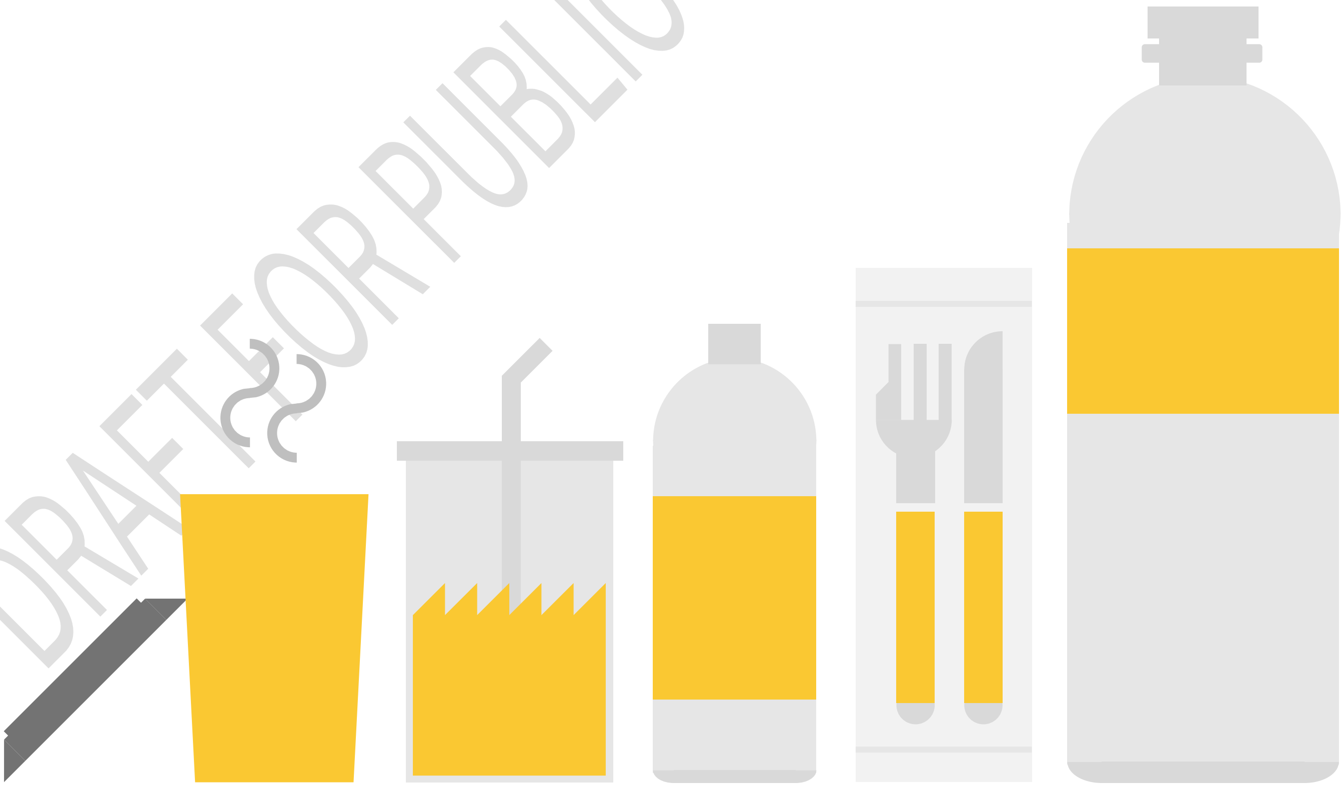
IN-DEPTH

Harmonized life cycle assessment methodology for single-use plastic products and their alternatives in the airline sector

Draft for public consultation from:

22 April – 31 May 2025



ABOUT

This document was prepared by the International Air Transport Association (IATA) with support from WRAP.

IATA is the trade association for the world's airlines, representing some 320 airlines or 83% of total air traffic. IATA's mission is to represent, lead, and serve the airline industry. IATA supports many areas of aviation activity and helps formulate industry policy on critical aviation issues.

WRAP is a global environmental action NGO transforming our product and food systems to create Circular Living. We examine sustainability challenges through the lens of people's day-to-day lives. We transform the systems that provide the products we consume. We catalyse action from policy makers, businesses, NGOs and citizens to make it happen.

Disclaimer

This document is intended for public consultation purposes only and should not be considered official guidance or policy. The information contained herein is subject to change and should not be relied upon for any decision-making or official use.

Contents

List of Tables

List of Figures

NOTE TO READER

This guidance outlines a harmonized methodology for conducting life cycle assessments (LCA) of single-use plastic products (SUPP) and their alternatives in the airline sector. While SUPPs are widely used due to their practicality and compliance with safety regulations, growing environmental concerns and international policy developments necessitate a systematic approach to assessing and mitigating their environmental impacts. Key challenges include the limited transferability of non-aviation SUPP alternatives, fragmented global regulations and the need for sector-specific solutions.

The methodology proposed supports consistent, robust, and comparable LCA studies across three key aviation product categories: inflight catering items, passenger comfort provisions, and cargo wrappings.

The guidance aligns with ISO standards and includes detailed protocols for identifying the goals and scope of an LCA, defining functional units, selecting impact categories, modeling end-of-life scenarios, and assessing data quality and uncertainty. It emphasizes a cradle-to-grave perspective and includes recommendations for conducting sensitivity analysis and interpreting environmental trade-offs.

This methodology comprises information on specifying the aim of the study and its intended audiences before moving on to the scope, functional units and bounds of studies. It then outlines the life cycle stages required for studies following the guidance with rationale for their inclusion. The later sections cover data choice decisions, how to present the certainty of consequent results, and choosing appropriate impact categories. Finally, it outlines the ways to approach governing quality and robustness of resulting studies, while allowing for necessary scrutiny.

To accelerate the transition to a circular economy in aviation, the report calls on airlines, regulators, and industry stakeholders to adopt this methodology, harmonize regulatory approaches, and collaborate on practical, scalable solutions that reduce SUPP use and improve environmental performance across the sector.

1. INTRODUCTION

Single-use plastic products (SUPP) are widely used in aviation due to their strength, lightweight, and ability to meet safety and security regulations. Countries apply disparate rules and restrictions with respect to SUPP use and end-of-life treatment, which means that airlines might be unable to comply with all stipulations along a multi-leg flight. Legislation tends to focus on reducing the consumption of materials, promoting the transition to a circular economy, and preventing plastic pollution. While wholly laudable aims, the legislation rarely considers the specifics of air transport. The collection of evidence of sector-specific environmental impacts and tailoring SUPP regulation to these can improve the success rate across the whole economy.

There is a proliferation of methods for measuring the environmental performance of products. Many follow, in whole or in part, the life cycle assessment (LCA) methodology as a wide-reaching and relatively comprehensive way of considering environmental impact in a robust manner. These methodologies provide a broad framework within which variation is permitted, regarding, for instance, the scope and the environmental impacts that should be considered. The large number of LCA methodologies to choose from makes it difficult to interpret and compare results. Many methodologies are voluntary and general in nature, but some might be linked to regulatory requirements. For example, the Product Environmental Footprint (PEF)[1] proposed by the European Commission is linked to the proposed new law on green claims[2] in the EU.

