Aerospace Industry Tool for Calculating Scope 3 Greenhouse Gas Emissions of Purchased Goods & Services and Capital Goods: Methodology

24 July 2025

Version **3.0**

This document is released for purpose of supporting voluntary accounting and reporting of greenhouse gas (GHG) emissions associated with purchased goods and services and capital goods across the aerospace industry.

Version History

Date	v#	Modified By	Section, Page(s) and Text Revised
24/07/2025	3	Accenture & IAEG WG3 Members	Entire document revised

Table of Contents

DISCLAIMER

THIS DOCUMENT IS NOT A STANDARD. IT IS NOT INTENDED TO, NOR SHOULD IT BE USED TO SUPPORT A CAUSE OF ACTION, CREATE A PRESUMPTION OF A BREACH OF LEGAL DUTY, OR FORM A BASIS FOR CIVIL LIABILITY. NOTHING EXPRESSED OR IMPLIED IN THIS INFORMATIONAL DOCUMENT IS INTENDED, OR SHALL BE CONSTRUED, TO CONFER UPON OR GIVE ANY PERSON OR ENTITY ANY RIGHTS OR REMEDIES UNDER OR BY REASON OF THIS INFORMATIONAL DOCUMENT.

THIS DOCUMENT IS PROVIDED BY THE INTERNATIONAL AEROSPACE ENVIRONMENTAL GROUP (IAEG) FOR INFORMATIONAL PURPOSES ONLY. DETERMINATION OF WHETHER AND/OR HOW TO USE ALL OR ANY PORTION OF THIS DOCUMENT IS TO BE MADE IN YOUR SOLE AND ABSOLUTE DISCRETION. RELIANCE SHOULD NOT IN ANY WAY BE PLACED ON THIS DOCUMENT FOR ISO CERTIFICATION OR OTHERWISE. NO PART OF THIS DOCUMENT CONSTITUTES LEGAL ADVICE. USE OF THIS DOCUMENT IS VOLUNTARY.

IAEG DOES NOT MAKE ANY REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THIS DOCUMENT OR ITS CONTENTS. IAEG HEREBY DISCLAIMS ALL WARRANTIES OF ANY NATURE, EXPRESS, IMPLIED OR OTHERWISE, OR ARISING FROM TRADE OR CUSTOM, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, NONINFRINGEMENT, QUALITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE, COMPLETENESS OR ACCURACY. TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAWS, IAEG SHALL NOT BE LIABLE FOR ANY LOSSES, EXPENSES OR DAMAGES OF ANY NATURE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, PUNITIVE, DIRECT, INDIRECT OR CONSEQUENTIAL DAMAGES OR LOST INCOME OR PROFITS, RESULTING FROM OR ARISING OUT OF A COMPANY'S OR INDIVIDUAL'S USE OF THIS DOCUMENT, WHETHER ARISING IN TORT, CONTRACT, STATUTE, OR OTHERWISE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

1. Glossary

Acronym	Definition
ADEME	Agence de l'Environnement et de la Maîtrise de l'Energie
A&D	Aerospace and Defense
CG	Capital Goods
CtG	Cradle-to-Gate
DoD	US Department of Defense
EIO-LCA	Economic Input-Output Life Cycle Assessment
EEIO	Environmentally Extended Input Output
EF	Emission Factor
GHG	Greenhouse Gases
GHGP	GHG Protocol
GtG	Gate-to-Gate
kgCO_2e	Kilograms of CO_2-equivalent
k$	1000 US dollars
k€	1000 euros
LCA	Life-Cycle Analysis
NAICS	North American Industry Classification System
PG&S	Purchased Goods & Services
tCO_2e	(metric) tons of CO_2-equivalent
USEEIO	United-States Environmentally Extended Input-Output model

2. Executive Summary

As described in "GHG Reporting Guidance for the Aerospace Industry, A Supplement to the GHG Protocol Corporate (Scope 1 and 2) and Value Chain (Scope 3) Accounting and Reporting Standards", the International Aerospace Environmental Group (IAEG) identified that both "Purchase of Goods and Services" (PG&S) and "Capital Goods" (CG) categories are potentially relevant as Scope 3 categories.

As for other potentially relevant categories, IAEG decided to develop relevant methodology and guidance materials to allow the aerospace companies to report greenhouse gas (GHG) emissions for these categories.

This methodology document is meant to complement the user guide by providing additional supporting information. The document highlights the context and purpose of the work as well as the criteria used to build the tool and to select the databases. It also elaborates on the proxies used for each subcategory of products and helps the user get a sense of the results' level of uncertainty. In sum, it will help users who wish to improve their understanding of the reasoning behind the methodology or who might have additional questions.

This document also includes all relevant information for updating the tool and maintain the methodology up to date as newly information becomes available.

