The Global Language of Business

Measuring your corporate carbon footprint: how to obtain reliable well-structured data

Disclaimer

Summary

About us

We are the barcode people, for a global language in digital transformation.

GS1 is a non-profit organisation that develops the most trusted standards for communication between businesses worldwide. In Italy, GS1 has gathered 40,000 active ventures in all of the main industry sectors.

For 45 years, we have improved relationships among businesses, associations, institutions and consumers. We innovate data management processes throughout the entire supply chain.

The barcode: the product's digital twin

GS1's mission to enhance visibility, efficiency and sustainability through supply chains dates back to 1973, upon the launch of the barcode. BBC defined the barcode as one of the "50 things that made economy global".

Now more than ever, businesses must guarantee immediate access to exhaustive and reliable information for their consumers.

GS1 standards, ECR shared processes and the services that GS1 makes available help businesses

- Enable the creation of a single, global and verifiable product identity.
- Digitise contents in order to create a digital twin for the product.
- Connect data throughout the entire supply chain from each and every source.
- Enable a seamless online/offline experience.
- Make the identification of sustainable choices easier.

Foreword

For a company, knowing how to measure its carbon footprint is a key element in its journey towards sustainability. This inevitably complex topic implies setting up and gradually fine-tuning a process to collect data.

With this document, GS1 Italy intends to give companies concrete support on this subject, helping them to acquire structured and reliable data which they can use to take informed business decisions, set out their objectives and identify actions for improvement. Additionally, they will be able to communicate and report on the company's commitment towards sustainability.

This document is a practical guide and, based on input from companies and support from GreenRouter[1], it summarises the main points that must be taken into account when setting up a well-organised data collection process in a clear manner; it also gives reliable references on the subject.

The guide is another building block in our objective to respond to the needs of companies and to the priorities set out in our three-year strategic plan. Reducing business-related emissions is a strategic direction of development, based on the aim to promote a culture of measuring one's corporate carbon footprint. We therefore intend to pass on to companies the principles and tools they need to calculate their CO_2 equivalent (CO_2e) emissions.

This handbook adds to the collection of tools already available to companies, and is designed to travel at their side throughout their journey to continuously improve their environmental performance:

- Ecologistico$_2$, a simulation tool to help companies understand and measure their logistics climate impact and identify the actions for improvement.
- Ecologistico$_2$ best practice, a set of real examples of how ECR businesses have learnt to reduce their CO_2e emis-

1 https://www.greenrouter.it/

sions through logistics optimisation projects, all measured through Ecologistico$_2$.

- Technical datasheets, with the main solutions and technologies that can reduce emissions along the supply chain.
- Training sessions to increase internal know-how on these topics in companies.

In this virtual pathway of growth, collaboration is a basic requirement to learn from each other and help the supply chain to evolve, including for environmental sustainability, with this thought always in mind: what gets measured gets improved.

Executive summary

The objective of this guide is to outline the possible data collection methods and actions for a company to map its climate impact, its corporate carbon footprint, and provide useful information on how to carry out these tasks so that the results are as close to reality as possible.

Climate impact can be measured quantitatively over time by measuring CO_2e (CO_2 equivalent[2]) emissions, meaning that monitoring, reporting and detailed analyses can be carried out with relative ease. The approach however must be, on the one hand, organic and aligned with best international practice, and, on the other, constant and transparent over time, underpinned by solid and accountable methodology.

Companies should view the mapping of their CO_2e emissions as a basic task, because it gives them their current situation and shows them what to do in terms of planning and implementing carbon management policies. It is also a way for them to disclose their commitment towards environmental sustainability (e.g. Global Reporting Initiative - GRI[3], Carbon Disclosure Project - CDP[4]).

However, quantifying and monitoring CO_2e emissions presents a series of difficulties, starting from defining the perimeter of the survey, and collecting and normalising data, to deciding on how to calculate the final results, which must be easy to repeat over time. It is even more critical to set in place accurate monitoring processes now that Europe and in some cases individual businesses have laid down specific targets to reduce CO_2e emissions in the medium and long term.

2 The climate-changing effect of all greenhouse gases listed in the Kyoto Protocol (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, sulphur hexafluoride (SF_6) and perfluorocarbons) is expressed in terms of CO_2e emissions. The contribution of each gas is weighted against the value of CO_2.

3 Global Reporting Initiative (GRI): https://www.globalreporting.org/

4 Carbon Disclosure Project (CDP): https://www.cdp.net/en

This guide thus focuses on gathering the climate data necessary to measure CO_2e emissions. These, in turn, may be used for a variety of purposes, including to develop internal business cases, bring added value to products and services, and to report and communicate to the outside world, for example through environmental, social and governance (ESG) reporting.

The initial chapters set out the main international standards that a company can refer to when it draws up or fine tunes its process to collect data and measure its climate impact.

Companies can decide whether to apply a complete or a simple method. In either case, the guide takes note of the evolution in quality and structure of the data gathered during verification, completion and "standardisation" processes before they are used to elaborate CO_2e emissions.

In order to give more substance to the operational topics covered in the handbook, company experiences are displayed in a series of information panels. The cases were assembled by the work group operating in the context of efficient consumer response (ECR) and relate to structuring a data collection process and calculating a company's corporate carbon footprint.

1

Reference Area

It is becoming substantially more important for companies to measure their carbon footprint and the topic is now a key point of interest for many reasons. By calculating and disclosing their CO_2e emissions, companies can evaluate their impact on global warming and thus their environmental performance. As a consequence, they can plan realistic strategies to reduce their emissions that are in line with the "science-based targets" (SBTs) set by the Science Based Targets initiative (SBTi) and can also monitor the resulting effect.

More in general, this kind of calculation and disclosure is a way for companies to understand and manage their exposure to risk (e.g. linked to legislation and climate change), evaluate the opportunities (e.g. differentiate between value propositions) and satisfy their various stakeholders' interests (starting from requests made by customers or consumers, investors, third-party bodies and government institutions).

By joining the Science Based Targets initiative (SBTi)[5], organisations commit publicly towards neutralising the emissions they are responsible for generating along the entire supply chain. As of today, these commitments are voluntary and placed alongside similar national objectives (Europe's declared objective is to reduce its CO_2e emissions by 55% within 2030, and, in the United States, President Joe Biden has recently stated that his intended target is -50/52% within 2030).

These commitments are underpinned by the estimation and reporting on CO_2e emissions that make up the company's greenhouse gas (GHG) inventory, the list of emission sources and associated emissions measured through standardised methods. In this guide, we will apply this concept to organisations, be they distributors, manufacturers or logistics and/or transport companies.

Environmental reporting is now a proven tool to demonstrate a company's commitment, objectives and results on this matter. Companies publish reports at least once a year,

5 https://sciencebasedtargets.org/

and they contain evermore detailed analyses prepared by organisations and experts, even from outside the environmental world.

CDP, Ceres[6], Robeco Bank[7] and similar organisations carry out their own analyses and then formally recognise the players that are leaders in their fields in various industrial and economic sectors, awarding relative indices, rankings and acknowledgements.

The reporting of CO_2e emissions has developed over the years, becoming progressively more standardised and expanding the perimeter/scope of analysis. International standards (e.g. ISO 14064 and the GHG Protocol) are gradually extending the set of operations that companies report on. Companies have widened their perimeter, which initially only took in their internal operations (Scopes 1 and 2) and started to include emissions produced along the entire value chain (Scope 3).

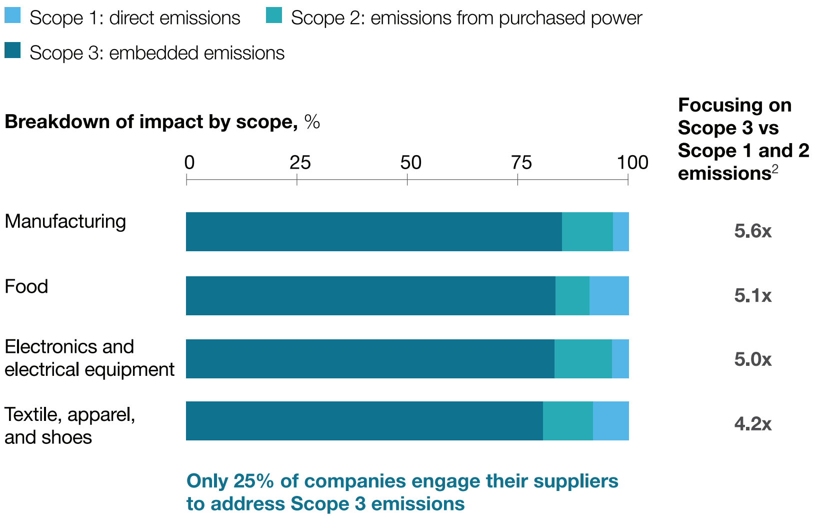
> The typical consumer company's supply chain creates far greater social and environmental costs than its own operations, accounting for more than 80 percent of greenhouse-gas emissions

Scope 3 emissions relate to all a company's indirect actions, those outside its boundaries in a strict sense, but over which it still has decisional power and/or exercises some type of control (e.g. procurement of raw materials, transport, waste and so on).

Back in 2016, a study by McKinsey highlighted the fact that, in the consumer goods sector, 80% of all CO_2e emissions are estimated to arise from indirect operations.

6 https://www.ceres.org/
7 https://https://www.robeco.com/en-int/about-us

>80% of greenhouse-gas (GHG) emissions in most consumer-goods categories are in supply chains[1]



Note: Supply chains are defined here as all organizations, including energy providers, involved in producing and distributing consumer goods.

[1]Supply-chain impact multiples are lower for GHG emissions than for natural capital because GHG multiples consider Scope 1 and Scope 2 emissions jointly.
[2]Among companies that disclose to CDP.

McKinsey&Company | Source: Carnegie Mellon University; CDP; GreenBiz; McKinsey analysis

Source:
https://www.mckinsey.com/business-functions/sustainability/our-insights/starting-at-the-source-sustainability-in-supply-chains#

1.1 Principle regulations and international guidelines

Organisations normally refer to international standards when they select which aspects they intend to report on, pick the most suitable methods to calculate their CO_2e emissions and decide how they will communicate the results.