There are more than 1,000 LCA studies that consider the life cycle impacts of elements of the air transport industry, but only a handful that address the impact of SUPP and their alternatives to date[3]. The boundaries and issues studied in these reports were not harmonized, and results cannot be compared, neither with respect to measured outcomes, nor the scope of the analyses.

A harmonized methodology for measuring the environmental impacts of SUPP and their alternatives is needed. This would bring consistency to the air transport industry's efforts to assess the environmental impacts of three product categories: catering supplies, provision of items for the comfort of passengers, and cargo operations. Such methodology would also help to:

- Improve the environmental impact of the air transport industry
- Benchmark the performance of alternative systems
- Support a harmonized regulatory approach to SUPP in air transport across jurisdictions
- Work toward a sectoral approach to catering items and passenger and cargo packaging product choices
- Enable communications to passengers regarding environmentally driven decisions

The objective of this document is to provide a common methodology and set of default assumptions to help strengthen the robustness and comparability of LCA studies of the use of SUPP in aviation. Its focus is on reusable alternatives to SUPP, but the methodology can also apply to non-plastic single-use products and to the comparison of different reusable options. The methodology presented here is aligned with the general methods and principles of LCA, including ISO 14040 and ISO 14044, while not supplanting these nor any other regulatory requirements.[4]

[1] **European Commission. Product Environmental Footprint method.**
[2] **European Commission (2023). Proposal for a Directive on Green Claims.**
[3] **IATA (2024). Reassessing single-use plastic products in the airline sector – Annex 3: Life Cycle Assessment Literature Review.**
[4] **For an introduction to the principles of LCA, UNEP's Life Cycle Initiative hosts a range of freely available training documents and e-learning courses.**

2. GUIDANCE

2.1. Goal and context of the LCA study

It is essential that the study clearly states the purpose, setting out the context of the work and the reasons for which it has been conducted, its intended application, and its intended audience.

Box 1. Examples of the goal and context of the LCA study.

Topic	**Example**
Reason for the study	To compare the life cycle impacts of single-use plastic versus metal cutlery for the provision of passenger meals in flight.
Intended application	To inform operational decisions around the provision of cutlery. To contribute to the debate regarding the most environmentally beneficial option for the airline industry.
Intended audience	Internal use to inform purchasing decisions. Other air operators, researchers, and policymakers.
Other considerations	Whether the study is intended to be used to make comparative assertions to be disclosed to the public.

2.1.1 Reason for study and decision context

This guidance supports the primary use case of informing environmental decision-making when considering single-use plastic products versus reusable options during the onboard experience and across cargo.

To inform decision-making, it is essential both to adopt a suitable range of impact categories that are relevant to the product system studied, and to analyze these in the wider context of their use, in this case, air transport. For example, while single-use plastic cutlery and food containers may make a significant difference to the waste arising from a flight, the greenhouse gas emissions will be very low relative to both the emissions of the airline industry as a whole (where aircraft and fuel type have the largest impact), and to the more restricted decision context (where the choice of food served is likely to have a larger impact than cutlery or container choices). Making these issues explicit in the LCA ensures that relative impacts are understood.

2.1.2 Intended application

This guidance focuses on the assessment and comparison of life cycle impacts of single-use plastic products and alternatives to these in the context of air transport, analyzed in the following category pairs of single-use plastic versus:

- Non-plastic cutlery
- Non-plastic crockery
- Non-plastic cups
- Non-plastic bottles
- Reusable or non-plastic cargo wrapping
- Reusable or non-plastic items provided for the comfort of passengers, such as:
  - Headphones
  - Wrapping of blankets

The guidance is neutral with respect to materials and can be applied to plastic or non-plastic items without modification. Similarly, it can be used to compare single-use with single-use, or reusable with reusable products simply by discarding any sections that do not apply.[5]

2.1.3 Target audiences

The guidance is intended primarily for decision-makers in the aviation industry, but may be relevant to:

- Regulators and policymakers[6]
- Environmental NGOs
- Scientists and researchers
- Members of the public

2.1.4 Comparative assertions

This guidance is designed to allow comparison of different products, specifically single-use plastic products versus reusable or non-plastic alternatives. ISO 14044 sets out several specific requirements for comparative LCAs that are to be disclosed to the public. These, and the approach that this guidance adopts to address them, are set out below:

- Analysis of material and energy flows to justify their inclusion or exclusion. This is covered below in the discussion of the cut-off rules and requirement for a screening LCA before any processes or material or energy flows are cut off.
- Evaluation of the completeness of the life cycle impact assessment (LCIA). The cut-off rules and recommendations regarding scope and system boundaries cover this.
- Assessment of the precision, completeness, and representativeness of the data used. The section on data quality and the requirements for a data quality matrix provides guidance on this.
- Description of the equivalence of the systems being compared. This is addressed in part by the proposed default functional units, although the LCA practitioner must ensure that the product systems being compared are indeed as equivalent as possible.
- A statement as to whether international acceptance exists for the selected category indicators and a justification for their use. While this guidance suggests the most appropriate indicators to include, the LCA practitioner should take additional steps to ensure that all significant indicators are included.
- An explanation for the scientific and technical validity and environmental relevance of the category indicators used in the study.
- The results of the uncertainty and sensitivity analyses. This point is considered in the section on uncertainty.
- Evaluation of the significance of the differences found. This guidance does not recommend using weighting to produce a single factor. Instead, the LCA should discuss the relative importance of each indicator, considering their relative magnitude (e.g., using normalization) and the environmental priorities that the commissioner of the study has chosen to address. The values must also be presented in the context of the product system as a whole. For example, the impact of the packaging of passenger meals should be reported as a proportion of the total environmental impact of passenger transport. This will analyze the impact differently in relation to overall CO2 emissions reduction, for example, (negligible), compared to, say, waste generation and waste management impacts (large).

[5] One caution here is that certain material combinations (particularly bio-based polymers) may lack robust LCA data, and consideration of these materials may require assessment of additional indicators, such as carbon sequestration. Such considerations should be made on a study-specific basis, and any decisions should be clearly documented.
[6] UNEP has produced a briefing paper on the use and interpretation of LCAs aimed at policy makers. Please refer to [UNEP (2024) A policymaker's guide to lifecycle assessment.]

2.2. Scope definition

Following ISO 14044, the scope definition must clearly describe:

- the product system to be studied
- the functions of the product system or systems
- the functional unit and reference flow
- allocation procedures
- LCIA methodology and types of impacts
- interpretation to be used
- data requirements and data quality requirements
- assumptions
- value choices and optional elements
- limitations
- type of critical review, if any
- type and format of the report

The report should also set out the time period over which the study was conducted, and the time period and geography which it is intended to represent.

Many of these elements will be report-specific and can be left to the discretion of the research commissioners and LCA practitioners, which is essential if an LCA is to have the flexibility needed to answer a wide range of questions. Nevertheless, key recommendations for elements of the scope are set out in the following sections.

2.3. Functional units and reference flows

Comparisons must always be made on a like-for-like basis, or they become misleading. For this purpose, in the context of LCA, a standardized measure called a functional unit is identified. It describes the service provided by the system, such as passenger or freight transport over a certain distance.