3. Acknowledgements

Accenture: Adélaïde Pin, Alice Poletti and Thibaut Perchet

IAEG Work Group 3 - Greenhouse Gas Management and Reporting:

- Audrey Uguen
- Pedro Soares
- Matthew Payne
- Mau Nguyen
- Guillaume Oberlaender
- David Valo
- Gilles Bacquet
- Rebecca Bergkamp

4. Context and Purpose

4.1 Context and Purpose

Corporate disclosure of Greenhouse Gas (GHG) emissions has garnered increasing momentum over the years due to a convergence of regulatory requirements, public pressure, and investor concerns over the impact of climate change-related risks on corporate performance. With most publicly listed companies already disclosing Scopes 1 and 2 emissions on a regular basis, attention is turning towards Scope 3 emissions disclosure.

There are multiple reasons to justify this shift. Scope 3 emissions often represent the largest part of a company's carbon footprint and can account for up to 90%[i] of its total emissions. Organizations are exposed to a multitude of carbon constraints and risks along their entire value chain, each potentially impacting long-term returns.

Recent studies provided hard evidence to support the idea that Scope 3 emissions may turn out to be a more powerful indicator of a company's resilience and preparedness than Scopes 1 and 2 emissions. As a result, investors' focus is shifting to ensuring that relevant Scope 3 emissions information becomes available. Furthermore, under evolving regulations such as France's disclosure requirements and the EU's CSRD, reporting on significant Scope 3 categories is increasingly becoming mandatory. Companies that proactively calculate and disclose their Scope 3 emissions send a strong signal of transparency and readiness, positioning themselves ahead of regulatory and market expectations.

IAEG Work Group (WG3) has a mandate to address the issue of GHG accounting and reporting by aerospace companies. Its objective is to promote these practices and bring consistency across the industry. The first deliverable from this group is the GHG Reporting Guidance for the Aerospace Industry – A Supplement to the GHG Protocol Corporate Accounting and Reporting Standard[ii]. This guidance provides a common framework of guidelines, methodologies, vocabulary, and relevant recommendations for GHG accounting and reporting to promote consistent, complete, and accurate reporting across the aerospace industry. It also identifies the relevant Scope 3 categories for the aerospace sector.

In the aerospace and defense industry, both "Purchase of Goods and Services" and "Capital Goods" categories are among the most material Scope 3 categories. The actual document describes the methodology developed for assessing GHG emissions associated with PG&S and CG. An Excel tool and a user guide to facilitate the implementation of calculations are provided separately.

4.2 Main objectives of the methodology

The aim of the methodology development process was to find the best balance between the following key elements:

- **Reliable** emission factors and, if possible, regional differentiation.

- Fully **applicable** to the aerospace sector.
- As **robust** as possible.
- As **simple** as possible.
- As **accurate** as possible.
- **Compatible** with the technical capabilities of IAEG members.
- As **transparent** as possible.
- Based on recognized **standards**.
- Free of intellectual property rights.

A thorough review of design recommendations performed in Phase 2 led to the identification of the requirements presented in Table 1.

#	Topic	Requirements for phase 3
1	Emission factors	1.1 Use publicly available Emission Factors (EF), whenever available
		1.2 Priority given to public EF originating from key areas such as the EU and the US. When easily available, integrate EF from China, India, Brazil, Mexico, Japan.
		1.3 Enable the use of supplier specific LCA data if available, under restrictions
		1.4 Provide steps and requirements for integrating new EF
2	Resources	2.1 Enable users to estimate the order of magnitude through simple calculations requiring less than a week of work.
		2.2 The initial accounting should require less than a week using the spend-based approach and up to a few months using the mass-based approach.
3	Accuracy vs. Simplicity	3.1 Maintain coherence across all three approaches.
		3.2. Favor simplicity over accuracy. Strive to provide a good order of magnitude as a starting point and provide options to increase accuracy for those who wish to and can do so.
		3.3 Sectorial Aerospace & Defense (A&D) agreed purchasing categories reflecting the spend-based categories.
		3.4 A mass-based approach as auditable as possible.

4	Standards	4.1 Absence of conflict with ISO14064-1[iii] and the GHG Protocol[iv,v].
5	General approach	5.1 Define the spend-based approach as the default option to help newcomers get started with scope 3 accounting. Provide detailed guidelines on how to obtain and categorize datasets for PG&S.
		5.2 Satisfy the needs of all members of the IAEG community using a multi-level approach.
		5.3 Define an approximate level of accuracy for each approach.
		5.4 Provide mass-based datasets for those who seek more accurate results.
		5.5 Present the pros and cons of each approach, focusing on ease of use, accuracy, time, and resources.

