



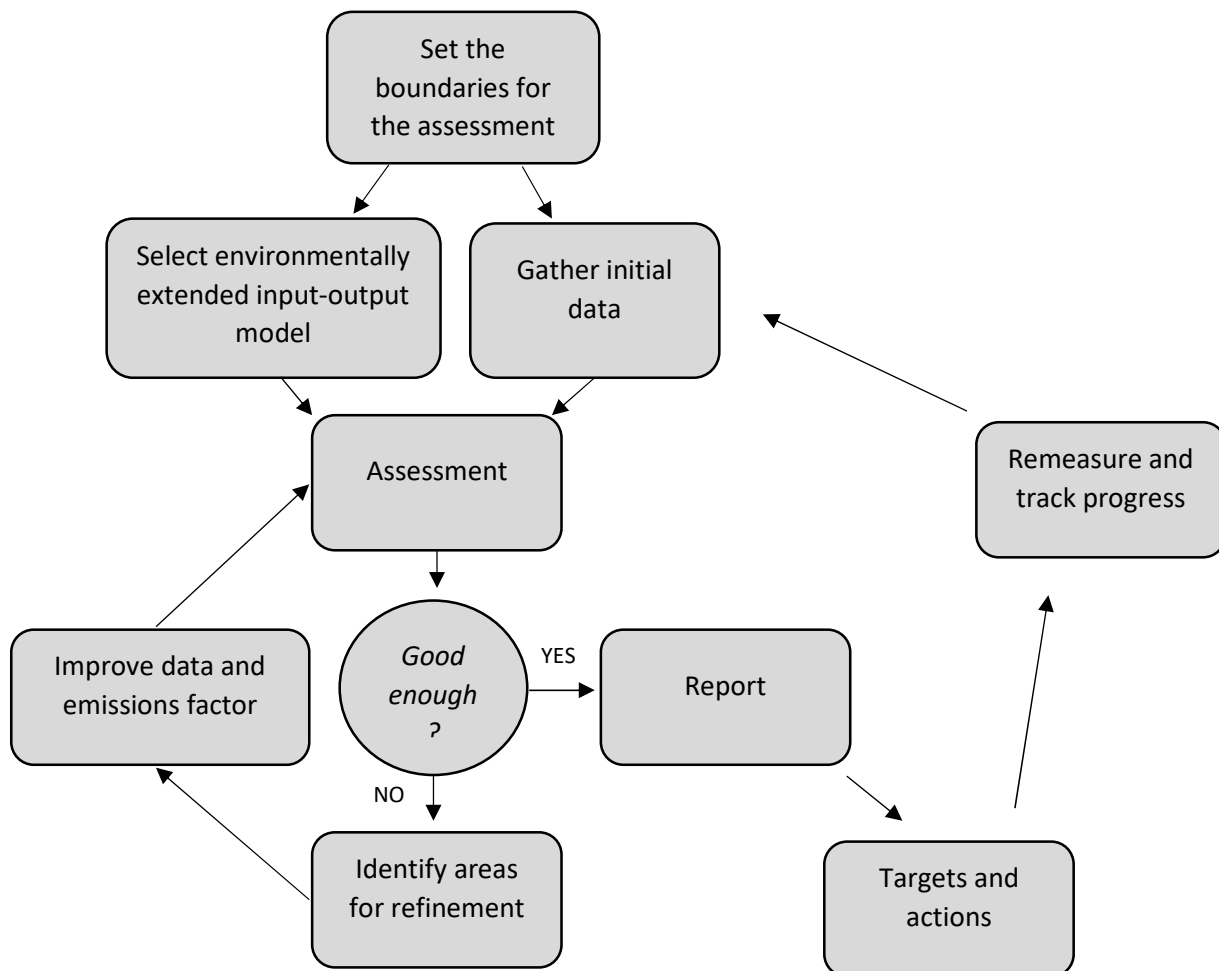
SWC Guidelines for Supply Chain Emissions Assessment and Reporting

Outlined here are some basic principles and guidelines for companies and other organisations. We recommend these are followed except where reasons for deviation can be justified and are clearly articulated. This document is not intended to be a comprehensive manual, but lays out the key steps, derived from Small World Consulting's 15 years of carbon accounting experience.