The reference flow is the actual amount of goods or services needed to fulfill this function. It translates the functional unit into specific product flows. For instance, when assessing the environmental impact of providing passenger beverage containers across various airlines, the functional unit could be "providing beverages to passengers across the duration of one flight, per passenger-kilometer", and the reference flow would be the number and types of containers required to provide this service.

For this guidance, three relevant functional units and reference flows are considered, pertaining to passenger inflight food and beverage provision, passenger comfort items, and cargo wrapping.

2.3.1 Passenger inflight food and beverage provision

The function of cutlery is to convey prepared food from the food container to the passenger who consumes the food. To fulfill this function, the cutlery must meet acceptable quality thresholds and be hygienic, safe, and convenient to use.

The proposed functional unit is the provision of a meal container or cutlery services to one passenger across the full duration of a flight, per passenger-kilometer, in such a way as to meet all safety requirements associated with serving food and beverages on flights and to meet passenger expectations regarding quality of service.

The proposed reference flow is the quantity of cutlery or containers required to provide all meals to one passenger per passenger-kilometer across the full distance and duration of one flight.

To improve ease of comparison between different LCAs, where the LCA is intended to be published and made publicly available (e.g., in a journal article or a policy brief), it is suggested that the impacts are calculated for each of short, medium, long and ultra-long-haul flights, using the distance assumptions stated in Table 1.[7]

The number of meals served on flights of each duration will vary between operators and flight class and should be stated in the study.

Further default assumptions regarding flight distances and aircraft type that may be used to maximize the comparability of studies are given in Appendix 1. Note that these distances are not intended to reflect the activities of any given airline – they represent only default assumptions based on commonly used aircraft that can be used to compare multiple LCAs produced using this guidance. They are not intended to represent the mix of distances and aircraft types that an air operator would need to assess to make specific decisions. LCAs with this objective will require each airline to conduct its own research to identify the most appropriate values.

When comparing single-use items with reusable ones, the calculation of life cycle inventories (LCI) will require consideration of a number of trips equal to the expected number of uses to be obtained from the reusable item with the longest expected lifetime, expressed as a number of trips. For example, when comparing plastic single-use cutlery with reusable cutlery intended to fulfill twenty flights, the life cycle inventory of both single-use and reusable products should be calculated on the basis of twenty flights and divided by twenty to normalize to a single flight.

2.3.2 Items provided for passenger comfort

Comfort items, such as blankets and headphones, provide a range of functions, which can make defining a functional unit difficult. For the purposes of this guidance, the function is simplified and presented as providing passenger comfort functionality to passengers throughout a flight. To fulfill this function, items must meet specific requirements, including safety, convenience, and quality.

This alone does not constitute sufficient detail to define a functional unit. It will need to be defined on a product-specific basis as part of the study, depending on the particular passenger comfort function that is fulfilled (for example, providing access to audio in the case of headphones).

The proposed functional unit is the provision of the defined passenger comfort function to one passenger across the full duration of one flight per passenger-kilometer. For example:

- Headphones: providing passengers access to audio for inflight entertainment for the duration of one flight per passenger kilometer.
- Blanket wrapping: providing packaging and containment for one passenger blanket for the duration of one flight per passenger kilometer.

The proposed reference flow is the quantity of items required to provide this functionality to one passenger, per passenger-kilometer, across the full distance and duration of one flight, assessed across each of the flight duration scenarios outlined in Table 1.

2.3.3 Cargo wrappings

Cargo wrapping is used to cover and protect cargo both in flight and on-ground handling operations, preventing damage to the products being transported. It is also used in pallet build-up and to facilitate load consolidation. The most commonly used cargo wrappings are plastic sheeting (typically low-density

---

[7] **This is not a requirement, and LCAs concerned primarily with understanding the operation of a specific airline should place priority on accurately representing that operator's flight portfolio. Note, however, that the importance of fuel burn means that flight distance (expressed in km) of different flight durations must be accounted for the LCA to be valid.**

polyethylene [LDPE] film with fire retardant additives, used for weather protection and to protect the airframe from potential leakages) and stretch wrap (highly stretchable linear low-density polyethylene [LLDPE] film wrapped around items during pallet build-up to secure and protect them).

For the purposes of this guidance, the proposed function of cargo wrap is to consolidate, cover, and protect cargo in flight and during on-ground handling operations. Cargo wrapping must also meet all necessary ancillary functions typically associated with this product, such as being transparent and carrying labels to enable clear identification of the goods transported, handling instructions, etc.

The proposed functional unit is the safe transportation of one cubic meter volume of cargo throughout the duration of a flight, per 1,000 kilometers, plus loading, unloading, and handling operations at the airport (note that some plastic sheeting may be used for ground handling operations only, without traveling on the flight, and this should be considered as part of the product system).

The proposed reference flow is the quantity of cargo wrapping required to enable the safe transportation of one cubic meter of product over 1,000 kilometers (including all associated on-ground handling operations), assuming cargo is palletized or otherwise handed in units (e.g., AKE container).

Where average or default data are being used, results should be presented for the different flight distances (see Appendix 1).

The LCA should consider the entirety of the cargo wrapping used under each scenario. For example, an LCA comparing single-use versus reusable plastic sheeting, in a scenario where each would be used with single-use stretch wrap, should consider both the reusable and the single-use elements in both scenarios.

The LCA should be based on primary data pertaining to the types of ULD most commonly used by the airline, the quantity of each type of wrapping used to wrap each ULD, the cargo volume of the ULD, and the average laden weight of each ULD type. The table below provides recommendations for the maximum size and thickness of plastic sheets for cargo handling regarding different ULD types.

Table 1: Recommendations for plastic sheets for cargo handling.

Specification for ULD type	Max. size	Max. thickness
Main-Deck ULD	6.6 m x 5.85 m	0.05 mm
Lower-Deck ULD	5.59 m x 4.58 m	0.05 mm
AKE container (specific)	2.42 m x 2.06 m	0.05 mm

Source: IATA Cargo Handling Manual (ICHM). Chapter 9.

While cargo weight is not a determinant of the amount of cargo wrapping used, the weight of cargo transported is essential for the interpretation section, which requires impact data to be shown in the context of the impacts of the whole product system. This means that the impact of cargo wrapping and covers needs to be shown relative to the full impacts of air cargo transport, where fuel use will be significantly affected by weight.

When considering the quantity of wrapping used, IATA research sets a default assumption that cargo requires three layers of wrapping material (one layer of stretch wrapping and two units of plastic sheeting). Alternatively, airline or handler-specific data can be used to reflect their particular operational conditions and procedures, for example if they don't use any stretch wrapping in their operation. The use case for a reusable option will vary depending on its specific design and should be clearly outlined in the report.

As with the other item types, modeling of the lifecycle should consider the reusable option's expected lifetime (expressed as the number of uses). The number of trips modeled should be based on this. For example, when comparing single-use cargo wrapping with an alternative expected to provide five uses, the lifecycle should be modeled across five full flights before being normalized to the functional unit of one cubic meter of product per 1,000 kilometers.