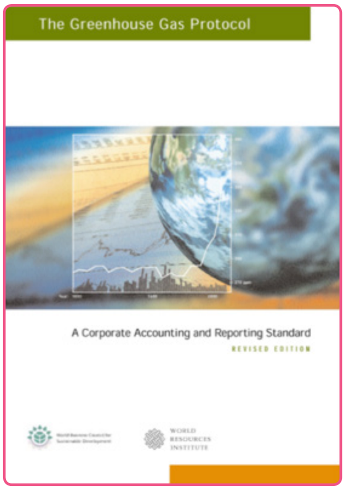
The leading international bodies responsible for this matter (ISO, WRI, WBCSD and others) are in agreement about promoting the GHG Protocol and ISO 14064, which thus remain the primary references for the method used to calculate emissions. In particular, ISO 14064 provides a clear certification framework that enables a third party to carry out the checks on whether an organisation is compliant with these standards.

The European standard to calculate CO_2e emissions in transport is UNI EN 16258. In terms of worldwide reach, the Global

Logistic Emission Council Framework (GLEC) was introduced in 2016, led by the Smart Freight Centre of Amsterdam, followed by a second release in 2019 (GLEC Framework 2.0). The GLEC Framework is at the basis of the new ISO 14083, a global standard to calculate CO_2e emissions in transport (of goods and people), which will replace the existing European standard EN 16258.

GHG Protocol[8]

WRI and WBCSD have coordinated a multi-stakeholder initiative that brought together companies and non-governmental organisations (NGOs) to develop a set of uniform standards and methodologies for corporate GHG inventories. The standard covers the seven main greenhouse gases in the Kyoto protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3), with their relative Global Warming Potential (GWP) or CO_2e emissions.



The GHG Protocol classifies a company's GHS emissions into three "scopes":

- Scope 1 emissions are direct emissions from sources owned or controlled by an organisation.
- Scope 2 emissions are indirect emissions from electricity, heat and steam consumed by an organisation.
- Scope 3 emissions are indirect emissions resulting from an organisation's activities which occur at sources that it does not own or control.

[8] www.ghgprotocol.org

The GHG Protocol is now widely accepted and used as a global reference, especially subsequent to the Paris Agreement of December 2015, at COP 21.

ISO 14064

ISO 14064 is an international standard in the ISO family which is applied to measuring and reporting on greenhouse gas (GHG) emissions and removals at the organisational level.
This standard has numerous contact points with the GHG Protocol, such as its focus on the entire organisation instead of a single product. ISO 14064 makes a distinction between direct and indirect emissions, going beyond the concept of Scope, classifying emissions into categories and introducing criteria of emission significance. An organisation will be required to include in its GHG inventory all the emission categories considered significant in terms of relative impact (and not just these, the organisation's capacity to influence the operations that generate these emissions is also considered a significance criterion). Emissions are divided into categories according to their source, which is closer to the typical approach used in life cycle assessment (LCA) studies. The intention is to consider the production process in its entirety, with all the upstream and downstream phases in the value chain.

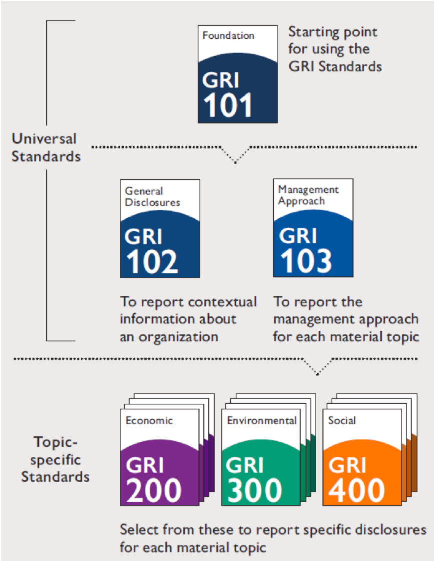
EN 16258/GLEC Framework[9]

EN 16258 and the GLEC Framework are the two primary reference points to calculate CO_2e emissions in the transport sector. EN 16258, as the European standard, sets out the way to calculate emissions in the transport of both goods and people. The GLEC Framework, promoted and published by the Smart Freight Centre, extends beyond Europe's boundaries and sets itself up as the global reference for companies that want to measure the environmental impact of their goods transport. In both cases, the objective is to achieve greater transparency in how companies calculate their emissions, to make it easier to compare their published data, and to encourage them to reduce their freight carbon footprint.

9 www.smartfreightcentre.org

GRI

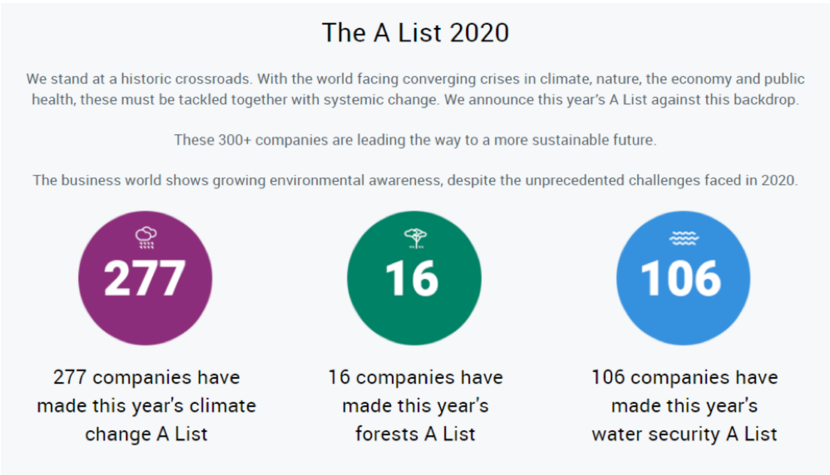
The Global Reporting Initiative (GRI) is an international standards organisation that publishes the most significant body of reporting standards and their principals.



Companies wishing to measure their sustainability performance cannot disregard the GRI standards, as they are at the basis of sustainability reporting and dictate all the guidelines. The areas taken into consideration touch upon most aspects linked to sustainability, and range from reporting on emissions and energy consumption to waste management.

CDP

The Carbon Disclosure Project is the leading organisation that deals with the collection and management of environmental reporting. CDP is supported by more than 800 institutional investors with about US$100 trillion in assets.



Data on individual companies are collected through questionnaires that hinge on different kinds of environmental information, including the companies' GHG emissions and their targets to reduce their emissions. Obviously, a company that already applies the above standards, such as the GHG Protocol to calculate its carbon footprint and the GLEC Framework for its freight, will find the questionnaire easier to answer and be able to give more detail. The aim of the Climate Disclosure Project (CDP) is to raise awareness and transparency in companies on environmental issues to improve their sustainability performance and reduce risks linked to climate change.

2

Calculation Objectives

Carbon accounting can have a number of purposes. The ones worth mentioning include:

1 Reporting on measurements periodically, specifically about the amount of CO_2e emissions emitted, which can thus be disclosed and monitored over time.

- Reporting implies drawing up an official record, whatever shape it takes (text, slide show, video, etc.).
- The report can be inserted within a more substantial CSR/ESG report, making reference to the GRI standards and to the United Nations Sustainable Development Goals[10].
- The report will typically be published every year, thereby creating historical series over time.
- Its communication can be for internal or external consumption.

Conad

As from 2016, Conad has included a section in its Annual Report and, for the past two years, in its Sustainability Report, where it sets out its logistics carbon footprint. By defining a reporting scope that has remained constant over time and the uniformity in its data collection and elaboration, Conad has been able to create historical data series and investigate environmental key performance indicators (KPIs).

Historical data can be used to evaluate climate performance and the impact of particular strategic and operational decisions, both in detail and organisation-wide. Furthermore, Conad employs an approved tool to calculate its CO_2e emissions and keeps an archive of its climate data, two factors that have helped in the evaluation process.

The processes of gathering data from the various parties involved are audited by a certified third party. As well as confirming the value, reliability and completeness of its results, the certification process was a way to raise awareness on this topic within the company, and to drive the work to define the process and information necessary during the data collection stage.

10 https://sdgs.un.org/goals

2 Preparing internal business cases linked to specific projects or investment that can be used to calculate the reduced CO_2e emissions:

- Test projects, these can also raise attention to climate impact internally (e.g. to evaluate or promote a project, or to motivate staff) and externally (e.g. for purposes linked to the organisation's reputation).
- Business cases, these can be seen as actual field guides to help make investment choices, and used to assess the impact of a given option in terms of CO_2e emissions alongside other criteria such as costs (economic benefit), service level and so forth.

Barilla

Within the organisation as a whole, requests for investment and project approvals are based on KPIs, which also take in the measurement of Barilla's CO_2e emissions, to show the impact of these investments and/or projects.

This reasoning has positively affected the approval of certain projects, among which:

The Parma-Ulm(*) intermodal project and other intermodal projects in Italy.

Optimised use of auxiliary warehouses.

Forklift trucks powered by lithium batteries.

(*) https://www.barillagroup.com/en/press-releases/barillas-sustainable-exports-germany-travel-train

Lavazza

Lavazza has been driving the environmental sustainability of its organisation and products for years, underpinned by a deep understanding of the impact of its processes and operations. It is thus able to target its improvement actions more effectively and define internal plans to contain or reduce its CO_2e emissions. In parallel with its continuous improvement work, Lavazza analyses part of its new investments for their economic and environmental sustainability. The company draws up business plans for these projects with an estimation of the impact of their CO_2e emissions. CO_2e emissions are assessed within a range linked primarily to the voluntary carbon offset market, and Lavazza continuously monitors its emissions.

Both differential reporting, which gives a comparison between the current and a hypothetical future situation, and “carbon pricing” can be used in these cases. Carbon pricing highlights the economic benefits of a reduction in carbon emissions measured against a given corporate value, for example, the Emission Trading Scheme (ETS)[11] conversion value which operates in Europe. This can translate into added income or savings (if less than the carbon tax due) in the eyes of the person preparing the business case.

11 https://ec.europa.eu/clima/policies/ets_en

3 External communication

Relating to periodical reports (e.g. annually), external communications are normally addressed to stakeholders, primarily investors or those preparing independent studies, rankings, classifications and indices linked to sustainability (CDP, Dow Jones Sustainability Indices, Ceres, etc.).