Table 1 - Requirements used in the conception of methodology

5. Emission factors Database

5.1 Emission factor databases selection criteria

The following criteria were used to select the EF databases:

- Whenever possible, use **public sources**
- Whenever possible, use **cradle-to-gate EF**
- Databases **updated** within the last 5 years when possible
- **Geographical scope**: USA, Canada, Europe, or China
- **Environmentally Extended Input-Output** (EEIO) tables for spend-based approach.

Publicly available EF: An important database criterion for IAEG was the free access to the EF to ensure that no copyright limitation would constrain the use of its tool in years to come. The main drawbacks, however, are a lower number of suitable databases as well as older EF being accessible.

Cradle-to-gate EF: Cradle-to-gate EF encompass all the emissions from raw material extraction to the delivery of the material/part/system. Using such factors increases accuracy and robustness and reduces the risk for incomplete factors. The main challenge is that these EF tend to be disseminated in the literature and are not always public.

Up-to-date EF: The most recent EF were selected to account for up-to-date industrial processes, realistic electricity emission factors, and to limit corrections due to inflation.

Geographical standpoint: EF may vary by location due to a multitude of factors such as the predominant energy sources of a given country. To increase accuracy, the tool proposes, when possible, EF at world, country level and/or at regional level. This new released version enables the user to chose for one selected EF the associated location between 1, 2 or 3 regions when available.

EEIO tables: These databases allow for simple and quick access to sets of spend-based EF for numerous economic sectors and subsectors. Their accuracy is relatively low because the EF are aggregated.

None of the identified database could meet all the criteria mentioned in Table 1. In the public field, several databases seemed to match the cradle-to-gate criterion. Their age or geographical scopes were heterogeneous. For this updated methodology, we use twenty-one suitable databases:

- AusLCI (Australian National Life Cycle Inventory Database)
- BAFA (German Federal Office for Climate Action)
- Base Empreinte (ADEME)
- BEIS; DEFRA (UK Government GHG reporting organisation)
- CAEP (Chinese Academy of Environmental Planning)
- California Metals (California Government Emission Inventory Data)
- CBAM (European Union's Carbon Border Adjustment Mechanism)
- CCF (Cloud Carbon Footprint)
- Climate Trace (Initiative for Tracking Real-Time Atmospheric Carbon Emissions)
- CO2 Emission Factoren (Belgium & Netherland Emission Factors resources)

- EPA (US Government GHG emission factors provider)
- Exiobase (Multi-Regional Environmentally Extended Supply-Use Table for estimating emissions and resources extractions by industry)
- France Strategie (French minister for Climate Action)
- GEMIS (Global Emission Model for Integrated Systems)
- ICE DATABASE (Energy and emission factors resource)
- LCA Report (International Zinc Association – LCA Emission factors resource)
- Market Economics Limited (New Zealand Consultancy for Environmental Resources)
- Nickel institute (LCA and Emission factors resource)
- OEKOBAUDAT (German Ministry for extensive database EF for construction)
- Open IO Canada (EEIO to estimate LCA impacts of products in Canada)
- PCAF (Partnership for carbon accounting financials)
- SEFR (Initiative led by Singapore Business Federation consolidating EF across sectors)

5.2 Emission factor databases selection overview

Since no single database meets all criteria for every category, several databases were used, as presented in Table 2:

Databases or Source	Type of EF		Geography	Last update	Source
	Mass-Based	Spend-Based			
AuslCI	x		Australia	2023	AusLCI
BAFA	x		Germany	2025	BAFA
Base Empreinte	x	x	France / Europe	2024	ADEME
BEIS	x	x	UK	2024	BEIS
CAEP	x		China	2022	CAEP
California Metals	x		USA	2024	GHG
CBAM	x		USA & Europe	2024	CBAM
CCF	X		USA	2022	CCF
Climate Trace	X		Europe	2022	TRACE
CO2 Emission	X		Netherlands	2024	CO2
EPA		x	USA	2024	EPA
Exiobase	x	x	USA & Europe	2021	Exiobase
France Strategie	x		France	2020	France
GEMIS	x		Germany	2021	GEMIS
Ice Database	x		Global	2024	Database
IZA LCA	x		Europe	2021	IZA
Market Eco Limited		x	New Zealand	2023	MEL
Nickel Institute	x		USA	2024	Nickel
Oekobaudat	x		Germany	2024	Oekobaudat

Open IO		x	Canada	2024	OpenIO
PCAF	x		France	2023	PCAF
SEFR	x		Singapore	2024	SEFR

Table 2: Summary of the databases used in the methodology

6. Approaches

6.1 Spend-Based Approach

The inputs needed to use this approach are annual spend data for the relevant sub-category. This information is combined with spend-based EF which is embedded in the tool. The spend-based approach granularity is relatively low.