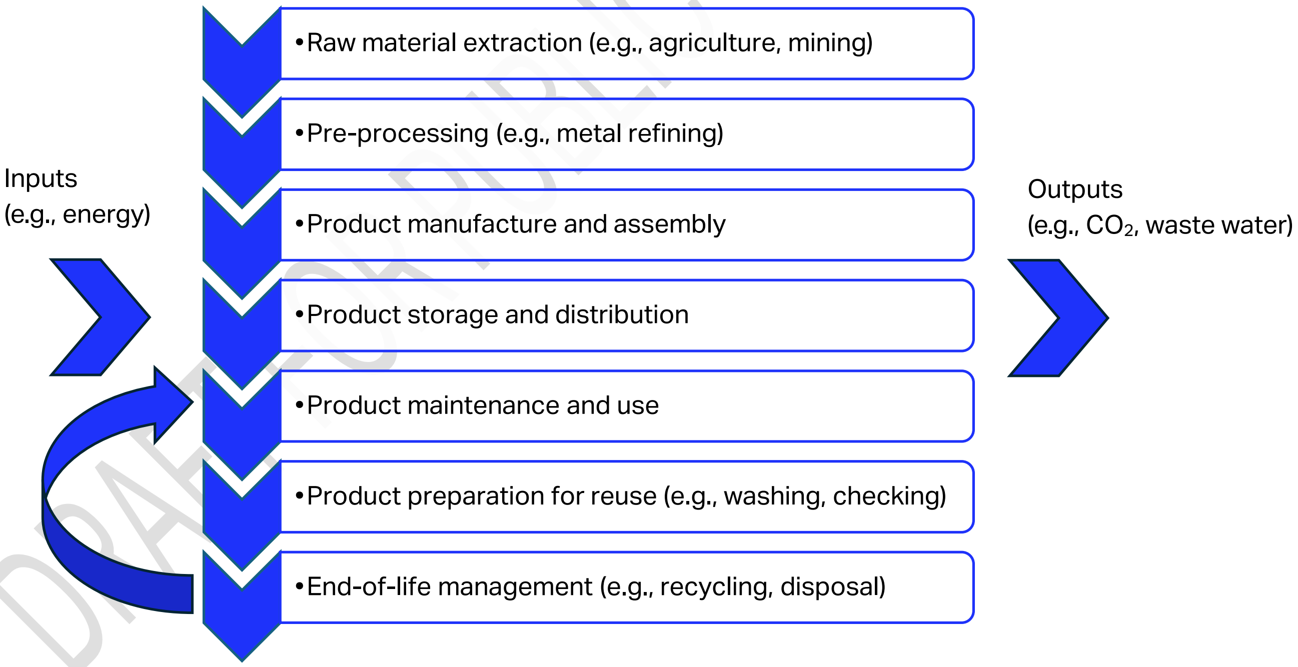
2.4. System boundary

LCA studies for aviation need to take the cradle-to-grave approach and fully account for use phase emissions.[8] The system boundary should therefore always include the following:

- Raw material acquisition and pre-processing
- Production of the main product
- Product distribution and storage
- Any washing, repacking, refurbishment, or reconditioning stages required before use or reuse of the product
- Product use stage
- Treatment and disposal of the product at the end-of-life

Cut-offs should not be used except in cases where a prior scoping LCA is conducted. The cumulative value of cut-off processes should not exceed 3% of the total material and energy flow, and processes subjected to cut-off should be explicitly identified, along with justification for the decision. Determination of whether a process or material or energy flow can be omitted under the cut-off rules should be based on a screening LCA conducted using data that are comparable based on product system, geography, and technological context.

Figure 1: Scope and system boundary.



Source: Adapted from IATA (2024).[9]

[8] IATA (2024). Reassessing single-use plastic products in the airline sector.
[9] Ibid.

2.5. Life cycle stages

2.5.1 Raw material acquisition and pre-processing

Includes the production and extraction of processed raw materials (through mining, drilling, forestry operations, refining or lumber operations, etc.), accounting where materially relevant for capital and operation services (e.g., mine construction and operation). Transport of the raw material to the place of production should be accounted for in this stage and may be reported as a separate stage or included in market data.

2.5.2 Product manufacture and assembly

Covers all activities from the factory gate to the production of the finished product ready for shipping. This stage includes the consumption of energy, water, and heat associated with the production of the product, along with construction, operational, and service activities (e.g., capital, factory operation, and transforming processes).

2.5.3 Product storage and distribution

Covers the distribution of the project to its place of use, storage, etc. Examples of processes in this part of the life cycle include:

- Transport and distribution from place of manufacture.
- Packaging and filling emissions (e.g., if ready meal trays are pre-packed and sealed).
- Storage emissions (e.g., refrigeration if items need to be stored chilled or frozen).
- Whether flights take off and land on each leg of the journey with the exact quantity of an item required or whether additional items are carried. This will affect emissions associated with non-flight transport and handling, and also use phase (fuel use) emissions.
- Whether any inflight or ground-side infrastructure is required to store and maintain the items prior to use or between use and disposal or preparation for reuse.
- Any distribution and transport emissions resulting from preparation for reuse (for example, if reusable items are backhauled in the aircraft hold for reconditioning at a base location).

2.5.4 Product maintenance and use

Impacts associated with the use phase of the product. Examples include:

- Fuel use during flights that is attributable to the product. In the absence of aircraft-specific data, this should be accounted for by using the marginal fuel burn rates given in Table 7 (Appendix 1). While the average rate is given as 0.02 – 0.03 kg fuel per 1,000 kilometers for every kilogram of additional weight, practitioners should refer to the distance-specific figures, as these take account of the differing proportions of fuel burn accounted for by climb.
- Heating or preparation emissions associated with food (if different between the compared products).
- Handling and wrapping emissions (if different between the compared products).
- Product wastage. If one option is likely to lead to an increase in product waste (whether of cargo in the case of cargo wrappings or wasted food in the case of food service containers), the likely extent of the wastage should be quantified, and the life cycle impacts of the wasted product accounted for. In cases where the container or wrapping might be used to protect a range of product types, empirical research should be conducted to establish a representative average mix and the average impacts presented. In this case, the study should also include separate results for each of the product types considered in constructing the average.

2.5.5 Preparation for reuse

Includes any processes associated with reuse, such as any washing, repacking, refurbishment, or reconditioning stages required before the reuse of the product. Example processes might include:

- Transport for off-site preparation for reuse, if relevant.
- In the case of reusable cargo sheeting, an additional step of inspection for dirt and tearing before washing, storage, and reuse might be included.
- Washing (including hot water, detergent, capital equipment, etc.).
- Refilling and repackaging of containers.
- Any additional redistribution required for reusable products, if required (as discussed in the distribution and storage section above).

The full life cycle of each product being considered should be modeled for a number of trips equal to the expected average trip lifetime of the product.

Box 2. Examples of the goal and context of the LCA study.	
Single-use item	**Reusable item**
Single-use plastic cutlery that is incinerated at end-of-life should be modeled through one use from raw material extraction to final disposal	An item with an expected average use life of twenty trips should be modeled through twenty full trips, which would include: ▪ 1 x raw material extraction and manufacture. ▪ 20 x use phases. ▪ 19 x preparation for reuse phases. ▪ 1 x end-of-life phase.

In cases where the expected number of trips is not known, the study should consult with stakeholders to establish the most reasonable value for the product type and conduct a sensitivity analysis to account for the uncertainty of the estimate.