- Relating to a given project or investment, external communications can also address the wider public (through generalist media outlets and on social media) or target specific sectors.
- Additionally, material can be published on the internet and the digital platforms commonly used in any society.

4 When relating to suppliers of products or services (like a fast moving consumer goods manufacturer or a logistics operator), the CO_2e emissions value is also used:

- To bring added value to the offer of:
    - Products, both for end users today keenly aware of green matters and for other organisations (e.g. large-scale distribution). The reason is that, as mentioned above, an organisation's indirect emissions include emissions arising from the purchase of products (upstream purchase chain).
    - Services, as companies can offer added value by showing that their services are linked to reduced emissions, and they can also differentiate their offer by setting out various options with their relative CO_2e impact (for example, in transport logistics, comparing a 100% road journey to intermodal rail-road travel).

Coop

Since 2006, Coop has been engaged in an extensive operation targeting its suppliers of branded products, where it promotes virtuous actions to reduce greenhouse gases and, in parallel, gathers the relative data.

Initially 30 suppliers joined the scheme and today there are 370 (over half the suppliers of branded products), corresponding to 556 factories.

Data are collected twice a year, initially using traditional methods and paper questionnaires, but the process has evolved over the years into a digital exercise. At the same time, data requests have become more sophisticated and extensive, often with different sections according to topic. Suppliers can input information themselves over a platform, and all will go through an initial stage to check the quality of the data (order of magnitude, abnormal values). Additionally, a third-party certification body checks that the information is correct and complete.

The data gathered form the basis of indices to determine ranking by topic and overall, and the suppliers that perform best are rewarded at a public event to encourage the companies most sustainable policies.

- To measure the impact of emissions arising from operations that a specific customer has contracted out, within an evolved trading relationship, which could potentially also include shared targets to reduce greenhouse gases in a particular period against an initial reference value.
- More in general, to respond to customer and/or supplier demands.

5 To qualify for Health, Safety and Environment (HSE) certifications and statements, including the previously mentioned:

- ISO 14064
- EN 16258
- ISO 14065

When the organisation is already conforming to environmental standards such as ISO 14001 or ISO 14004, it is clearly easier to introduce the concept of carbon accounting and formulate the data gathering process.

6 Get points for particular environmental criteria that are included in particular tendering processes.

7 Compliance and access to finance and loans.

Another situation arising with greater frequency is when companies declare their intention to become carbon neutral for one or more product lines, by a certain date (such as within 2030). The implication is that CO_2e emissions will not only be calculated, they will also be offset, in view of achieving a neutral carbon balance within the scope of analysis, and that third party stakeholders will then potentially be informed of the results.

As of today, there are no specific standards (such as ISO) explaining how to offset one's emissions by product or organisation, although several recent international initiatives have been reviewing the offer of carbon credits and the associated compensation services. In terms of the organisation as a whole, a company can apply ISO 14064 (EN 16258 for transport) to arrive at a certifiable database that includes the measurement of greenhouse gases generated by operations linked to its life cycle, and it can always refer to the GHG Protocol.

The GHG inventory should be at the basis of a company's climate strategy, when that organisation is defining, for example, risks, situations and emission reduction targets. There is a global tendency for companies to declare their net-zero emissions target or to join the Science Based Targets initiative, setting objectives that are in line with climate science.

A company that defines targets in line with climate science must commit itself to reducing its emissions along its value chain (carbon insetting). In the final phases and whenever it is impossible to make further reductions in greenhouse gas emissions, a company can neutralise their impact at the source. In fact, a company can carry out any kind of carbon offsetting (compensation actions to reduce or prevent emissions outside the company's value chain) on a voluntary basis, but this will not alter the organisation's overall carbon balance.

The case is different for net-zero emissions targets, which is where companies take the voluntary commitment to become carbon neutral by a given date, and it involves carbon credits and carbon removals, which are compensation actions.

In terms of product, the carbon removal option is linked to studies on a product's life cycle (life cycle assessment, LCA) which are outside the scope of this guide, although the basis of calculation and methodological references presented here can be useful to fine-tune emission values in removal projects for a product or a brand.

DHL

DHL's GoGreen programme targets zero emissions by 2050. DHL has also set itself a series of medium-term objectives for 2025, involving a three-pillar strategy:

- People's skills: two training modules so that, by the end of 2025, 80% of staff will know about climate matters and understand what they can do to contribute, both operationally and in terms of commercial solutions.
- Operations: the target is to have carbon neutral warehouses by 2025, reduce the impact of its transport based on 2007 levels (the year when DHL first calculated its CO_2e emissions in transport), and use 75% sustainable packaging.
- Customer involvement: 75% of revenue linked to GoGreen solutions by 2025. The targets and available solutions are monitored in each country.

3

Useful Data

The bases for a GHG inventory in an organisation are therefore:

- Define the reporting scope and make a list of the operations falling within that perimeter.
- Understand what data are useful for the calculation.

In the next sections, we will enter into the detail of the first point, and then briefly touch on the topic of data. This topic will be covered more thoroughly in Chapter 5.

3.1 Survey perimeter

Building a GHG inventory means firstly analysing the reporting boundaries, which are needed to set out the reporting scope and so the perimeter of the data to be surveyed. This stage consists in identifying all the operations linked to the organisation that can generate greenhouse gas emissions.

Focus: organisational boundaries

In terms of reporting, the organisation's perimeter and all the entities and assets to be included in its GHG emissions inventory make up its organisational boundary. To define a company's organisational boundaries, the GHG Protocol and EN 14064 both refer to these two principles:

- Control (operational and financial).
- Share in equity.

These principles help a company determine if and how it should or should not include particular operations carried out, for example, by subsidiaries (equity share) or businesses it uses for outsourcing, over which the company itself has operational control or influence. The definition of organisational boundaries becomes more critical when consolidating final results (e.g. in annual reports), where the company must be particularly careful not to include indirect emissions more than once (double counting).

In defining its reporting scope, the organisation must make the effort to understand which areas and aspects should be included in the reporting process. According to the main guidelines set out previously, GHG emissions can be classified as:

- Direct emissions (Scope 1 emissions).
- Indirect emissions from electricity, heat and steam consumed by an organisation (Scope 2 emissions).
- Indirect emissions from operations or assets that do not belong to the company, but which are under its control (Scope 3 emissions).

As a point worth mentioning again, over time it has emerged that indirect emissions (those in Scope 3) are particularly significant in terms of magnitude, especially in manufacturing, transport, fashion, large-scale distribution and fast moving consumer goods (FMCG) in general, and so are of particular concern in reporting exercises (see Chapter 1).

For the most part, it makes sense to examine the evidence showing that a company's reporting scope goes well beyond its organisational boundaries, along the entire value chain.

Examples of indirect emissions are:

- Indirect emissions from raw materials, or at the end of the product's life cycle, from waste.
- Indirect emissions from transport (distribution, sourcing, commuting, business travel).
- Indirect emissions from using the product.
- And so on.

In terms of methodology, especially with the introduction of ISO 14064, an organisation is expected to apply and document the process and criteria that can determine which indirect emissions are important and as such should be included in the CO_2e calculations and reports.

Examples of the applicable criteria are:

- Magnitude.
- Level of influence.

- Risk or opportunities.
- Sector-specific norms.
- Outsourcing and staff involvement.

Substantially, the main point is to understand which GHG emissions should be included in the organisation's GHG inventory on the basis of their relative importance. The decision to include or not specific categories of greenhouse gas emissions can be made by drawing up a relevance scale and identifying a threshold of relative importance. Decisions can be based on relative considerations, for example, the amount of CO_2e emissions generated by a given operation or the influence that the company can exert concerning this operation.

Companies should analyse the categories of emissions in broad terms to establish their importance.

If we take as an example greenhouse gas emissions from transport, the most substantial share will most probably relate to:

- The main transport flows for volumes and distance travelled.
- Wherever transport involves air travel.

In general, the concept is to come up with suitable criteria and an objective and rational method when making a first estimate, to determine the emissions to include in the GHG inventory. As its first step, the company must prepare a complete map list and define a series of levels, which should help it understand which categories to include in its reporting exercise.

The company should usually select its criteria so as not to exclude significant amounts of indirect emissions and, in any case, it must justify any exclusion of non-negligible amounts of indirect emissions.

Additionally, a scalar approach is normally preferable, first defining an initial perimeter and gradually expanding the scope over time.

Another point to consider is that various factors can contribute towards substantially extending or altering the perimeter. These include the acquisition of new companies, expansion of the reporting scope (taking a scalar approach and starting from a significant subset of flows/operations and, in time, scale up to the complete parameter), and fine-tuning the process of gathering data and the calculation methods. For this reason, it is a good idea to define the reporting scope very precisely from the beginning, keep trace of the changes and convey it in a very transparent way (for reporting, certifications etc.).

In this guide, we will mainly refer to direct and indirect emissions from electricity and indirect emissions from the transport of goods and passengers (ISO 14064, Category 3). We will briefly cover emissions from the purchasing and use of raw materials.

3.2 Meaningful consumptions

Here we are outlining the information and data necessary to measure CO_2e emissions from a given source (e.g. operations).

Substantially, the following are set out in the norms and guidelines:

- The method to apply to reporting on CO_2e emissions that includes the level of detail required for an estimate (e.g. EN 16258 expects the calculation to be carried out for each individual journey).
- What calculations are to be applied to go from an input value (that of the operation) to an output value (that of the CO_2e emitted for that operation).

We can start from the concept that the organisation may include operations in its reporting scope that involve CO_2e sources (carbon sinks). It can be hard to obtain primary data (such as data relating to the effective consumption of fuel and/or on-site measurements of leakages. The data relating to the company's operations are often the input for calculating its CO_2e emissions (output).

The sources for these data include:

- Administration and accounting systems and functions.
- Management systems and functions (purchasing, operations).
- General services.
- Third-party service providers.

Coop

Over the years, Coop's data collection and reporting scope has gradually expanded.

Since 2006, Coop has been working on its suppliers to convince them to adopt measures to reduce their energy consumption and thus their greenhouse gas emissions. After first collecting data from suppliers, the process has been expanded to include water usage, waste, the use of recycled materials and sustainability certifications/projects.