For all categories, emissions are estimated using the equation below:

Subcategory Emissions (tCO_2e) =
Subcategory expenses (k$, kCAD, kNZD or k€) × Subcategory EF ($kgCO_2e$/ k$, kCAD, kNZD or k€) / 1000

The conversion tab is updated to consider inflation and currency rate from 2000 to 2024 to apply to spend-based approach emission factors.

6.2 Hybrid-Based Approach

The hybrid-based approach is a combination of mass-based approach and spend-based approach. It therefore applies in the case when the mass breakdown is partially known. Therefore, it still allows the estimation of emissions from products for which some material breakdown is missing.

When the material breakdown is known, the following equation is used:

Subcategory emissions (tCO_2e) =

$$\sum_i \sum_j Units\ of\ products\ \boldsymbol{i}\ bought \times Mass\ of\ material\ \boldsymbol{j}\ in\ product\ \boldsymbol{i} \times material\ \boldsymbol{j}\ EF\ / 1000$$

For other products with unknown material breakdowns, the same equation as the spend-based approach is used.

Subcategory emissions (tCO_2e) =

Subcategory expenses (k$ or k€) × Subcategory EF ($kgCO_2e$/k$ or k€) / 1000

The hybrid approach proposes a higher number of subcategories and therefore it provides a higher resolution than in the spend based approach.

6.3 Mass-Based Approach

The mass-based approach uses a mass-based EF for most of the purchased products, hence providing the most granular and accurate reporting of all approaches. For products with a known mass breakdown, the following equation is used:

Subcategory emissions (tCO_2e) =

$$\sum_i \sum_j Quantity\ of\ products\ \boldsymbol{i}\ bought \times Mass\ of\ material\ \boldsymbol{j}\ in\ product\ \boldsymbol{i} \times material\ j\ EF\ /\ 1000$$

Emissions from other purchased products for which a known material mass breakdown is not available are estimated based on total mass or number of units purchased:

Emissions from subcategory A (tCO_2e) =

Purchases on subcategory A (kg) * EF for subcategory A ($kgCO_2e$/kg) / 1000

OR

Emissions from subcategory A (tCO_2e) =

Purchases on subcategory A (units) * EF for subcategory A ($kgCO_2e$/unit) / 1000

In this approach, spend-based EF are used for all services. For goods, a spend-based approach is allowed only if a very specific spend-based EF is identified. In both cases, the following equation is applicable:

Emissions from subcategory A (tCO_2e) =

Expenses on subcategory A (k$, kCAD, kNZD, K€) * EF for subcategory A ($kgCO_2e$/ k$, kCAD, kNZD, K€) / 1000

7. List of subcategories and emissions factors

7.1 General considerations

The purpose of this section is to detail the nomenclature for all purchases covered by the methodology. Indeed, the different types of purchases are classified in 3 levels: group, category and subcategory.

Each product subcategory is associated to a product proxy selected from one of the databases. The matching proxy's description can be found under the column "EF Proxy" and the corresponding database under the column "database."

Most EF used in the spend-based approach originate from either the Base Empreinte, EPA or GEMIS database[9]. In the mass-based approach, most EF were taken from ADEME Base Empreinte[11].

The classification is based upon North American Industry Classification System (NAICS) standard which classifies business activities and gathers them according to the similarity of the processes used to produce goods or services.

In the V3 2025 IAEG GHG Calculation tool, the EF location has been considered, to enable the most reliable and precise calculation. Indeed, the user can indicate the region associated with the EF. These extended lists with each region, are showed in the tables below. *Note: Not every EF has a value for each region (Africa, America, Asia, Europe, Oceania, Global/unspecified.) (Please refer to 9.1 section for more details).*

7.2 New commodities list

In 2025, a new list of commodities asked by IAEG WG3 Members, has been added to the GHG calculation tool to improve the tool and the precision.

Subcategory	*Values*	*EF Unit*
Aluminium Recycled	0,56	kgCO2e/kg
Aluminium Virgin	7,80	kgCO2e/kg
APU	201	kgCO2e/kUSD
Brass Virgin	1,39	kgCO2e/kg
Other chemical products	500,00	kgCO2e/kUSD
Clay and ceramic	464	kgCO2e/kUSD
Recycled Copper	1,3	kgCO2e/kg
Door	221	kgCO2e/kUSD
Engine	347	kgCO2e/kCAD
Explosives	500	kgCO2e/kUSD
Virgin ferroalloy	1070,00	kgCO2e/kUSD
Virgin Ferronickel	3,48	kgCO2e/kg