These Guidelines are written specifically for use in conjunction with SWC's Multi-Regional Input-Output Model, although the principles also apply for use with other environmentally extended input-output models.

This guide aligns with the Greenhouse Gas Protocol's (GHGP) greenhouse gas (GHG) accounting and reporting principles of **relevance, completeness, consistency, transparency, and accuracy.**

The chart outlines the eight core stages described in this guide, within which we describe 26 steps.



Select the assessment boundary

The boundary should include a system-complete treatment of all upstream emissions. The timeframe, the entity under assessment, and the gases included should be made clear.

- 1) Define the boundary of the organisation being assessed. The boundary may contain multiple businesses or exclude some components of a business, and where this is the case, it should be clearly stated. Within that boundary, include all the supply chain pathways of everything the organisation spends money on. It will encompass value chain categories 1 to 8 [as defined by the GHGP](#). Importantly, within those categories the assessment should be system-complete. In other words, you must include all supply chain pathways, eliminating the truncation error that is inherent in LCA-based emissions factors.
- 2) Define the time period for the assessment (usually one specified calendar- or financial year).
- 3) Specify which greenhouse gases are included and the timescales over which they are brought together as a single unit of carbon dioxide equivalent (CO₂e). Usually this will include all the gases covered by the GHGP. The most common time period will be 100 years, although there are strong arguments for also reporting shorter time periods, such as 20, 30 or 50 years, since these change the relative importance of different gases. For example, a shorter period increases the relative significance of methane, conventional refrigerant gases and aviation contrails.
- 4) State clearly whether the organisational boundary includes the following elements:
 - a. Commuting.
 - b. Activities downstream from the point of sale. These are very important for some organisations, but are not dealt with in this document. Here we simply make a few notes in passing:
 - i. Downstream emissions estimates often require the setting of relatively arbitrary system boundaries, as well as assumptions about use scenarios. These should be made explicit.
 - ii. Truncation of the system boundary can lead to underestimation of downstream impacts, including the serious omission of macro-economic rebound effects.
 - iii. Unrealistic claims of ‘avoided emissions’ have often arisen from problems with i) and ii) above. Any such claims are also reliant on comparison against an alternative scenario which must be both realistic and explicit. The difficulty in meeting all these criteria mean that claims of avoided emissions are generally not robust.
 - iv. Generally, calculation of the instrumental or detrimental downstream effect of goods and services, with a view to enabling a low-carbon world, requires a more qualitative assessment, with thoughtful consideration of direct and indirect impacts.
 - c. Customer transport.
 - d. Emissions or removals from land use, land use change and forestry (LULUCF) relating to land managed by the organisation.

Note that no form of carbon removal or offset should be included in this assessment. Any ‘net emissions’ assessment should consist of two components: an emissions assessment, the supply chain component of which is covered here, and a removals assessment. In this way carbon removals are less easily misconstrued as a substitute for emissions reductions.

Gather data

This includes comprehensive data on organisational expenditure as well as on physical consumption in key areas. Perfect data never exists. The data gathering process may well be iterative, as initial analysis highlights the key areas where improvements are required. The effort spent on data gathering should generally be targeted on the areas where improvements will have the greatest impact on the realism of the overall assessment.