Coop's commitment has, in its latest version, centred also on packaging and recycled plastics, and on all sorts of packaging in general. Regular reporting of quantities and types of materials saved through its changes to packaging has also proven useful to show its CO_2e savings. It was possible to quantify these savings because of the reference work carried out beforehand, enabling Coop to analyse the type of packaging used for each stock keeping unit (SKU) and connecting it to sales and purchasing data.

In general, the level of maturity and precision in retrieving data varies considerably from one company to another, in terms of information management systems in use (paper, Excel spreadsheets and sophisticated computer systems), and the supporting structure (e.g. a corporate social responsibility (CSR) or health, safety and environment (HSE) coordinator).

The information generally available increases as time goes by, is more accurate and is more easily accessed. There are several reasons for this, in that awareness and training can be continued when climate data is being gathered, while the processes to improve and optimise the information managements systems (IMS) also play their part. For example, it is plausible that, after introducing particular kinds of vertical software (like EMS or TMS[12]), consumption and/or flow data will be more precise and simpler to collect, leading to more reliable results.

12 Energy management system software and transport management system software

Stef

The Italian branch of STEF has developed internal methods to gather data and calculate CO_2 emissions from transport on behalf of its customers. STEF initially used an Excel spreadsheet to input data and make calculations, but subsequently developed its own calculator (certified by France's Bureau Veritas) integrated with its corporate systems, so data are fed in automatically, at least in part. STEF collects data on transport rounds, warehouse transits and waits, the volumes transported, the kilometres travelled and the types of vehicles. Vehicle fuel consumption is personalised and parametrised on a regular basis. After calculating the value of its CO_2 emissions, STEF passes the data on to its French mother company and to all its customers (the company is preparing a personalised dashboard with customer portal so customers can see the data directly).

When the customer's code is input to STEF's calculator, it produces a letter addressed to the customer highlighting its transport data and relative CO_2e impact, and there is the option to select the time frame of reference. Data are also compared against the data from the previous period.

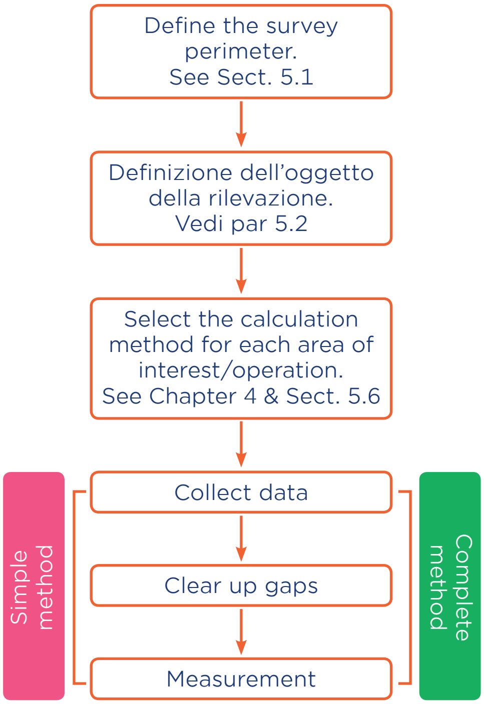
Concerning Scope 1 and Scope 2 emissions, STEF is finalising a touch screen dashboard that contains data and analyses on direct and indirect energy consumption. Users can measure the effect of particular operational and investment choices in real time. For example, last generation facilities have advanced sensor systems (sectional opening of heat exchanger flaps) and refrigeration optimisers. STEF can connect these tools to a reference management model and so use precise data, even for single facilities, to monitor consumption, establish operational rates and monitor the actions for improvement.

4

Simple vs Complete Method

The figure at the side gives an example of the process of mapping and gathering data introduced in the previous chapters, and it will be covered in greater detail later on. In general, once the reporting scope has been established, the next stage involves making a list of the operations whose GHG emissions are to be disclosed. The data sources must also be established and checks carried out to see which data are available, although they may not have been retrieved immediately. After completing these preliminary phases, the company will have all the information it needs to decide how to measure its CO_2e emissions. This document contains two methods to gather data and calculate GHG emissions.

The simple method produces a sufficiently reliable estimate of the order of magnitude of the CO_2e emissions for one or more of the company's operations.



Tendentially however, it is always best to opt for processes that are in line with the complete method. This method gives an outline of how environmental performance is progressing and companies can monitor their emissions precisely against established targets, and analyse them in the frame of operational choices and the context.

In general, a company can decide whether to use the simple or the compete method, but it must keep the following variables in mind:

Level of maturity

Depending on where the company is placed in terms of collecting environmental data, logically it will find it more or less easy to start gathering data for a given area of interest. It will find it easier to use the complete method if, for example, it already has its environmental certifications, such as ISO 14001, or has a person who coordinates this area, who could be someone working in HSE or CSR within the organisation. In mature organisations, those familiar with gathering climate data, the responsibilities can be shared out, in the sense of there being people responsible for gathering data in the various departments, and these people can be involved at the verification stage.

- Initially, it is possible and advisable to use the simple estimation method under these conditions:
- It is the first time that the organisation is looking at how to measure GHG gases for a given operation or the entire perimeter.
- There is no coordination structure already in place internally (e.g. CSR and HSE).
- The end purposes for the data are such that the method can be used.
- The data gathering process has seriously critical points.

Lavazza

In 2014, Lavazza embarked upon a new system to gather data, produce reports and engage the company on environmental matters, based upon GRI reporting principles. Lavazza set up a formal line of responsibility whereby data input by designated people are approved by an overseer who validates the datasheet and sends it on to the next stage. At the end of the internal data gathering and validating process, external inspectors examine the data, which are then used for reporting. These third-party inspectors have been involved in the process from the very beginning and their feedback has helped to improve the procedure to gather data.

As of today, the company employs about 80 people across the group to gather data via questionnaires, Excel sheets and interviews. Gradually, the work has extended to the acquired companies and subsidiaries, to expand the organisation's scope of analysis. Lavazza's objective is to train the data gatherers in companies that have joined the group up to its same level, so their skills and contributions matches staff in the parent company, overcoming any difficulties linked to having the right tools or working within a different legislative framework. This kind of challenge is part of a broader programme to gradually expand the reporting scope and the detail of the data gathering process, which was initially tackled internally by the parent company.

In the early days, Lavazza found it hard to recover detailed data, and many proxy values were used in the reports. Over the years, its focus shifted towards a comprehensive and detailed data collection process through involving, informing and training the data gatherers, as well as to make the work less taxing by introducing suitable methods and tools.

Objectives

The purpose behind a company's wish to disclose its climate performance can dictate the method it will select. For example, if such reporting is for purposes of benchmarking, publishing, certification or setting targets, the best solution, despite the hurdles, is to follow the complete data gathering method. This method gives the most reliable results and, as data are accurate, gives the true picture of the company's progress for its CO_2e emissions.

If the company wants to shed light on the subject and/or draw attention to climate matters within its organisation for the first time, say with a business or test case, then it can follow the simple process. As a medium-term strategy, the company could take a step-by-step approach, where it first obtains an estimate from the simple method, and then uses this estimate to plan a sensible roadmap. In other words, a company could start from a small yet still significant perimeter and then expand the analysis to other countries or types of flow or categories of emissions, while in parallel it goes into more detail and accuracy in its estimations.

As a general rule, it is always a good idea strategically to start with a simple programme and gradually move towards the complete procedure. Data can thus be compared from year to year and is more reliable, which is a plus point for certification.

Stef

Over time, STEF has found a full range of purposes for its measured CO_2e emissions (mainly data on its physical facilities and transport systems). The process was set up from the start as a management exercise, to support the processes of monitoring performance and taking decisions. STEF set itself specific targets to reduce its CO_2e emissions (-30% in transport by 2030) and these are pursued with the view to collaborating with suppliers of transport services and through contingent investment choices.

STEF's CO_2e emission values are also used in commercial relationships, and customers are given access to a platform where they can find current and historic GHG data on the transports carried out on their behalf, updated every month.

STEF Italia transmits the complete set of data used to calculate its CO_2e emissions to its French parent company for reasons of transparency and data consolidation. After looking at the methods and tools used by its parent company, STEF Italy was able to improve its internal calculation tool and achieve ever more accurate, reliable and comparable results, noting that the method used by the STEF Group has been certified by Bureau Veritas for its French transports. The information is reported in the parent company's balance sheet, in the non-financial sector and, in 2022, it also started publishing aggregate data for each country.

Outsourcing (potential problems in retrieving data)
In general, it is easier for an organisation to find data managed internally, less so for the operations it outsources (e.g. 3PL in transport). When the operation to report on is managed by a supplier externally, and it is hard to find, it makes sense to start from a simple estimation method. The supplier, however, should make an initial estimate, to help set priorities (e.g. by first considering the operations of greatest impact) and determine the main critical issues involved in developing a complete calculation process.

Conad

Conad has been measuring its transport CO_2e emissions for five years. Its transport is managed by various logistics operators that service Conad's national hubs and cooperatives. Conad's reporting also covers the transport of goods delivered by the suppliers of branded products, which is often managed by the actual suppliers. Where transport is not managed by Conad directly and the provider does not have a transport management system (TMS), the data available internally relates to the order management side, so inevitably information on the transport methods and means of transport used will be missing, as will data on the delivery organisation more broadly. As Conad was keen for its results to be as accurate as possible, it decided to implement a platform for gathering, checking and normalising the transport data it does not manage internally, to be used by its suppliers of logistics services and branded products.

The data are fed in from various sources - about 40 or so managed in the last round of reporting - and come with all sorts of structures, semantics and levels of quality. The platform also improves calculation accuracy, so the results are more reliable, and data normalisation can be carried out automatically on data from different sources.

The platform slots into a wider picture of automating the process of collecting data, and engaging with in internal data gatherers and suppliers. The most positive aspect that emerged over time is that people have become more aware of this kind of reporting, its importance and the variables that influence the carbon footprint of transport.

Another point is that, while early on these types of requests were rare, they have now being included in contracts and, in general, customers and buyers ask for climate data more frequently.

ICT in data management

How widely data are available throughout an organisation is closely connected to the IT systems in the company and how they are used.