Fluids, oil, skydrol	178,60	kgCO2e/kCAD
Flight control actuator	278,00	kgCO2e/kUSD
Helicopter blades	223	kgCO2e/kUSD
In Flight entertainment (IFE)	81	kgCO2e/kUSD
Iron Recycled	0,94	kgCO2e/kg
Iron Virgin	2,21	kgCO2e/kg
IT hardware, unknown quantity	216	kgCO2e/k€
Landing Gears	179	kgCO2e/kUSD
Recycled Lead	2,09	kgCO2e/kg
Manufacturing Buildings	327	kgCO2e/kUSD
Metal-based structural product, unknown material and/or mass	405	kgCO2e/kUSD
Recycled Nickel	9,17	kgCO2e/kg
Other non-ferrous metals, unknown mass	431	kgCO2e/kUSD
Other non-residential buildings	337	kgCO2e/kUSD
Printed Circuit And Electronic Assembly	101,00	kgCO2e/kUSD
Processed Polycarbonate granulate (PC), EU-25	5,936	kgCO2e/kg
Professional services (printing, advertising, architecture and engineering, multi-technical maintenance of buildings, etc.)	129	kgCO2e/kUSD
Radar	414,80	kgCO2e/kUSD
Slides	1,25	kgCO2e/kg
Recycled Steel	0,938	kgCO2e/kg
Virgin Steel	2,21	kgCO2e/kg
Virgin Titanium	48,33	kgCO2e/kg
Window	221,00	kgCO2e/kUSd
Recycled Zinc	2,93	kgCO2e/kg
Zinc Virgin	2,69	kgCO2e/kg

7.3 Assembly and structural components group

This group includes all assembly and structural components, whether metallic or non-metallic (i.e., fuselage, wing, landing gear, brakes, nacelles, engine housing, stabilizers, etc.).

This group is composed of 2 categories:

- Metallic assembly and structural components
- Non-metallic assembly and structural components

7.3.1 Metallic assembly and structural components category breakdown

Subcategory	*Proxy EF*	*Value*	*EF unit*
Aluminium, extrusion profile - Casting - Europe	Aluminium, profilé extrudé	2,46	kgCO2e/kg
Aluminium, extrusion profile - Casting - Global or unspecified region	Aluminium, profilé extrudé + Casting - Moulage (impact réduit)	2,86	kgCO2e/kg
Aluminium, extrusion profile - Hot rolling - Europe	Aluminium, profilé extrudé	2,46	kgCO2e/kg
Aluminium, extrusion profile - Hot rolling - Global or unspecified region	Aluminium, profilé extrudé + Hot rolling - Laminage à chaud (impact modéré)	2,46	kgCO2e/kg
Aluminium, extrusion profile - Metal drilling - Europe	Aluminium, profilé extrudé	2,46	kgCO2e/kg
Aluminium, extrusion profile - Metal drilling - Global or unspecified region	Aluminium, profilé extrudé + Metal drilling - Perçage du métal (impact modéré)	2,46	kgCO2e/kg
Aluminium, extrusion profile - Metal sheet stamping - Europe	Aluminium, profilé extrudé	2,46	kgCO2e/kg
Aluminium, extrusion profile - Metal sheet stamping - Global or unspecified region	Aluminium, profilé extrudé + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	2,45	kgCO2e/kg
Aluminium, extrusion profile - Unspecified process - Global or unspecified region	Processed Aluminium extrusion profile	3,69	kgCO2e/kg
Aluminium, sheet - Casting - Europe	Aluminium, tôle	3,22	kgCO2e/kg
Aluminium, sheet - Casting - Global or unspecified region	Aluminium, tôle + Moulage (impact réduit)	3,62	kgCO2e/kg
Aluminium, sheet - Cold rolling - Europe	Aluminium, tôle	3,22	kgCO2e/kg
Aluminium, sheet - Cold rolling - Global or unspecified region	Aluminium, tôle + Cold rolling - Laminage à froid (impact modéré)	3,22	kgCO2e/kg
Aluminium, sheet - Hot rolling - Europe	Aluminium, tôle	3,22	kgCO2e/kg
Aluminium, sheet - Hot rolling - Global or unspecified region	Aluminium, tôle + Hot rolling - Laminage à chaud (impact modéré)	3,22	kgCO2e/kg
Aluminium, sheet - Metal drilling - Europe	Aluminium, tôle	3,22	kgCO2e/kg
Aluminium, sheet - Metal drilling - Global or unspecified region	Aluminium, tôle + Metal drilling - Perçage du métal (impact modéré)	3,22	kgCO2e/kg
Aluminium, sheet - Metal sheet stamping - Europe	Aluminium, tôle	3,22	kgCO2e/kg
Aluminium, sheet - Metal sheet stamping - Global or unspecified region	Aluminium, tôle + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	3,21	kgCO2e/kg