- 5) The key data will include:
 - a. Organisational spend, broken down as far as possible by the type of goods and services, and where possible by the geographic source location. Source locations may be unknown, or a single country may be chosen as best fit or ‘centre of gravity’ for the supply chain, or a weighted blend of countries may be selected.
 - b. Energy use, broken down by type and source (this is needed even if a scope 1 and 2 assessment has been carried out separately, since energy-related emissions have supply chain components).
 - c. Travel and transport, factoring in physical distances, modes, and vehicle types. Where possible, data on further nuances such as load factors for freight and driving style may also be incorporated.
 - d. Commuting estimates, including distances by each mode, and vehicle types. If commuting is not included in the assessment, this should be made clear in the statement defining the organisational boundary.
 - e. Capital investment and expenditure should be included. It is acceptable to amortise this over a period of years, perhaps following conventions that are common in financial reporting. However, this must be done in a consistent way between years, and if one year’s capital investment is amortised, then amortised investment from previous years must also be included. Note also that whilst we believe it can be a sensible and defensible practice, the amortisation of emissions from capital investment is not currently allowed under the Greenhouse Gas Protocol.
 - f. Where elements of spend or consumption are partially attributable to the entity within the boundary of the assessment, this can be proportionally allocated in a way that sensibly reflects the driver for the emissions. In this case allocation conventions drawn from financial accounting may often be useful.

Select an EEIO model

In selecting an EEIO model from which to draw spend-based emissions factors, the following criteria should be applied:

- Transparency and rigour of the methodology.
- Quality, transparency and “up-to-dateness” of the data feeding into the model.
- The ability to reflect regional differences in the carbon intensity of industries.
- The level of disaggregation, taking care to check that the quality of the underlying data justifies the level of disaggregation in emissions factors produced.
- A series of methodological details such as, for example:
 - The inclusion of high adjustments to take account of high-altitude impacts of aviation emissions.
 - The inclusion of gross capital formation in the underlying supply and use tables.

- The impartiality and expertise of the creators of the model.
- Any available evidence of the realism of the emissions factors produced by the model.

The SWC MRIO

This has been developed with the above principles in mind, and with the intention of raising the standard and compatibility of organisational supply chain emissions reporting. The methodology has been developed specifically to maximise the realism of the results – an aspect that has been extensively tested – for the purposes of supply chain emissions reporting. The underlying datasets and detailed methodology of the SWC MRIO are publicly available.

The SWC model contains many sets of emissions factors, including one each for 105 sectors in 65 countries. The variables are:

- The year to which they apply,
- A choice of basic and purchasers' prices,
- A choice of emissions factor by either *country of supply* (to be selected when the country of origin is known) or *country of demand* (for use when only the country in which the goods or services are purchased is known).

Each emissions factor is reported as a total and broken down into components of the supplier's scope 1, scope 2 and supply chain scope 3. (SWC also has a *structural path decomposition* of the scope 3 component by industry and supply chain tier, and this data may be released as resources permit. However, for now please enquire directly to SWC for this).

Create an initial estimate

It is important to begin with a system-complete sketch of the whole entity. This can be achieved through a spend-based assessment, possibly augmented in the first instance with consumption data for key areas, such as energy use, travel, transport, and core materials.

- 6) Apply spend-based emissions factors derived from Environmentally Extended Input-Output (EEIO) to every item of organisational expenditure, excluding staff remuneration, tax, and dividends. If possible, the EEIO model used should be open-source and have a credible and transparent methodology. When selecting emissions factors to apply to expenditure, the objective is to pick one or a blended mix of several that best represent the purchase. The following should be considered:
 - a. The industry sector to which the purchased goods or services belong, or occasionally another sector that better represents the supply chains for the particular procured item. Where the latter is the case, the rationale for industry sector selection should be made clear.
 - b. The region or country (or a weighted blend of regions) to which the spend applies.

For complete transparency, the categorisation would be made publicly available, with descriptions of and the rationale for key subjective categorisation judgments. This should be done wherever practical.

Iteratively refine the estimate

The initial sketch can be used to focus refinement attention on the areas likely to be of greatest material significance. Refinements can be made by improving data and/or by substituting physical

consumption data coupled with LCA-based or hybrid emissions factors¹ into the model, taking care not to truncate the supply chain pathways. A third method is to apply adjustment factors to reflect known differences between the carbon intensity of the spend and the generic EEIO-based emissions factor. Fourthly, supplier scope 1, 2 or even upstream scope 3 emissions may be substituted into the model, provided that their methodology and rigour are deemed sufficiently compatible with it.