Companies can retrieve the information they need to measure their CO_2e emissions from their existing IT systems (e.g. order management, TMS, supplier management, instruction input platforms) and gather data automatically through these applications. In this way, the gathering and elaboration of data can be automated, and the next step is to integrate tools to measure CO_2e emissions directly into the system.

Note also that companies often use their current systems for other purposes, so the data necessary to assess their climate footprint may not necessarily be included in their current transactions. In this case, our suggestion is first to conduct a careful analysis and then adjust the transactions so that they can accommodate climate data, insert new transactions and train users to compile input data correctly.

Barilla

Barilla has a ten-year experience in reporting on Scope 1 and Scope 2 emissions, as it implemented a system to collect data back in 2008, using a proprietary web tool developed to meet its own needs and specifications.

The web tool is fed periodically through precise structures and procedures. There is also the direct involvement of the group's production plants, which own and are responsible for data at each site, and head office, which is in charge of analysing and validating data.

The job to validate the data input at the head office falls under the HSE&E department, which analyses data and coordinates directly with the data gatherers at the various production sites, especially if there are differences or anomalies.

The type of data gathered, including energy usage and refrigerant leakages, are in compliance with the GRI requests and are used in processes to measure GHG emissions in projects such as, for instance, carbon neutrality for products and brands and for Environmental Product Declarations, EPD*.

(*) Environmental Product Declaration: a statement setting out the environmental impact of a product covering its entire life cycle, so comparisons can be made between products that do the same thing.

Complexity of the data collection process

Whenever data cannot be retrieved, or there are serious issues in their collection (such as a failure in managing the data internally, or third party-data was not disclosed), then the best option may be to use a simple estimation method. In this case also, the process can be reviewed to improve it, in this case the first step is to make sure that all data are collected.

To begin with, it can be useful to check what caused the problem, and if it can be influenced directly or indirectly, or whether it will change/solve itself in due course. Companies commonly need to make changes over time to how information is structured, and will find it relatively easy to make adjustments to simplify the process of gathering climate data. An example can be where a given field stored in a computer database is not used correctly.

This case must not be confused with the situation where the data will always be difficult to retrieve even in the future for reasons outside the company's control. For example, it may be hard to extrapolate primary data (e.g. relative to sourcing/producing raw materials) for a small firm in a particularly complex supply chain. In substance, companies must assess the complexity of the data collection process in a medium-long term perspective, and try and see whether it can assume (and/or prefer) that the type of data difficult to get hold of today will be easier to secure tomorrow.

Dhl

DHL has been calculating its CO_2e emissions in transport since 2007 using an internal computer system.

It does not have actual fuel consumption data, but it can recover data on transport journeys, such as start and arrival points (and distance), weight transported, payload percentage, type of transport means. Data from DHL's traffic management system (TMS) are extracted by the person looking after the reporting process, and fed into an internal tool that assembles the elements needed to proceed with the calculation step.

DHL mostly uses third party suppliers for its transport and, over the years, has surveyed its main suppliers (about 30 firms, which account for 80% of transport costs). Its objective is to gather information on their fleets, whether they are inclined to be transparent about their data, their policies to contain their GHS emissions, their management systems and certifications. This means that DHL can rate each supplier and, as the next step, set up partnerships to promote the adoption of sustainable operational practices (e.g. driving lessons, alternative fuel, etc.) and strategies to reduce their carbon footprint.

If the suppliers retrieve the data themselves, the method to calculate CO_2e emissions could be improved by using primary data (e.g. fuel type and quantity) to estimate consumption.

Below is a decision matrix that summarises (and simplifies) all these considerations. It can potentially help organisations on the point of deciding which method to choose for their imminent task of measuring their GHG emissions. The matrix looks at the organisation's level of maturity and the objective of the calculation (described in Chapter 2). An organisation's maturity is assessed on the basis of how capable its internal systems are to manage the data gathering stage. There are three levels of maturity:

- Low. In this case, the organisation has no internal facilities to measure data in a structured way. This is when, for example, the company does not have a computer system to trace its deliveries and/or orders, or no unit or person internally with, or which can be given, the job of retrieving data, or when it is particularly hard to retrieve data from outside the organisation for outsourced operations.
- Medium. In this case, the organisation has internal management systems that it uses for other purposes which nevertheless can be adapted to gather climate data. This is possible when, for example, there are internal people who can coordinate the work of collecting climate data, or in outsourced operations, make it easy to retrieve these data.
- High. In this case, the organisation has a computer system designed to manage energy and fuel consumption data for its operations. This is when, for example, the organisation uses an energy management system (EMS) or transport management system (TMS), which compiles the variables needed to calculate emissions, or when there is an internal unit or person to coordinate the data gathering process (such as a CRS unit, an energy manager, a sustainability manager or optimally a person with this specific function).

Intersecting the variables brings up several options, shown in the matrix:

Purpose of the calculation							
Area of intervention	External communication		Internal communication	Customer relationship		Operational	Strategy
Level of maturity/ purpose of calculation	Frequency of CO_2e reporting (e.g. annual report, DJSI, other)	Targeted external communication	Develop internal business cases internal and/ or pilot cases	Adding value to the offer of services and products	Satisfy customers' requests	Certification	Target setting
Low	N/A	Simple method	Simple method	N/A	Simple method (not certifiable)	N/A	N/A
Average	Complete method	Simple method/ Complete method	Simple method/ Complete method	Complete method	Simple method/ Complete method	Complete method	Complete method
High	Complete method	Complete method	Complete method	Complete method	Complete method	Complete method	Complete method

5

Data Acquisition and Normalisation

The process of data acquisition and normalisation must be set up accurately, as it is critical both to achieve reliable results and to make calculations that are consistent and easy to repeat over time.

The process takes note of the evolution in quality and structure of the data gathered during the verification, completion and standardisation processes before they are used to elaborate CO_2e emissions. By this we mean the primary data used as the starting point, those available straightaway from inside and outside the organisation (e.g. provided by suppliers), whether they are in digital format or not.

5.1 Defining the survey perimeter

In the preliminary phases of the process, this is also known as the survey perimeter. A good first step is to prepare a list of areas and operations to be mapped, although it can also be seen as a target list, something to work towards. At the point when companies check which data are actually available, they can see what needs to be done to retrieve them and how long it will take, and the timings may be much longer than anticipated. This is why it makes sense to work on a narrow area of interest initially, and then expand it to the target perimeter. So it is not surprising that, up to a few years ago, companies would report mainly on their Scope 1 emissions (direct emissions) and Scope 2 emissions (indirect emissions linked to electric energy), and rarely just some aspects of Scope 3 emissions (indirect emissions caused by the companies' operations).

In practical terms, these are the relevant elements for a company:

1. The sites and facilities (offices, shops, warehouses, factories) that need to be mapped.
2. The connected operations/flows (e.g. transport of people or goods).
3. The survey period, typically 12 months, whereby reporting can be coordinated with preparing the financial statements.

Because of the careful work to determine/list the areas to be mapped, the areas to be excluded are also highlighted. This is significant at both macro and micro levels. In the first case, it can be useful to know if and when these areas are to be covered in future. In the second case, while a certain area of interest may be mapped, it might not be possible to map it totally 100% (for example, if data are missing on the system or were not stored at the date of the survey). Both situations can be corrected over time, as long as the description of the area is kept as consistent as possible in the reports over the subsequent years. This consistency will highlight the differences and improvements in the mapping coverage. A single year is realistically not sufficient to draw up a complete report, especially in complex organisations.

Another element to keep in mind from the initial stages is the consistency/completeness of the areas that the company intends to include in its reports. Evaluations can be made using reference totals and subtotals such that can give the picture of the entire perimeter.

In other words, our suggestion is that a company can take, as its initial reference, one or more management parameters (e.g. total quantity transported, total journeys, total number of transport means, etc.) that have been recorded and verified during its ordinary business and so are basically reliable. Checks in the consistency and completeness of data surveyed are also useful to square the set of what is recorded against what is excluded.

5.2 Defining the survey's objective

In order to set out the objective of the survey clearly, during the preliminary phases, it is useful to have a reference list of the data that must be gathered for each mapped element.

As an example, to map a particular site (a supply chain node), these are the data to collect:

I. Electricity consumption and type of electricity (e.g. if from renewable sources).

II. Fuel consumption (for each type of fuel).

III. Refrigerant leakages (for each type of refrigerant).

IV. Flows concerning the site (e.g. total numbers of people or quantities of goods).

V. Surface areas used (and, if required, the different temperatures managed).

VI. Other data relevant for the site (e.g. the operations carried out at the site, the volumes managed, type of business, etc.).

The sources are generally very diverse, and can be divided into:

I. Operational functions, which can provide data on manufacturing consumption or for the transport means, and also on volumes in production, in transport, and so on.

II. The general services manager and/or energy manager, who can access:

1. Energy management systems.
2. The suppliers' energy and fuel (methane) platforms.
3. The company's meters, including for its self-generation plants (e.g. solar power systems and/or cogeneration or trigeneration systems).

III. Administration and/or Purchasing, which can supply:

1. Data on current energy contracts (e.g. mix of energy purchased or certified, such as energy with a "Garanzia di Origine" GO certification) and services contracts (e.g. car rental).
2. Data on the invoices from various suppliers, which are particularly useful for refrigerants, as leaks are generally equated with the annual refilling of refrigerant in the systems.
3. Periodical reports from suppliers on goods and services (e.g. list of corporate journeys from travel agencies).

IV. The various computer systems used in the company for:

1. Enterprise resource planning (ERP), transport management systems (TMS), etc.
2. Company databases (typically one or more data warehouses - DWs).
3. Simple data extraction repeated over a period of time.

When the system is fully up and running, someone like the sustainability manager can plausibly be the data gathering coordinator and collect the information needed for the annual reports. In general, it is essential to know which sources of data are actually available and the relative timing to have the information. At the beginning, this is usually months not weeks, as time is needed to explain what the sources are and what data are needed, and then to receive the data from the internal and external sources.

Furthermore, there is also the equally critical point of the quality of available data. The data that arrives may often not be complete or correct, and this implies making checks on the integrity of data by setting up control mechanisms.

- Completeness over time.
- Completeness of sites/nodes mapped.