The results for each product should be normalized for comparison by dividing the result by the number of trips considered.

2.5.6 End-of-life management

Waste treatment and disposal, including recycling, should be modeled using the average disposal mix across the geographical boundary of the study for aviation waste. For example, a study based on aviation within the EU should use the average EU mix for aviation waste based on empirical data (this could be operational waste management data or interviews with stakeholders in the geographies that the study is intended to cover). Note that, in most geographies, the default disposal mix found in life cycle databases should *not* be used, as the treatment and disposal mix is likely to be very different from the average mix for other waste types due to the high level of regulation of waste from international flights.

Other mixes may also be used as appropriate (e.g., a predefined end-of-life route in a study exploring the impact of different treatment scenarios). The mix of treatment and disposal scenarios should always be explicitly stated in the main body of the study.

2.5.7 Recycling

Recycling should be modeled using the cut-off method.

In the cut-off method, all the environmental impacts from making and using a material – such as extracting raw materials, processing them, manufacturing the product, and using it – are given entirely to the first product that uses those materials. If a product is then sent for disposal at end-of-life (i.e., if it is landfilled or incinerated, with or without energy recovery), the impacts of waste disposal are allocated to the product that is being disposed of.

If a product is recycled instead of thrown away, the product that is recycled takes on only the impacts associated with collecting and transporting the material to the point where it is recycled. The recycled material will then be used to make a new product. This new product will take on the environmental impacts of the recycling process itself, but it will not take on any of the impacts from the original raw material extraction or the earlier product's life.

Box 3. Example of the cut-off method using the case of a single-use plastic fork.

Process	Impacts from the following life cycle stages
Manufacture from virgin materials	Raw material extraction and processing Manufacture Distribution and use
Sent to landfill or incineration	Landfill or incineration at end of life (including transport)
Sent to recycling	Collection and transport to the recycling plant
Recycled plastic used to produce a new product	Recycling the plastic to produce the secondary raw material Manufacturing Distribution and use End-of-life (as appropriate, depending on whether it is landfilled, incinerated, or recycled)

One major advantage of the cut-off method is its relative simplicity. It does not require the LCA of a product to consider the life cycle impacts of previous or subsequent products generating or using the recycled material. Such an approach is easier to implement, simple to interpret, and reduces reliance on assumptions.

Behaviorally, this approach has the following implications:

- It incentivizes recycled content by reducing the product footprint in cases where recycled content has a lower environmental footprint than virgin material.
- It encourages reuse and recycling by avoiding or minimizing the burden of end-of-life processes (since the recycling process itself is allocated to products made from recycled material rather than items reaching end-of-life).
- When materials reach the end-of-life stage and are no longer suitable for recycling, it incentivizes disposal via the waste management route with the lowest footprint.

Practitioners may also wish to conduct a sensitivity analysis around the choice of allocation method using another approach (for example, the APOS or material quality/value methods). This is not mandated in this guidance but is recommended for compliance with ISO 14041.

2.6. Data sources and quality

2.6.1 Company-specific versus average data

Whether to use company-specific or average data for all of a study or for specific parts of the product system is a decision for those commissioning and conducting the study. It is dependent on:

- Availability of suitable published data.
- The cost and operational impacts of collecting company-specific data.
- Commercial sensitivity of company-specific data.
- The scope and intended use of the study.

The last of these is likely to be a key factor. For example, a study intended for internal use by an airline to inform a decision between two specific products is likely to benefit from the added specificity of company-specific data around product production and transport impacts, average flight length and fuel use, airport-specific waste management processes, etc. Conversely, a broader study comparing a range of reusable and single-use options intended for publication in a journal may benefit from the greater generalizability of average data. Those conducting an LCA should ensure that the data used have the most appropriate level of generality considering the intended use of the study. If averages are used, they should be representative of the geography and time period modeled, as inappropriate use of averages can undermine the credibility of the study.

2.6.2 Data transparency

Studies should be as transparent as possible and seek to publish all data used, including the unit process inventories for each process and the life cycle inventory for the whole study. It should be clearly stated where this has not been possible or appropriate and why. For example:

- Some data may be commercially sensitive or confidential
- Published data sets may be used under commercial licenses that pose restrictions on how much detail can be published around individual data points

2.6.3 Data quality

All data sources used in the study must be assessed for quality regarding:

- Reliability of the data source
- Completeness
- Temporal correlation
- Geographical correlation
- Technological correlation

Data should be assessed using a data quality matrix, scoring from Very Good to Very Poor, using the scoring criteria below. The data quality matrix assessment for all data sources must be included in the report. In cases where data are scored as poor or very poor, all reasonable attempts should be made to find an improved data source. If this is not possible, the limitations of the data should be made clear and sensitivity analysis conducted to assess the potential impacts of data quality on the result.

Data scoring should be carried out by the practitioner constructing the LCA. This can be beneficial in ensuring that robust sources are identified and used. The scores assigned should be reviewed as part of the critical review process.

Table 2: Data quality matrix

Indicator	Very good	Good	Fair	Poor	Very poor
Reliability (of the data source)	Verified data based on measurements	Verified data partly based on assumptions	Estimated data	Non-verified data	Unknown or very uncertain data
Completeness	Representative data for all regions and time periods	Representative data for most regions and time periods	Representative data for some regions or periods	Data gaps exist	Unknown completeness
Temporal Correlation	Less than 3 years difference	Less than 6 years difference	Less than 10 years difference	Less than 15 years difference	Unknown age or >15 years
Geographical Correlation	Data from the same area	Data from similar areas	Data from broadly similar areas	Data from distant areas	Unknown area or very different regions

Technological Correlation	Same technology	Similar technology	Broadly similar technology	Distantly related technology	Unknown or very different technology

Source: Green Delta.[10]

2.7. Sensitivity and uncertainty analysis

Any LCA conducted following this methodology and that is communicated to a third party must be accompanied by an analysis of uncertainty and sensitivity.

An uncertainty analysis must begin with a thorough review of the data quality matrix to ensure that all model assumptions and parameters are fully accounted for. Each data point should be accompanied by an estimate of uncertainty, whether based on sampling conducted when the data were collected or based on an estimate. If an estimate of uncertainty is not available with the data source, the LCA practitioner should note this explicitly and assign a level of uncertainty based on the data quality matrix.

Analysis of uncertainty must be accompanied by a sensitivity analysis of key parameters to determine how changes in these inputs affect the LCA results. This involves systematically varying key parameters within their plausible ranges and observing the impact on the outcome. This assists in identifying the most influential parameters and in prioritizing areas for further research and data collection.

For simplicity and ease of interpretation, this guidance recommends a one-at-a-time approach (varying each parameter individually throughout its potential range and reporting its impacts on the outcome) to the sensitivity analysis element of the study. Any parameters that are identified as both relatively uncertain and as having a significant effect on the final results should be clearly identified, and their potential impacts on the end result should be shown using the uncertainty ranges identified by the data pedigree matrix.

If additional robustness is required, the interaction of uncertainties may be explored by means of Monte Carlo simulation, propagating these uncertainties through the LCA model to provide a probabilistic distribution of the results. This is not a core requirement of this guidance but may be useful in cases where several uncertain parameters can significantly affect the results.