Using these methods, it is possible to improve both the accuracy of the results and the extent to which all possible carbon-cutting actions can be reflected in the modelling. Refinement can be an iterative process, continuing until the model is fit for purpose and the benefit of further effort is outweighed by the opportunity cost of directing that effort into emissions management action.

- 7) Identify key elements of the footprint (e.g. by proportion of overall footprint, or by importance of the activity to business operations), and the associated spend for which LCA-based physical consumption data will be used instead of expenditure. These are likely to include energy use, transport, and key materials. The selection of these components should take account of the expected materiality of the category and the practicality of acquiring physical consumption data. The identification of areas warranting bespoke treatments should be impartial as regards whether the expected difference will lead to a rise or fall in the emissions estimate.
- 8) Select LCA-based emissions factors and apply these to the physical quantities of consumption. Where the LCA-based emissions factors are not system-complete, or the inclusion criteria differ from those of the EEIO, a correction must be made, to account for the boundary difference as realistically as possible, in order to honour the principle of counting all parts of the supply chain once and once only. Examples of boundary differences include: omission of tertiary goods and services, exclusion or inclusion of capital investment, inclusion or exclusion of high-altitude radiative forcing, and truncation error from significance cut-off criteria. One way of adjusting for these system boundary differences is to apply an industry-specific adjustment factor². Another way would be to use emissions factors that specifically add EEIO components to account for supply chain pathways not included in the LCA (hybridised factors).
- 9) Substitute the resulting hybridised LCA-based components into the assessment, being careful to remove the corresponding spend-based components, honouring the principle of counting every element once and only once.
- 10) Additionally, to substitute hybridised LCA factors into the model, it may sometimes be possible to apply adjustment factors based on known differences between the organisation's procurement and the sector average. (To give a simple example, if a company were to procure only recycled paper, with a sound estimate (derived from credible LCAs) of the difference in emissions per kg compared to virgin paper, and the relative costs can be estimated along with the sector average recycled rates, it would be possible to apply such a multiplier, and in doing so reflect the carbon benefit of the procurement decision to buy recycled paper.) Where such an approach is taken, the methodology needs to be made publicly available and easy to access.
- 11) Where suppliers publicly report scope 1 and 2 carbon intensities and where this is deemed to be of sufficient quality, it may be possible to substitute these into the analysis, by disaggregating the EEIO-based emissions factors by scopes, provided that the EEIO model used supplies these emissions factors. The same approach may be applied to supplier upstream scope 3 emissions intensities, provided that the core principles outlined in this

¹ Hybrid emissions factor – an emissions factor derived from process-based life cycle analysis, but with an EEIO-based component added, to ensure or approximate system-completeness.

² See also SWC's guide: "Integrating process-based life cycle analyses (LCAs) into spend-based environmentally extended input-output (EEIO) emissions estimates for company supply chains."

document have been followed by the supplier, and ideally that the same EEIO model has been used.

*Note: for electricity consumption we recommend using a grid-average emissions factor even if the tariff is certified as renewable, **unless** all the electricity sold by the supplier is backed by renewable power purchase agreements (PPAs).*

Report the results in context

Reports should be clear about what is included and what is not. They should seek to create the clearest impression of where emissions lie, so that attention can be focused on the areas of greatest material significance. They should enable readers to gain perspective on the significance of the organisation's emissions within the wider economy. The issues of greatest material significance should be given clearest prominence in any reporting. The reporting should give a nod, as appropriate, to wider environmental and social sustainability issues where these intersect with the climate agenda, so that emissions are not treated as an isolated sustainability issue.