- The value or goodness of each specific piece of data, which may require comparisons with analogous data.
- The consistency of partial and total data compared to management control data.
- And so on.

These aspects enable companies to see the need for an initial reference framework for the perimeter and the specific areas that are (to be) mapped.

5.3 Information gaps and how to solve them

The phase of gathering and checking available data can bring up a series of inaccuracies or patchiness in the data compared to what is desired. We have called these "information gaps".

They can be identified as a direct result of the work set out in the previous section, and it is normally good practice to highlight any such information gaps immediately and continuously, right from the start of the data gathering process. Every data collection project has its own clear deadlines and, if a company has a clearly defined list of missing or incorrect information, it can make practical considerations about whether the gaps can be filled or corrected in time. Also, during the data collection stage, especially for data from external sources, information can be tagged as "missing" or "irrecoverable" to distinguish it from data that are not at hand or cannot be accessed initially, but are likely to become available as the project progresses.

What is important is to build a work method that specifies:

- What data are available now.
- What data could become available, when and how (e.g. prompting, asking third parties, extracting from a different IT system/database, etc.)
- What will not be available.

Companies can use this method to progress along the lines of "data-completeness-quality-action"[13], which has two uses:

- In the very short term, freeze the list of gaps in information.
- Looking to the future, identify where work must be done to complete or improve the database (especially useful for periodical/annual reports).

By concentrating one's attention on these gaps in information, they can be solved accurately through appropriate priorities and timings. it is always best to give priority to missing data according to the size of the area of interest affected and/or their importance for the company.

Only later should the ease (or lack thereof) to puzzle out these problems be considered, an issue in itself always extremely variable. If time is short or it is impossible to resolve a gap, the company can prepare a suitable statement about not having included this or that information (which typically can be corrected in future). The key point in these cases is to be totally transparent and clear in setting out the exclusions.

Lastly, while we are fully aware that every situation is different, our intention is to propose practical solutions that can help reduce the gaps in information. These are some of our suggestions:

- Use connected data (e.g. consistent average values for company entities/facilities).
- Use default or proxy values (e.g. Department for Environment, Food & Rural Affairs - DEFRA, International Energy Agency - IEA, Italian National Institute for Environmental Protection and Research - ISPRA, Global Logistics Emissions Council - GLEC, etc.).
- Use public sources (e.g. get average vehicle consumption from specialised journals, technical consumption from technical equipment datasheets, etc.)

[13] By **action**, here we mean seeking and implementing solutions to get round these gaps in information, such as asking for explanations or applying average factors

- Use historical data (e.g. from past period) providing suitable information and when the volume of operations is coherent.
- Use "prudent" values (e.g. national electricity mix when there are no precise numbers for the mix from the single providers).
- And so on.

Other assumptions are, as previously mentioned, based on a future programme to improve the availability and quality of data. An iterative process is normal in these cases, and it shows a natural increase in the quality and availability of data over time.

When organisations are particularly complex and data is fragmented across many sources, it is not unusual to set up trial gatherings and elaborations (e.g. a year zero, which is considered the pilot). The values for this zero year are not published immediately or used in external reporting, because of the likelihood of substandard data or patchy information. In general, the second iteration of the process produces much better results on both fronts, meaning the company can trust the data when it discloses its emissions values for the reference period to a third party.

5.4 Methodological aspects

At this point, note that it is important to observe several methodological principals that concern the points below:

- Check that volumes/quantities are in line with previous years for the same perimeter, even where there is business growth or decrease.
- Keep documentation on the provenance of data.
- Describe the process to extract data.
- Explain the estimation/approximation methods used to patch up the gaps in information.
- Supply a list of all scientific/trustworthy sources (for example, indicating which are endorsed by the standards).

- Explain the method used to create a normalised database to feed the calculation system.
- Draw up a programme of continuous improvement.

We highly recommend that these aspects should be put into an official project document, which is useful independently of the level of complexity in the gathering of data or automation in their elaboration. The document must be updated periodically (e.g. annually or when given conditions change, such as the survey perimeter or the main assumptions). It is also a good idea to include copies of the modules and questionnaires used to gather data, making the task of inputting data simpler for those responsible and the data owners.

The document is very useful practically in order to:

- Create a methodological document for the year zero and subsequent years (where the various assumptions and parameters will always be up to date).
- Share its information within the organisation.
- Have a methodological base typically requested during external audits and certifications.
- Have a methodological starting point for subsequent surveys (after a few months, it is difficult to remember what was decided or assumed).

5.5 From normalised data to elaboration

By gradually closing the gaps in information, a company can create a complete database to tap into for its calculations.

In practical terms, this means creating a set of quantitative values associated with the various aspects to monitor, for each element in the survey. Say that I only have consumption data on fuel and refrigerants at a given site, I have to use an estimated value for my energy consumption (e.g. based on the site's floor size in square metre and the consumption per square metre for similar nodes where I do have the data). I will be able to start my calculation using CO_2e emission factors.

There are at least two feasible options:

- Create a model on a spreadsheet (like Excel), deriving it directly from the lists of survey entities, so as to retain consistency and the same classification.
- Feed data into or interface with a more or less sophisticated calculation tool, respecting the data sharing rules for that tool, (from simply filling in fields in the tool's spreadsheet or web page to forwarding data periodically through a digital interface).

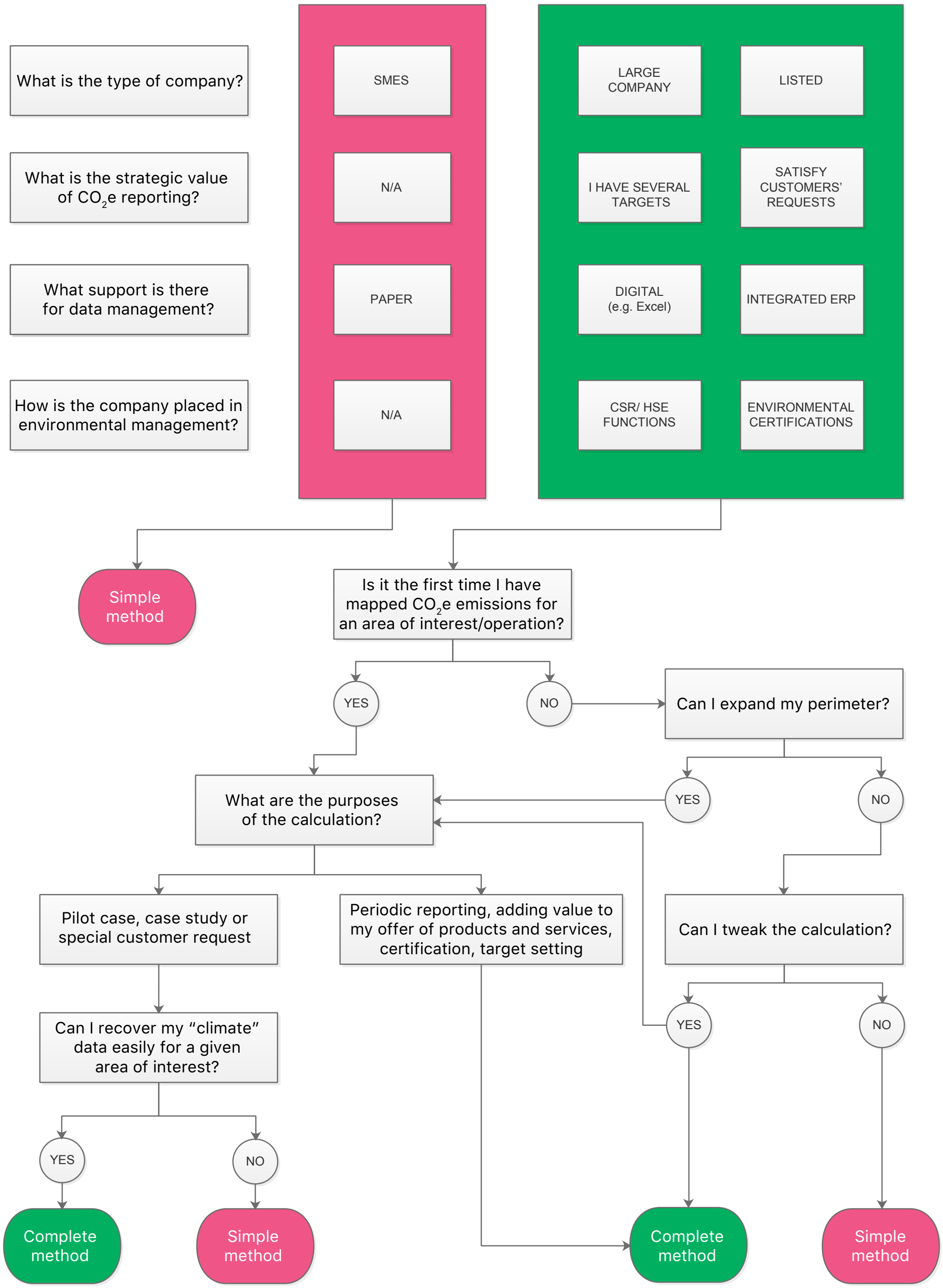
In the first case, it will be harder to find the calculation parameters and relative sources, which can range from the GHG Protocol to ISPRA (for consumption) and from the GLEC Framework to EN 16258 (for the transport of goods and more). The result can be repeated over time using the same calculation scheme, apart from potential updated sources. A typical example are the national electricity mixes which evolve year on year.

In the second case, there must be preparatory work also for the flow of data to feed into the calculation system, which involves creating a homogeneous data format. The database so obtained will be uploaded for the next calculation. The data elaborated are potentially included in a summary report, as they can be suitably extracted and/or received and then inserted in the initial file.

Once again, the values elaborated from input data must be thoroughly checked for completeness and that they balance, at least for the totals and always net of potential exclusions. This is an additional element to endorse the quality of the data elaborated. As mentioned, there can often be two rounds of calculations before emission values are disclosed in reports for public consumption. The objective is to arrive at data whose quality is acceptably reliable, where the level of accepted reliability is agreed with external auditors and certifiers.

The resulting elaboration can produce a CO_2e emission value which is the basis for a series of possible actions to reduce emissions through special initiatives or as part of multi-year corporate objectives, such as science-based targets (SBTs) or similar.