Box 3. Examples of key elements to consider for a sensitivity analysis when comparing reusable and single-use products.	
The type and quantity of material used to produce each product	This will be relevant when an LCA is intended to cover a broad class of products (e.g. single-use plastic versus reusable plastic cups) where there may be differences in polymer and item weight. A sensitivity analysis would explore the impact of material and design choice on the comparative assessment of the product options. This would not be relevant if the study intended only to compare two specific products of known design.
Use-phase emissions	Assumptions about the impact of a reusable option's extra weight on fuel consumption may be affected by the weight of the product, the aircraft model, the use of sustainable aviation fuel, etc.
The return rate and number of reuse trips achieved by the reusable option	This factor will be critical to establishing whether a reusable option (which may have a higher initial impact due to being designed for greater durability) will be reused enough times to break even. It should account for durability, loss, etc.

[10] Green delta (2013) Refining the pedigree matrix approach in ecoinvent: Towards empirical uncertainty factors **Green Delta (2013) Refining the pedigree matrix approach in ecoinvent.**

The reconditioning cycle for the reusable option	In the case of reusable cups, for example, it will be important to explore the model's sensitivity to assumptions around wash temperature, dishwasher fill level, detergent use, etc., as this will significantly impact the number of trips required for a reusable option to break even. Sensitivity analysis should also include variations in transport choices for reconditioning the items (e.g., whether reusable items are prepared for reuse on-site or transported back to a central location).
End-of-life treatment	The choice of disposal option at end-of-life (landfill, incineration, recycling) can make a significant difference to a product's life cycle impact and is materially relevant to the consideration of which product option is the most sustainable.

2.8. Impact categories

Any LCA should take care to account for as many materially relevant impact categories as is practicable, to produce a robust and unbiased assessment of the full range of environmental impacts. The precise choice of impacts to be used and the methods used to calculate these impacts will also depend to a large degree on the choice of LCIA method that is used. For example, work conducted within the European Union may wish to align with the EU Product Environmental Footprint (PEF) methodology, while work presented to the US Environmental Protection Agency (EPA) should use the TRACI LCIA method.

The precise choice of indicators is, therefore, left to the LCA practitioner to make based on the requirements of the study. To enable comparison, this guidance recommends a minimum set of mid-point indicators that should be included in all LCA studies conducted following this guidance. These are set out below in **Error! Reference source not found.**; these indicators should be supplemented with any other indicators needed to comply with a given LCIA method.

Table 3: PEF environmental impact categories with indicators and units.

Impact category	Impact category indicator	Unit
Climate change	Global warming potential, GWP100	kg CO_2 eq.
Ozone depletion	Ozone depletion potential, ODP	kg CFC-11 eq.
Human toxicity, cancer	Comparative toxic unit for humans (CTU_h)	CTU_h
Human toxicity, non-cancer	Comparative toxic unit for humans (CTU_h)	CTU_h
Particulate matter	Impact on human health	kg PM2.5 eq.
Ionizing radiation, health	Human exposure efficiency relative to U235	kBq U^235 eq.
Photochemical ozone formation, human health	Tropospheric ozone concentration increase	kg NMVOC eq.
Acidification	Accumulated exceedance (AE)	mol H+ eq.
Eutrophication	Accumulated exceedance (AE)	mol N eq.
Ecotoxicity	Comparative toxic unit for ecosystems (CTU_e)	CTU_e
Land use	Soil quality index	Dimensionless
Water use	User deprivation potential (deprivation-weighted water consumption)	m^3 water eq. deprived water
Resource use, minerals, and metals	Abiotic resource depletion (ADP ultimate reserves)	kg Sb eq.
Resource use, fossil	Abiotic resource depletion, fossil fuels (ADP fossil)	MJ

The LCIA often includes two additional stages: normalization and weighting to produce a single final score. Methods to achieve this vary between LCIA methods. Normalization can be conducted relative to annual average per capita impact in each impact area (i.e., normalized figures are person year equivalents) while weighting attempts to combine the measures based on a (necessarily subjective) assessment of priority to reach a single integrated value.

This guidance leaves the decision of whether to normalize the data to those commissioning and conducting the study. If normalization is adopted, the guidance recommends an approach based on person year equivalents as discussed above. The guidance does not recommend weighting indicators by priority, though calculation of a weighted score may be required if conducting the LCA following a methodology that requires this.

2.9. Interpretation

All LCA studies should include a section dealing with the interpretation of the findings. This should include a discussion and comparison of the indicator results regarding their relevance and materiality.

Normalization might be used here to enable the different indicators to be expressed in a common unit (for example, person year equivalents) to facilitate the comparison of impacts.

Discussion should also cover the materiality of impacts on the context of the wider product system being discussed. For example, as noted above, cutlery and food container provision may make a significant difference to the amount of waste generated by a flight but are likely to have a negligible relative impact on the greenhouse gas impacts of a flight when compared with flight distance, fuel type, passenger number, etc. It is important to present these relative comparisons. It is therefore strongly recommended that each LCA includes tables or figures that express the impacts of the product system under investigation (e.g., cutlery, cargo wrappings) for each of the impact areas included in the study relative to the impact of the whole flight. This is essential to maintain transparency around the relative impact of the product system under investigation in the wider context and helps to ensure that the study is used appropriately to inform decision-making.

The interpretative section might also be used to provide a more discursive overview of the findings aimed at a less technical audience. LCA requires detailed technical reporting with an emphasis on quantitative analysis that may not always be readily accessible to decision-makers who may not be able to spend sufficient time to examine the technical details. An accessible summary that presents the key findings in broader terms (for example, placing more emphasis on the decision context and on end-point indicators) can make the document more useful and impactful, though care should be taken to ensure that this simplification does not introduce bias.

2.10. Peer review, governance, and transparency

All studies should be conducted to maximize the transparency of the outputs. Transparency in this case means that the scope and system boundaries should be clearly stated that data should (so far is practicable given reasonable considerations of commercial confidentiality or licensing arrangements) be publicly disclosed, and that a log should be kept of any important decisions, especially any decisions that may have led to an adjustment of the parameters of the study. Useful guidance on these points may be found in ISO 14040 and in the UNEP's "A Policymakers' guide to Life Cycle Assessment"[11].

This last is important – producing an LCA is an iterative process; it may make sense to change some aspects of the study design as new data and findings emerge, but any *post hoc* selection of criteria runs a risk of introducing bias into a study. For example, a study might determine following a scoping LCA that a given impact measure not previously considered is likely to be materially relevant. Under such circumstances, it is appropriate to make such changes, but it is important to log them as changes to reduce any risk or perception of bias.

The requirements for critical review are set out in Chapter 6 of ISO 14044. While critical review is not a requirement of all LCA studies (it is a requirement for any study intended to make comparative assertions that

1. [11] UNEP (2024). A Policymakers' guide to Life Cycle Assessment.

will be disclosed to a third party), it is highly recommended that all LCAs contain some element of internal or preferably external peer review.

A review should address the following requirements.