- 12) Results should be stated with clear reference to the boundary of the study: what is included and what is not.
- 13) Results should usually be reported alongside assessment of scopes 1 and 2. However, it may sometimes also be useful to amalgamate scopes 1, 2 and upstream scope 3 for reporting purposes, so that, for example, all emissions relating to electricity or gas use can be seen under one heading.
- 14) Results should be reported as a total as well as normalised per unit of output, possibly in a variety of ways, including per unit of revenue and/or per unit of physical output. Other reasonable bases for normalisation are per proportion of the total market or of the global economy. These last two options are a little more complex, but may have the advantage of enabling targets whose science basis and level of ambition are more independent, simultaneously, of the fate of the company and the wider economy. In other words, the level of ambition remains constant whether the company grows or contracts, and regardless of the extent to which the total market or the global economy grows or contracts.
- 15) Results should be broken down such that the key hotspots and carbon management priorities can be readily identified.
- 16) The methodology should be made transparent, with at least a readily accessible outline of the principles, reporting methodology and emissions factors used, and their source. There should be transparent access to a more detailed methodology that makes a number of aspects public. For example, the emissions factors and their derivation, the key assumptions and judgements made during the assessment, and any bespoke elements of the modelling, including the derivations of emissions factors adjustments. Any EEIO model used should have a fully transparent, open-source and credible methodology.
- 17) The level of uncertainty should be realistically described, so that readers can gain a well-founded sense of the extent to which the results present an overall perspective, and within that a sense of the priorities for the organisation and its stakeholders regarding GHG management.

Set targets and identify actions

Setting a carbon reduction target will help to crystallise reduction goals and focus company efforts on achieving them. Calculating your company's footprint will provide a starting baseline, though care should be taken to ensure that targets are fit for purpose, meeting a range of criteria regarding scopes, boundaries, ambitions, and target year. From your analyses, it will be possible to identify key hotspots for reduction actions and strategies.

- 18) Set a target that is fit for purpose. It should include at least scopes 1, 2 and upstream scope 3. The level of ambition must be at least as strong as that prescribed by the scientific consensus (currently this means 1.5°-compatible). And a 'net zero' target must disaggregate into mitigation and negative emissions components, so that mitigation responsibilities are not traded against removals (most of which are finite).

Whilst negative emissions are not the focus of this document, note that any negative emissions should only include verifiable, additional carbon removals that also pass tests for wider environmental and social responsibility and for permanence. Not all certifications are guarantees of these essential criteria.

- 19) Identify easy wins from footprinting work, as well as longer-term, strategic goals. Which components of the footprint, which suppliers, and which departments account for the largest chunks of the footprint?
- 20) Model how particular actions may change your company's footprint in the future. Incorporate new data or assumptions into your calculation to explore possible scenarios.
- 21) Engage with staff from the top and bottom to obtain maximum buy-in and a range of ideas and opportunities. Explore whether you can substitute goods and services with lower-carbon options by talking to suppliers and exploring the market.
- 22) Incorporating carbon and other facets of sustainability into procurement policies, particularly for goods and services of strategic importance, may help to ensure that carbon considerations are part of decision-making from the start.

Re-measure and track progress over time

Companies are often obligated to report scope 1 and 2 emissions per 12-month period on an annual basis, usually in line with financial reporting. Re-measuring scope 3 on this basis enables organisations to monitor carbon reduction progress (or lack thereof) through the supply chain, and provides internal and external stakeholders with up-to-date information to allow appropriate decision-making. While consistent methodologies allow for meaningful year-on-year comparisons, building a GHG inventory is an iterative process which will inevitably improve over time with increased understanding and resource.

- 23) Methodologies should remain consistent except where data quality or assumptions have been improved. Disclose any changes to the data, methodology, assumptions, or any other relevant factors.
- 24) Significant changes to the methodology may warrant recalculation of base year emissions to match new approaches and assumptions.

- 25) Disclose any reduction actions your company has taken that account for changes to the footprint compared to the previous year. (Examples might include installation of air-source heat pumps, electrification of vehicle fleet, switching to low-carbon materials.)
- 26) When reporting progress against a baseline, the following principles should apply:
 - a. The organisational boundary should be unchanged.
 - b. The methodology should be unchanged, or changes in reported emissions resulting from methodological differences should be quantified and made clear.
 - c. Comparisons to the baseline should be reported both in absolute terms and normalised per unit of output.