5.6 Selecting the method



6

Examples of the Process

6.1 Scope 1 & 2

Data for the nodes in the supply chain (factories, warehouses, sales points, offices, etc.) that generally relate to the organisation's direct operations can be recovered from internal operational departments/units, from general services, or from a supplier interface (e.g. energy provider).

In the first stage, the company must obtain the list of the entities it owns or which it controls operationally and/or financially, such as main and branch offices, factories, warehouses, shops and stores, showrooms, outlets, and, if possible, their corresponding size in square metres.

While conducting the analysis, it is a good idea to collect data also on water usage and waste, as these data are needed in the respective sections of an environmental, social and governance (ESG) report.

We will now enter into the detail of the two methods proposed to collect data and subsequently measure CO_2e emissions, the simple method and the complete method. From here on, the text in magenta red refers to the simple method, and the text in green to the complete method.

SIMPLE METHOD

If a company opts to collect data using the simple method, it will nevertheless need to gain a clear idea of its analysis perimeter. In other words, it will need a list of entities belonging to the organisation (sales points, offices, warehouses, factories and so on) and their relative location, and also retrieve some related information to determine their size (e.g. size in square metres, number of employees, etc.).

After so establishing the reporting scope, the company can start analysing the data available. In more detail, the data to retrieve relate to:

- Energy consumption.
- Fuel consumption (for heating and moving goods).
- Refrigerant gas leaks.
- Fugitive emissions of greenhouse house gases caused by certain chemical or physical processes in the plants.

SIMPLE METHOD

After securing the list of entities (we will call them nodes here for simplicity) the next step is to locate the sources of information within the organisation to determine the effective consumption values. These can be found for example within internal management systems, or in the relative units (e.g. general services or administration).

More in general, the data on the consumption of electric energy and gas can always be found on the bill or invoice, while the data on refrigerant gases is recorded in the air conditioning booklets or in the assistance invoices (recharges). It can help to contact the supplier/s directly to ask for the consumption data, and perhaps set up a direct interface with suppliers.

In the cases where data is not easy to collect, gaps can be fixed by using standard factors taken from the literature or official sources (e.g. ENEA in Italy). If the sample is sufficient, these average values can be calculated from the company's own database.

COMPLETE METHOD

If the company has opted to measure its CO_2e emissions using the complete method, the starting point is the same, that is, it must draw up a list of the entities belonging to the organisation and their relative sizes (this information can be requested later through a questionnaire). In order to achieve the most reliable and complete estimate of Scope1 and Scope 2 emissions as feasible, our suggestion is to implement a data gathering process that can potentially cover the greatest number possible of sources and nodes, by for example:

- Circulating a questionnaire (or survey). As well as consumption data, the questionnaire will ask general questions about the node, for example for offices, it might check whether or not there are auxiliary services (e.g. server farms, canteen/cafeteria), the type of air conditioning (electric or a mix of electricity and gas), and if there is district heating.

- Sending a request to the energy manager and/or general services and/or the administration unit.
- Plan to input and store consumption data on internal management systems (e.g. ERP, SAP or others).

After receiving the consumption data, it is good practice to analyse and compare them, to check that they are effectively complete and congruent and, where there are anomalous values, ask for explanations.

In general, there are a series of specific cases that must be handled carefully during reporting. These include:

- Share of energy consumed deriving from self-generation plants on site.
- Share of energy consumed deriving from certified renewable sources.
- Owned co-generation plants.

For refrigerant gas and fuel consumption (plus fugitive emissions from chemical or physical processes carried out internally), it is essential to state the type of refrigerant or fuel and the quantity, specifying the unit of measurement.

If the consumption information is not available for some nodes, default values can be used.

6.2 Scope 3 – transport of goods

At least two methods can be used to measure Scope 3 emissions in transport:

- A simple method, which is the starting point to reach an initial estimate of the GHG emissions within the chosen perimeter and can highlight the macro areas of impact.
- A more complete method (and could be the Phase 2 in the simple method) which, in line with the reference norms, can produce more detailed elaborations and analysis of data elaborated (for example, by running through a series of "what ifs" or by segmenting the process along various business features).

In order to explain the process, we will give two possible ways to calculate CO_2e emissions for goods transportation, one for each method.

SIMPLE METHOD

The simple method is designed to approximate the magnitude of the CO_2e emissions in the company's goods transport chain.

According to the process described in Chapter 5, the first thing is to identify the survey perimeter. For simplicity, we will look at the perimeter of the physical distribution of finished products, which is equivalent to "outbound" logistics. For symmetry, we will carry out a similar exercise to estimate "inbound" flows (raw materials, semi-finished products, etc.).

A classical example of the logistics flow in country-wide distribution can include one or more levels of distribution, in function of the various starting points and the logistics nodes used. By way of example:

- One or more plants.
- One or more central warehouses/hubs.
- One or more peripheral warehouses and/or peripheral transit points.
- A series of end destinations (customers or consumers, depending on the business).

The map above shows an example of a real case in Italy, with:

- Two plants (yellow dots), one in Piedmont and one in Puglia.
- Two central warehouses (orange dots), one in Lombardy and one in Campania.
- Eight peripheral warehouses/transit points (blue dots), scattered across Italy. The end destinations cannot be marked clearly.

Having defined the nodes, we can set out the flows between them.

- Flows - plant to central warehouse.
- Flows - plant to peripheral warehouse.
- Flows - central warehouse to peripheral warehouse/transit point (T/P).

- Flows - peripheral warehouse/transit point to customers.
- After identifying the set of flows for which we want to calculate the emissions, we need to gather these data:
- Total number of journeys per flow in the period considered.
- The distance of each leg of the journey. If we don't have that information, we can use an average value.
- The deliveries per single journey. Here also, if the data are missing, we can use an average value.

Case 1 - Piedmont plant	No. journeys per week	Average km per journey	Average number of deliveries per journey (in tonnes)
Factory - Hub	10	200	24
Hub - T/P A	4	190	20
Hub - T/P B	1	110	24
Hub - T/P C	2	250	20
Hub - T/P D	3	490	20
Hub - T/P E	2	380	18
T/P A - customer	6	60	12
T/P B - customer	3	40	13
T/P C - customer	5	55	9
T/P D - customer	4	30	10
T/P E - customer	4	50	11

These data (shown in the table above) can be retrieved in various ways. For example, we can find the average number of kilometres and number of journeys on the ERP or TMS system or request them from our carriers or logistics operators. If all else fails, we can make an educated guess based on our knowledge of the company and its distribution network. We can also deduce the average weight through simple estimates (e.g. volume shipped over total number of shipments), remembering to include the gross weight by cross-matching with logistics lists, therefore also including secondary packaging and pallets or similar.

In this way, we can proceed to the next step, where the quantities transported will be evaluated for each flow. Ideally, we will calculate the tonnes per kilometre, according to the following table (taken from the GLEC Framework guidelines). In this case, we will preferably use an intermediate approach (chosen between the two "acceptable estimation approaches"), which uses either the average km travelled by the total tonnes transported, or the average tonnes transported by the total km travelled.

Table 3. Demonstration of tonne-kilometer (tkm) calculation approaches

Shipment	tonnes	kilometers	tkm
1	10	1,000	10,000
2	40	400	16,000
3	400	300	120,000
4	10	700	7,000
5	60	1,200	72,000
		Correct answer: total tkm	**225,000**

ACCEPTABLE ESTIMATION APPROACHES:	
Multiply total tonnes by average km	374,400
Multiply average tonnes by total km	374,400
INCORRECT ESTIMATION APPROACHES (Do Not Use!)	
If you multiply total tonnes by total km	1,872,000
If you multiply average tonnes by average km	74,880

Source: GLEC Framework, 2019

We will obtain a flow table with relative quantities of tonnes per km (tkm). We must identify a type of vehicle for each flow (defined by the size of the vehicle and what it runs on) with the relative emission factor per tkm. Whatever the type of transport, these factors can be extrapolated from the GLEC Framework, and refer to aggregate/average values, accepted in the literature but which, for example, prevent you from considering the vehicle's payload/carrying capacity or its emissions standard (e.g. Euro 3 to Euro 6 for diesel vehicles. We must stress that, for intermodal flows, we recommend breaking down the flow into its road-non road components (such as rail or roll-on roll-off, ro-ro) calculating the tkm differently for each type of transport.

In local distribution (from a transit point to a customer), given that there are numerous delivery points/customers and a variety of vehicles used, we could follow this approach:

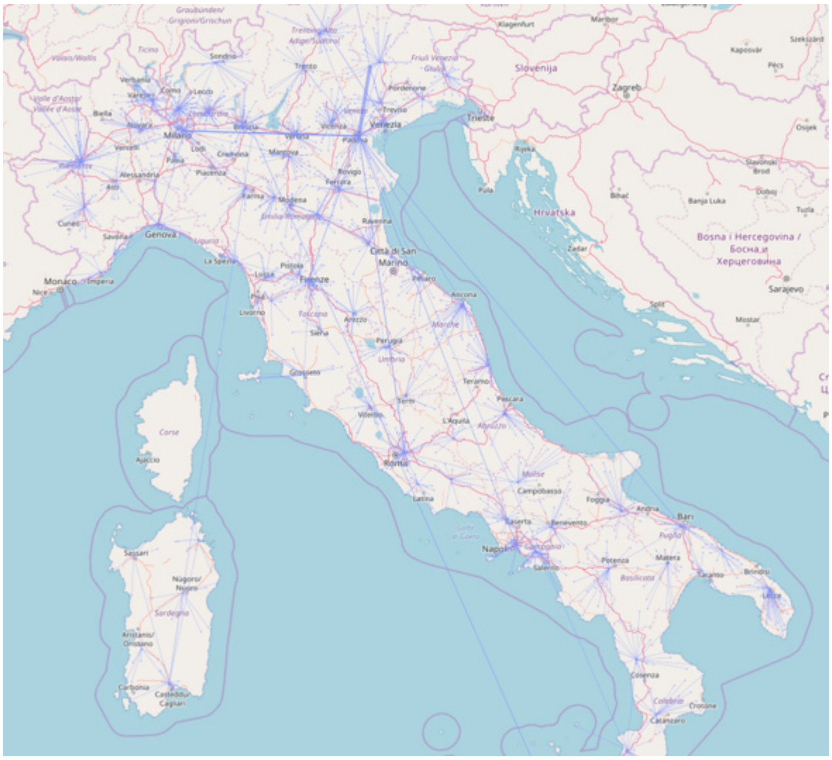
- Calculate an average delivery range from a peripheral warehouse/transit starting point.
- Distinguish between deliveries via circular routes known as "milk runs", where the vehicle returns to its starting point, and deliveries carried out by making a special journey.
  - In the first case, we should double the average kilometres to account for the journey back to base.
  - In the second case, we just need to account for the average range (outwards kilometres).
- We calculate the transport quantity in tkm, as describe previously.
- We define a means of transport used on average (e.g. 3-axle heavy goods vehicle).
- Similarly for the basic case, we must identify a GLEC Framework GHG emissions factor to allocate to the vehicle.

