEC default fuel / emission intensity value for transport service or specific vehicle type

Geographical data	Routing sources by mode: • Road: e.g. GIS-data, OpenStreetMap, Google Map, ... • Rail: own database • Sea: own database, CCWG and IMO • Air: own database • Inland waterway: own database Location information: • Zip codes • UN-/ Locodes • City names
Fossil fuel emission data	General fuel types considered • Diesel • Diesel with variable biodiesel component • CNG • LNG • LPG • HFO • Gasoline • Gasoline with variable bioethanol component • Aviation fuel
Renewable Energy Considerations	Emission factor sources • GLEC Framework • EN 16258: Appendix A • Handbook of Emission factors • Own database, DEFRA UK, Brazil Government

Electricity generating mix options	• Pure biofuels included
	• Biofuel feedstocks differentiated
	
	• Flexible application by
	  ○ Transport mode
	  ○ Transport activity
	  ○ Geography (e.g. per country, region, continent)

Outputs, Reporting and Use	
Output data	• Total emissions • Emission per transport chain element • Differentiation according to GHG Protocol scopes • Emission intensity per tkm • Compatible with GLEC Declaration • Statement of assumptions • Statement of data type(s) used
Typical use(s) of tool outputs	• Reporting to customers, e.g. general per timeframe or carbon footprint on invoice • Internal performance metrics

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