- The methods used to conduct the LCA are consistent with the standards set out in ISO14044
- The methods used are scientifically and technically valid
- The data used are appropriate considering the goal of the study
- The limitations of the study are clearly declared
- The interpretations are reasonable and take due account of the limitations of the study
- The study report is transparent and consistent

This guidance recommends that all reports should be subject to peer review, and that the report should contain a peer review statement from a named peer reviewer. LCAs that are intended for publication and that make comparative assertions should be reviewed by a panel of relevant stakeholders, including experts on LCA and on the sector studied; care should also be taken to ensure that the panel is not biased (for example, inclusion of a representative of a single-use product manufacturer with no equivalent representation from the reusable equivalent in an LCA comparing a single-use and a reusable product). Where a study has been peer reviewed by a panel, it is acceptable to provide a single agreed statement from the panel; however, if this agreement is not unanimous, dissenting panel members should be allowed to produce an alternative statement, which should be published as part of the report. This helps to ensure that the research has been conducted to an appropriate standard and improves confidence in the findings.

It is recommended, wherever possible, that the peer reviewer be recruited early in the study. This allows for a timely review and, if necessary, adjustment of the proposed scope and system boundaries before work commences. While it is essential that the peer reviewer retains independence from the study, to produce an objective assessment of the outputs, engagement with the reviewer at key points can provide access to additional expertise and ensure that the research remains on track – this is far preferable to a reviewer standing in judgment over a study that has gone awry.

3. COMPLIANCE WITH THIS GUIDANCE

It is recommended that a compliance statement be included in the interpretation section of the report where this guidance has been used. This section should clearly set out any cases where the study methodology has departed from the guidance and the justification for this departure. Including such a section will improve the transparency of studies and make it easier for readers to assess the applicability and comparability of study outputs.

Table 5 below sets out the essential requirements for LCA studies under this guidance. In the case of third-party studies intended for publication, all these requirements must be met in full before the study is published. Note that published third-party reports can be based on study documentation that confidential information that may not be included in the third-party report. In such cases, it is good practice to state clearly what data has been redacted and why.

Table 4: Summary of key requirements for LCA studies.

Criteria	Report not published – internal use only	No Comparative Assertions - Published	Comparative Assertions - Published
Reason for the Study	Clearly state the purpose, intended audience, and decision context.		
Scope and System Boundaries	Clearly delineate system boundaries, including functional units and processes.	Align with ISO 14000/14040 requirements for third-party reports (Section 5.2). Include boundaries, assumptions, and exclusions.	Align with ISO 14040/14044 requirements for third-party reports (Section 5.2) and comparative assertions (Section 5.3) to ensure equivalent system boundaries for compared systems.
Life Cycle Impact Assessment (LCIA)	Provide characterization of life cycle impacts using relevant methods.	Include LCIA results in line with recognized methodologies.	Ensure inclusion of all material impact categories.
Data Quality Assessment	Assess data quality using a data quality matrix (ISO 14044 Annex D).	Include detailed data quality assessment, documented in the report.	Include data quality assessment and uncertainty analysis, as per ISO 14044 Section 4.2.3.6.
Uncertainty and Sensitivity Analysis	Optional but recommended where data limitations exist.	Mandatory: conduct sensitivity analysis to assess key assumptions.	Mandatory: conduct uncertainty sensitivity analysis of key parameters.
Interpretation of Results	Provide discussion of LCIA results, relevance, and materiality. Highlight limitations.	Provide interpretation of results, including completeness, consistency, and relevance.	Critical discussion of relevance, materiality, limitations, and significance of differences found.
Peer Review	Strongly recommended (internal review acceptable).	Independent critical review by a named external reviewer. Publish peer review statement.	Critical review by an expert panel to avoid bias. Dissenting views must be documented.
Transparency and Justification	Document limitations and decisions made during the study.	Explicitly document changes to scope, assumptions, and methods, along with justification.	Fully document changes to scope, assumptions, methods, and justification for critical decisions.
ISO Compliance	Not required but should aim to align with ISO 14040/14044 best practices.	Must comply with ISO 14040 Section 5.2 for third-party reporting.	Must comply with ISO 14040 Sections 5.2 and 5.3 for comparative assertions disclosed to the public.

4. GLOSSARY

Cradle-to-Grave - A full life cycle approach in LCA that includes all stages from raw material extraction (cradle) to disposal or recycling (grave).

Cut-Off Rules - Guidelines used to exclude inputs or outputs from an LCA study if they are below a specified threshold, such as 3% of total material or energy flows.

End-of-Life - The final stage in a product's life cycle, which involves waste treatment options such as disposal, incineration, or recycling.

End-point indicator - In LCIA, an indicator that maps from one or several mid-point indicators to a final impact defined in terms of damage in a specific area. Examples might include human health or environmental quality.

Equivalent Still Air Distance (ESAD) - The horizontal distance an aircraft would travel in still air (i.e., with no wind effect) under actual conditions of flight. ESAD accounts for real-world atmospheric factors such as wind, making it a standardized measure for comparative flight distance.

Functional Unit - A quantified description of the primary function or service provided by a product system, used as the basis for comparison in an LCA study. For example, "the provision of cutlery services for one passenger on a flight."

Impact Categories - Environmental impacts assessed in the LCIA phase of LCA, such as climate change or resource depletion, using characterization models to quantify impacts. These are often divided into mid-point indicators and end-point indicators.

Life Cycle Assessment (LCA) - A systematic method to evaluate the environmental impacts of a product, process, or service throughout its life cycle, from raw material extraction (cradle) to end-of-life disposal (grave).

Life Cycle Impact Assessment (LCIA) - The phase of LCA that evaluates potential environmental impacts using indicators such as global warming potential, water use, or human toxicity. LCIA translates emissions and resource use into impacts.

Life Cycle Impact Assessment Method - A methodology used within the Life Cycle Impact Assessment (LCIA) phase of an LCA. It provides the characterization models and impact categories used to assess environmental burdens. Examples include TRACI (Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts) and ReCiPe.

Life Cycle Inventory (LCI) - The phase of LCA where inputs (e.g., materials, energy) and outputs (e.g., emissions, waste) are quantified for each stage of the product life cycle.

Marginal Fuel Burn - The incremental increase in aircraft fuel consumption caused by additional weight, often expressed as kilograms of fuel per kilometer per kilogram of added load.

Mid-point indicator - A measure used in LCIA that quantifies environmental impacts at an intermediate stage in the cause-effect chain, such as global warming potential (GWP) or acidification, without linking to final damage.

Normalization - A technique in LCIA where impact results are scaled against a reference value, such as the average annual environmental impact per capita, to provide a relative comparison across impact categories.

Person year equivalent - An approach to normalization that expresses each environmental impact indicator as a proportion of the emission of an average human being's impact across one year.

Product Environmental Footprint (PEF) - A standardized method for assessing the environmental performance of products and services across their life cycle, developed under the European Commission framework.

Recycling - The process of collecting, processing, and converting used materials into new products, thereby reducing the need for virgin raw materials and minimizing waste disposal.

Reference Flow - The measurable amount of goods or services necessary to deliver the defined functional unit. For example, the quantity of cutlery needed for a single passenger over the duration of a flight.

Reuse - The practice of using a product more than once, for the purpose for which it was originally intended. Reuse often involves ancillary processes such as inspection, cleaning, refurbishment, or repair.

Sensitivity Analysis - A method to determine how variations in key assumptions or parameters (e.g., weight, return rate) affect the outcomes of an LCA study.