Following this set up, we can complete our calculation to estimate the CO_2e emissions of the variable flows for the reporting scope and the period under consideration.

COMPLETE METHOD

The logical subsequent step is a more accurate method. The complete method is designed to produce a precise as possible estimate of the CO_2e emissions for the company's operations goods transport chain, using one of the calculation tools on the market. According to the specific case, the level of detail can go down to single journey or shipment. Each journey is split into legs or "arcs", which are the segments linking the various logistics nodes (a warehouse, a terminal, a destination point, etc.). Each arc must be described according to the transport method used and features of the vehicles. This means that CO_2e emissions can be calculated for each arc.

The ideal set of information therefore includes two main sets, the nodes and the arcs connecting them, which represent the actual transport flow.



For the nodes, independently of the data format, we have to recover a list of all the transport departures/destinations (including the intermediate stops). These are the transport points, warehouses, ports, airports, terminals, customers.

In particular, the information needed for the "nodes" consists of:

- Global location number (GLN) or node code[14] (it usually can be taken from the logistics list). This code will be used to give an univocal location/identity for the node when transmitting transport data.
- Address, consisting of street/road number, street/road name, postal code, town/city, province (or county), country (using the ISO 3166-2 country codes).
- Type of node (es. salespoint, factory warehouse).

[14] GLN - Global LocationNumber (https://gs1it.org/assistenza/standard-specifiche/gln/)

- GPS coordinates (always useful, they can be taken from various systems automatically, but they are always gladly received if present).

The information needed for the "arcs" consists of:

- Route of the journey:
  - This includes all the stops and deliveries during the journey.
  - It includes the sequence of stops and deliveries.
  - It also includes any intermodal stretches (departure and arrival ports for deliveries to the islands).
- Type of transport, whether full truck load (FTL) or full container load (FCL), or a mixed load, i.e. less than truck load (LTL) or less than container load (LCL).
- Means of transport, which in this example of road transport can include:
  - Type (e.g. 40t articulated lorry, 7.5t 2-axle van, etc.)
  - Engine: Diesel vehicle, liquified natural gas (LNG) vehicle, compressed natural gas (CNG) vehicle, battery electric vehicle (BEV), etc.
  - Euro class (e.g. Euro 5, Euro 6, etc.).

If the consumption factors for the fleet are known, they can be customised, while other means of transport are subdivided into various classes (in airplane cargo, dedicated freighters vs belly cargo; in naval transport, bulk cargo vs container; in rail transport, traditional train vs swap bodies, etc.).

- Gross weight transported (total for journey or, if not available, weight for single delivery).
- Load temperature.
- Unladen journey (in general % of the return arc).

Above is the set of necessary information under ideal circumstances. In reality, not all the information will be available, at least in the short term: these are the gaps in information mentioned previously.

When setting out data sharing projects, it will also be possible to define the necessary assumptions about:

- The need for routing and relative networks.
- Modalities for sharing information about destinations (separately or when underway).
- Data not available directly by shipment but available in aggregate form, e.g. fleet mix.
- Data not available to estimate (e.g. weight from number of pallets).
- And so on.

The setup phase, therefore, involves specifying how to share the information through structured digital methods, using standard layouts such that the calculation system can receive the complete set of information and can calculate the ensuing CO_2e emissions, and potentially present them in reports, or in the form of extracted data or data flows, etc.

There are various aspects linked to experience which we must keep in mind:

- Transport systems usually refer back to international standards and codes (e.g. International Air Transport Association - IATA for airports, the United Nations Code for Trade and Transport Locations - UN/LOCODE for ports, etc.).
- We must be very clear and agree what we mean by journey and shipment (a journey could take in a number of shipments), and also consider load breaks (e.g. this is when a dedicated vehicle carrying a number of deliveries reaches a transit point and several vehicles continue from there and make delivery rounds; so effectively these are two distinct journeys).
- In the case of intermodal flows (the most common being road-sea-road, road-rail-road, road-air-road), this is a single journey with different arcs for each mode of transport.

More in general, the quality of data will improve visibly over time, as the company learns how to request, receive and store progressively more accurate data, often taking simple but essential actions. These can be to include the request for data in contracts with suppliers, integrate information from various computer systems into a single database, prepare more complete and accurate logistics lists, automate the process of sharing data between the company's IT systems from/for transport services providers, and so on.

When people have a good understanding of the scope of application and the purposes of the process, it leads to improvements in aspects linked to the gathering of data. We warmly recommend internal training so that people are more directly involved not only in the calculation work, but also in helping to achieve the company's climate emission targets.

To conclude our overview of the two calculation examples, we note that there is a hierarchy of data (e.g. the GLEC Framework and EN 16258), which tends to give priority to real consumption factors over estimates. If we exclude the consumption values for each specific journey (which are really hard to get), we should start from the consumption factor of the relative carrier (which can supply them using data from its own fleet, see SmartWay in the USA). We would then go on to model the consumption for each journey, and, if information is missing, then use average or default factors, which are today available globally.

ISO 14083 is expected to be released in autumn 2022 and it will presumably consolidate this arrangement, expanding it, as was the case with EN 16258, also to the calculation of greenhouse gas emissions in passenger transport. The logic of arcs and nodes remains the same, there are some different kinds of nodes (car parks, passenger train stations, etc.), means of transport (cars, passenger trains, etc.) and obviously consumption factors (expressed in "passenger-kilometre" instead of "tonne-kilometre").

6.3 Scope 3 – transport of people

CO_2e emissions relating to the transport of people fall into these categories:

- Commuting.
- Business travel.

- Consumers travelling between home and a salespoint.

As an example, we will concentrate on travelling between home and work, using our usual two methods:

- Simple method: this method is used to measure CO_2e emissions on the basis of information such as number of employees, the average distance between home and work and an average coefficient of car consumption, all of which can be obtained through a questionnaire.
- Complete method: this method is based on detailed information on the kilometres travelled and the means of transport used, applying specific factors that can be retrieved through surveys or fuel cards or other means.

SIMPLE METHOD

When using the simple method to calculate CO_2e emissions for commuting, we measure the emission data on the basis of several general parameters, such as:

- The number of employees in the organisation over the number of employees at the facility being reported on.
- The average distance home to work.
- The average number of days spent in the office a year - or over six months, or another chosen time frame (e.g. 220 days, or 176 days if, for instance, the person works from home one day a week).
- The percentage of employees who commute by car or who use public transport.

This information can be retrieved from departments and units in the organisation (HR, general services), or from a short questionnaire, which needs only be sent out to a small but representative sample of employees.

This gives us an estimate of the total number of kilometres travelled in the period of reference, divided by type of transport. If we then apply a suitable consumption/emissions coefficient to the kilometres, we will get the quantity of CO_2e emitted. Obviously, the greater is the detail or amount of information gathered, the more reliable will the result be.

COMPLETE METHOD

In general, the initial information needed to measure CO_2e emissions is:

- Number of employees.
- Average distance between home and work.
- The various means of transport used, given in percentages.

These data can all be retrieved from sources such as human resources, general services, fuel cards and the fleet manager. They can also be gathered from a standard questionnaire, to be sent to all or a significant sample of employees, asking:

- What means of transport do they generally use to commute (e.g. bus, tube, train, motorbike or scooter, bicycle, etc.).
- The approximate distance they travel each day to get to work.
- If they use a car or motorbike/scooter, some of its specifications (e.g. engine size, fuel, Euro class, etc.).
- If it applies, they should indicate how many days they work from home a week.

If we are looking at places of work in another country, we must take note of the country. This code is needed so that we can apply the consumption factor for that country. Other information that can be collected in this phase include the department/unit/function, the region or business unit and other details that can be used to break down data for internal analysis (e.g. commuting time).

The table shows an example of the possible results from a survey. We will then need to adjust the data for the days a person works in the office to get an estimate of the total kilometres they travelled over the chosen period of time (e.g. one year).

The data on their method of transport and vehicle can be used to select the most appropriate consumption coefficient.

	Type of transport	Type of fuel	Euro class	Engine size	Average km	Average travel time
Employee A	Motorbike	Petrol	2	50 HP	15	20 mins
Employee B	Car	Diesel	5	1200 HP	20	40 mins
Employee C	Train	-	-	-	15	30 mins

6.4 Scope 3 – raw materials

Scope 3 also includes emissions connected to the life cycle of raw materials, semi-finished products and components from suppliers and used in internal manufacturing. The emissions are those generated along the supply chain by those materials, from their extraction and their processing to the intermediate transport and end production (for semi-finished products or components). These emissions can be measured using the same two methods:

- Simple method: the raw materials and semi-finished products can be grouped by type of material (e.g. metal, polymers, etc.), and are measured using generic emission factors found in public literature sources.
- Complete method: the composition of raw materials and semi-finished products can be analysed in greater detail, also applying the emission factors for type of material, such as a metal (e.g. aluminium, steel) or a plastic (e.g. polypropylene - PP, polyethylene - PE, polyethylene terephthalate - PET). These factors can be retrieved from commercial databases using life cycle assessment (LCS) modelling software.

In both cases, the complexity of the analysis depends on the type of product or service provided, and sometimes can vary quite significantly, not just from company to company, but also between the units in the same company, as already discovered by organisations with greater experience in terms of the depth and scope of their analysis.

7

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