Aluminium, sheet - Unspecified process - Europe	Aluminium sheet	10,77	kgCO2e/kg
APU - America	Turbines and turbine generator sets	201,00	kgCO2e/kUSD
Brass - Casting - Europe	Brass (CUZn20) - Laiton	0,60	kgCO2e/kg
Brass - Casting - Global or unspecified region	Brass (CUZn20) - Laiton + Casting - Moulage (impact réduit)	1,01	kgCO2e/kg
Brass - Cold rolling - Europe	Brass (CUZn20) - Laiton	0,60	kgCO2e/kg
Brass - Cold rolling - Global or unspecified region	Brass (CUZn20) - Laiton + Laminage à froid (impact modéré)	0,60	kgCO2e/kg
Brass - Hot rolling - Europe	Brass (CUZn20) - Laiton	0,60	kgCO2e/kg
Brass - Hot rolling - Global or unspecified region	Brass (CUZn20) - Laiton + Hot Rolling - Laminage à chaud (impact modéré)+G35	0,60	kgCO2e/kg
Brass - Metal drilling - Europe	Brass (CUZn20) - Laiton	0,60	kgCO2e/kg
Brass - Metal drilling - Global or unspecified region	Brass (CUZn20) - Laiton + Metal drilling - Perçage du métal (impact modéré)	0,60	kgCO2e/kg
Brass - Metal sheet stamping - Europe	Brass (CUZn20) - Laiton	0,60	kgCO2e/kg
Brass - Metal sheet stamping - Global or unspecified region	Brass (CUZn20) - Laiton + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	0,59	kgCO2e/kg
Brass - Unspecified process - Global or unspecified region	Processed Brass (CuZn20)	0,90	kgCO2e/kg
Copper - Casting - Global or unspecified region	Mix cuivre (99,999% issu de l'électrolyse) + Casting - Moulage (impact réduit)	4,33	kgCO2e/kg
Copper - Cold rolling - Europe	Cold Rolling - Laminage à froid (impact modéré)	0,00	kgCO2e/kg
Copper - Cold rolling - Global or unspecified region	Mix cuivre (99,999% issu de l'électrolyse) + Cold Rolling - Laminage à froid (impact modéré)	3,93	kgCO2e/kg
Copper - Hot rolling - Europe	Hot Rolling - Laminage à chaud (impact modéré)	0,00	kgCO2e/kg
Copper - Hot rolling - Global or unspecified region	Mix cuivre (99,999% issu de l'électrolyse) + Hot Rolling - Laminage à chaud (impact modéré)	3,93	kgCO2e/kg
Copper - Metal drilling - Global or unspecified region	Mix cuivre (99,999% issu de l'électrolyse) + Metal drilling - Perçage du métal (impact modéré)	3,93	kgCO2e/kg
Copper - Metal sheet stamping - Global or unspecified region	Mix cuivre (99,999% issu de l'électrolyse) + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	3,92	kgCO2e/kg
Copper - Unspecified process - Global or unspecified region	Processed Copper mix (99,999% from electrolysis)	5,90	kgCO2e/kg
Engine - America	Aircraft Engines	476,35	kgCO2e/kUSD

Flight control actuator - America	Hydraulic pumps/motors/cylinders and actuators	259,40	kgCO2e/kUSD
Foam, polystyrene foam - Europe	Polystyrène expansé, mousse (PS 12)), RER	2,95	kgCO2e/kg
Helicopter blades - America	Saw blade and handtool manufacturing	223,00	kgCO2e/kUSD
Landing gears - America	Speed changer/industrial high-speed drive and gear manufacturing	179,00	kgCO2e/kUSD
Lead - Casting - Europe	Lead (primary)	2,07	kgCO2e/kg
Lead - Casting - Global or unspecified region	Lead (primary) + Casting - Moulage (impact réduit)	2,47	kgCO2e/kg
Lead - Cold rolling - Europe	Lead (primary)	2,07	kgCO2e/kg
Lead - Cold rolling - Global or unspecified region	Lead (primary) + Cold Rolling - Laminage à froid (impact modéré)	2,07	kgCO2e/kg
Lead - Hot rolling - Europe	Lead (primary)	2,07	kgCO2e/kg
Lead - Hot rolling - Global or unspecified region	Lead (primary) + Laminage à chaud (impact modéré)	2,07	kgCO2e/kg
Lead - Metal drilling - Europe	Lead (primary)	2,07	kgCO2e/kg
Lead - Metal drilling - Global or unspecified region	Lead (primary) + Metal drilling - Perçage du métal (impact modéré)	2,07	kgCO2e/kg
Lead - Metal sheet stamping - Europe	Lead (primary)	2,07	kgCO2e/kg
Lead - Metal sheet stamping - Global or unspecified region	Lead (primary) + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	2,06	kgCO2e/kg
Lead - Unspecified process - Global or unspecified region	Processed Lead	3,11	kgCO2e/kg
Nickel - Casting - Europe	Nickel (virgin)	17,53	kgCO2e/kg
Nickel - Casting - Global or unspecified region	Nickel (virgin) + Moulage (impact réduit)	17,93	kgCO2e/kg
Nickel - Cold rolling - Europe	Nickel (virgin)	17,53	kgCO2e/kg
Nickel - Cold rolling - Global or unspecified region	Nickel (virgin) + Cold rolling - Laminage à froid (impact modéré)	17,53	kgCO2e/kg
Nickel - Hot rolling - Europe	Nickel (virgin)	17,53	kgCO2e/kg
Nickel - Hot rolling - Global or unspecified region	Nickel (virgin) + Hot rolling - Laminage à chaud (impact modéré)	17,53	kgCO2e/kg
Nickel - Metal drilling - Europe	Nickel (virgin)	17,53	kgCO2e/kg
Nickel - Metal drilling - Global or unspecified region	Nickel (virgin) + Metal drilling - Perçage du métal (impact modéré)	17,53	kgCO2e/kg
Nickel - Metal sheet stamping - Europe	Nickel (virgin)	17,53	kgCO2e/kg
Nickel - Metal sheet stamping - Global or unspecified region	Nickel (virgin) + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	17,52	kgCO2e/kg