Single-Use Plastic Product (SUPP) - An item made primarily from fossil fuel-based chemicals (petrochemicals) and designed for one-time use, after which it is disposed of or recycled. Examples include single-use plastic cutlery, bottles, and cargo wrapping.

System Boundary - The set of criteria defining which life cycle stages, processes, and flows are included or excluded in an LCA study. For aviation, this typically includes cradle-to-grave analysis, covering raw materials to disposal.

Unit Load Device (ULD) - A device for grouping and restraining cargo, mail, and baggage for air transport. It is either an aircraft container or a combination of an aircraft pallet and an aircraft pallet net.

Weighting - The process of assigning importance to impact categories in LCIA, often based on policy or stakeholder priorities, to produce a single aggregated score.

5. Appendices

Appendix 1: Default flight assumptions

This appendix aims to provide useful default assumptions on standardized flight distances, aircraft types, and marginal fuel burn to improve comparability across different LCAs. The information presented in these tables is solely for the purpose of providing a set of general-purpose values that will allow LCAs to be more easily compared.

Note that company-specific or region-specific data may be more appropriate for any given study, and there is no requirement to use these defaults if more appropriate data are available.

Table 5: Default flight distances per flight duration.

Flight duration	Range (km)	Mid-point for modeling (km)
Very short haul	< 500	250
Short haul	500 – 1,500	750
Medium haul	1,500 – 4,000	2,800
Long haul	> 4,000	7,400
Ultra long haul	N/A	12,000

Source: Eurocontrol and Wilkerson et al. (2010).[12]

Table 6: Assumptions around flight distance.

Distance	Aircraft †	ESAD (km)	Passenger loading ‡	Cargo loading ††	Flight time (hours) ‡‡	Taxi time in (min) ‡	Taxi time out (min) †††
Short haul	B737	750	82%	47.3%	1.5	5	10
	A320	750	82%	47.3%	1.5	5	10
Medium haul	B737-900ER	2,800	82%	47.3%	4	5	10
	A321neo	2,800	82%	47.3%	4	5	10
Long haul	B777	7,400	82%	47.3%	9.5	5	10
	A350	7,400	82%	47.3%	9.5	5	10
Ultra long haul	B777	12,000	82%	47.3%	15.5	5	10
Ultra long haul	A350	12,000	82%	47.3%	15.5	5	10

† Which Planes Are Used for Short, Medium, and Long Haul Flights? - Aviation for Aviators
‡ 08-A/C ANALYSIS-feature (aircraft-commerce.com)
†† https://www.iata.org/en/pressroom/2024-releases/2024-12-03-01/
‡‡ Provisional figure based on WRAP review of flight times at: Flight Time and distance between airports - Flight Math
††† https://www.eurocontrol.int/publication/taxi-times-winter-2019-2020

[12] **Wilkerson et al. (2010).** Analysis of emission data from global commercial aviation: 2004 and 2006.

The table below shows the impact of 1 kilogram of additional (or reduced) weight on marginal fuel burn (kg fuel/kg payload) for a range of flight scenarios. It is intended to be used when considering the impact of differing product weights on the use-phase impacts of products.

Table 7: Assumptions on marginal fuel burn.

Aircraft	2,000km	4,000km	5,000km	7,000km	12,000km
A320-200	0.07	0.12	0.16		
A330-300	0.05	0.08	0.11	0.18	
A380-800	0.10	0.17	0.18	0.26	0.45

Source: Steinegger, R (2017). [13]

[13] **Steinegger, R. (2017)** Fuel Economy as Function of Weight and Distance.

Appendix 2: Resources

This section includes a number of resources that may be of use when constructing an LCA following the recommendations of this guidance. Of the sources below, the first two – the ISO standards – are essential documents. The guidance in this document does not substitute for fulfilling the core requirements of the standard and in any situation where this guidance might conflict with the standards, the ISO standards should be given precedence.

These resources make no attempt to be comprehensive. In particular, many jurisdictions have their own required LCA methodologies, LCIA methodologies or region-specific LCI datasets. Identifying and using the correct methodology and datasets is the responsibility of the parties conducting the LCA and it is advisable to consult with the regulatory authorities in the region where the LCA is to be conducted.

ISO 14040: Life cycle assessment: principles and framework[14]

This standard provides the principles and framework for conducting Life Cycle Assessment (LCA), including goal definition, scope, inventory analysis, impact assessment, and interpretation. It ensures consistency, transparency, and scientific validity in environmental assessments. ISO14040 is an essential basis for any LCA and the guidance in this document does not substitute for fulfilling all of the core requirements of the standard.

ISO14044: Life cycle assessment: requirements and guidelines[15]

ISO14044 specifies the detailed requirements and guidelines for LCA, including methodological choices, data quality, reporting, and critical review processes. It aims to ensure a robust and comparable assessment of environmental impacts across product life cycles. ISO14044 is an essential basis for any LCA and the guidance in this document does not substitute for fulfilling all of the core requirements of the standard.

UNEP (2024) A policymaker's guide to lifecycle assessment[16]

This document provides useful advice on reviewing studies to ensure adherence to recognized standards, goal and scope alignment, comprehensiveness and critical review and transparency. It is recommended that any LCA intended for communication to regulators or policymakers should follow this guidance, but the guidance has further application and should be considered best practice for any study intended for communication to third parties.

Life Cycle Thinking e-learning courses[17]

The Lifecycle Initiative have developed three introductory level courses aimed at addressing lifecycle assessment and lifecycle thinking from the perspective of businesses and governments. These courses cover:

- An introduction of lifecycle thinking.
- Lifecyle thinking in business decision making.
- Lifecycle thinking in policy making.

[14] **ISO 14040:2026.** Environmental management — Life cycle assessment — Principles and framework.
[15] **ISO 14044:2006.** Environmental management — Life cycle assessment — Requirements and guidelines.
[16] **UNEP (2024)** A policymaker's guide to lifecycle assessment.
[17] **LCI.** Life Cycle Thinking e-learning courses.

Product Environmental Footprint (PEF)[18]

Developed by the European Commission, PEF is an LCA methodology for measuring the environmental performance of products throughout their life cycle. It aims to standardize and improve comparability of environmental assessments across industries.

Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI)[19]

Developed by the U.S. EPA, TRACI is an LCIA methodology for characterizing environmental impacts, including global warming, acidification, and ecotoxicity. It is widely used in LCA and sustainability assessments in the U.S.

Global Guidance on Environmental Life Cycle Impact Assessment Indicators (GLAM)[20]

Currently being developed by the Life Cycle Initiative under UNEP, the GLAM project aims to provide a globally harmonized framework for Life Cycle Impact Assessment (LCIA). It integrates regionalized and sector-specific data to improve environmental impact modeling. The method aims to enhance decision-making by offering science-based end-point indicators for climate change, biodiversity, human health, and resource depletion. It supports global sustainability goals by improving the consistency and accuracy of LCA results.

[18] European Commission. European Platform on LCA | EPLCA. Environmental Footprint.
[19] United States Environmental Protection Agency. Tool for Reduction and Assessment of Chemicals and Other Environmental Impacts (TRACI).
[20] European Commission. European Platform on LCA | EPLCA. Global Guidance on Environmental Life Cycle Impact Assessment Indicators (GLAM).