Nickel - Unspecified process - Global or unspecified region	Processed Monel (nickel alloy)	26,90	kgCO2e/kg
Other basic metals and casting - Europe	Other basic metals and casting	81,25	kgCO2e/kUSD
Stainless Steel - Steel part turning - Global or unspecified region	Stainless Steel + Steel part turning (5% loss), GLO	0,09	kgCO2e/kg
Stainless Steel - Steel sheet scouring (deburring) - Global or unspecified region	Chariotage de pièces en acier (5% de perte), GLO	0,09	kgCO2e/kg
Stainless Steel - Unspecified process - Global or unspecified region	Processed Stainless Steel	5,34	kgCO2e/kg
Steel - Steel part turning - Global or unspecified region	Chariotage de pièces en acier (5% de perte), GLO	0,09	kgCO2e/kg
Steel - Steel sheet scouring (deburring) - Global or unspecified region	Steel + Steel sheet scouring (deburring), GLO	1,34	kgCO2e/kg
Steel - Galvanisation steel sheet - Europe	Steel sheet (galvanized)	2,28	kgCO2e/kg
Steel - Unspecified process - Europe	Steel	1,30	kgCO2e/kg
Titanium - Casting - America	Titanium	17,00	kgCO2e/kg
Titanium - Casting - Global or unspecified region	Titanium + Moulage (impact réduit)	17,40	kgCO2e/kg
Titanium - Cold rolling - America	Titanium	17,00	kgCO2e/kg
Titanium - Cold rolling - Asia			
Titanium - Cold rolling - Europe	Cold rolling - Laminage à froid (impact modéré)	0,00	kgCO2e/kg
Titanium - Cold rolling - Global or unspecified region	Titanium + Cold rolling - Laminage à froid (impact modéré)	17,00	kgCO2e/kg
Titanium - Hot rolling - America	Titanium	17,00	kgCO2e/kg
Titanium - Hot rolling - Europe	Hot rolling - Laminage à chaud (impact modéré)	0,00	kgCO2e/kg
Titanium - Hot rolling - Global or unspecified region	Titanium + Hot rolling - Laminage à chaud (impact modéré)	17,00	kgCO2e/kg
Titanium - Metal drilling - America	Titanium	17,00	kgCO2e/kg
Titanium - Metal drilling - Global or unspecified region	Titanium + Metal drilling - Perçage du métal (impact modéré)	17,00	kgCO2e/kg
Titanium - Metal sheet stamping - America	Titanium	17,00	kgCO2e/kg
Titanium - Metal sheet stamping - Global or unspecified region	Titanium + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	16,99	kgCO2e/kg
Titanium - Unspecified process - Global or unspecified region	Processed Titanium	25,50	kgCO2e/kg
Zinc - Casting - Europe	Zamak zinc alloy (ZnAlMgCu)	5,18	kgCO2e/kg
Zinc - Casting - Global or unspecified region	Zamak zinc alloy (ZnAlMgCu) + Moulage (impact réduit)	5,58	kgCO2e/kg
Zinc - Cold rolling - Europe	Zamak zinc alloy (ZnAlMgCu)	5,18	kgCO2e/kg

Zinc - Cold rolling - Global or unspecified region	Zamak zinc alloy (ZnAlMgCu) + Cold rolling - Laminage à froid (impact modéré)	5,18	kgCO2e/kg
Zinc - Hot rolling - Europe	Zamak zinc alloy (ZnAlMgCu)	5,18	kgCO2e/kg
Zinc - Hot rolling - Global or unspecified region	Zamak zinc alloy (ZnAlMgCu) + Hot rolling - Laminage à chaud (impact modéré)	5,18	kgCO2e/kg
Zinc - Metal drilling - Europe	Zamak zinc alloy (ZnAlMgCu)	5,18	kgCO2e/kg
Zinc - Metal drilling - Global or unspecified region	Zamak zinc alloy (ZnAlMgCu) + Metal drilling - Perçage du métal (impact modéré)	5,18	kgCO2e/kg
Zinc - Metal sheet stamping - Europe	Zamak zinc alloy (ZnAlMgCu)	5,18	kgCO2e/kg
Zinc - Metal sheet stamping - Global or unspecified region	Zamak zinc alloy (ZnAlMgCu) + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	5,17	kgCO2e/kg
Zinc - Unspecified process - Global or unspecified region	Processed Zamak zinc alloy (ZnAlMgCu)	7,77	kgCO2e/kg

7.3.2 Non-Metallic assembly and structural components category breakdown

Subcategory	Proxy EF	Value	EF Unit
Composite-based structural product, unknown material and/or mass - America	Carbon fiber (CF, from PAN, high strengths, long fibers)	326,53	kgCO2e/kUSD
Carbon fiber, high strengths, long fibers - Pultrusion - Europe	Fibre de carbone (CF, depuis PAN, haute résistance, fibres longues)	40,80	kgCO2e/kg
Carbon fiber, high strengths, long fibers - Pultrusion - Global or unspecified region	Fibre de carbone (CF, depuis PAN, haute résistance, fibres longues) + Pultrusion	40,80	kgCO2e/kg
Carbon fiber, high strengths, long fibers - Thermocompression - Europe	Fibre de carbone (CF, depuis PAN, haute résistance, fibres longues)	40,80	kgCO2e/kg
Carbon fiber, high strengths, long fibers - Thermocompression - Global or unspecified region	Fibre de carbone (CF, depuis PAN, haute résistance, fibres longues) + Thermocompression	40,80	kgCO2e/kg
Carbon fiber, high strengths, long fibers - Unspecified process - Global or unspecified region	Processed Carbon fiber (CF, from PAN, high strengths, long fibers)	61,20	kgCO2e/kg
Carbon Fiber, short fibers - Pultrusion - Europe	Fibre de carbone (CF, depuis PAN, fibres courtes)	18,40	kgCO2e/kg
Carbon Fiber, short fibers - Pultrusion - Global or unspecified region	Fibre de carbone (CF, depuis PAN, fibres courtes + Pultrusion	18,40	kgCO2e/kg
Carbon Fiber, short fibers - Thermocompression - Europe	Fibre de carbone (CF, depuis PAN, fibres courtes)	18,40	kgCO2e/kg
Carbon Fiber, short fibers - Thermocompression - Global or unspecified region	Fibre de carbone (CF, depuis PAN, fibres courtes) + Thermocompression	18,40	kgCO2e/kg
Carbon Fiber, short fibers - Unspecified process - Global or unspecified region	Processed Carbon Fiber (CF, from PAN, short fibers)	27,60	kgCO2e/kg
Glass fibers, high strength - Pultrusion - Europe	Fibres de verre (haute résistance)	2,43	kgCO2e/kg
Glass fibers, high strength - Pultrusion - Global or unspecified region	Fibres de verre (haute résistance) + Pultrusion	2,43	kgCO2e/kg
Glass fibers, high strength - Thermocompression - Europe	Fibres de verre (haute résistance)	2,43	kgCO2e/kg
Glass fibers, high strength - Thermocompression - Global or unspecified region	Fibres de verre (haute résistance) + Thermocompression	2,43	kgCO2e/kg
Glass fibers, high strength - Unspecified process - Global or unspecified region	Processed Glass fibers (high strength)	3,65	kgCO2e/kg
Glass fibers, low strength - Pultrusion - Europe	Fibres de verre (faible résistance)	3,22	kgCO2e/kg
Glass fibers, low strength - Pultrusion - Global or unspecified region	Fibres de verre (faible résistance) + Pultrusion	3,22	kgCO2e/kg
Glass fibers, low strength - Thermocompression - Europe	Fibres de verre (faible résistance)	3,22	kgCO2e/kg
Glass fibers, low strength - Thermocompression - Global or unspecified region	Fibres de verre (faible résistance) + Thermocompression	3,22	kgCO2e/kg

Glass fibers, low strength - Unspecified process - Global or unspecified region	Processed Glass fibers (low strength)	4,83	kgCO2e/kg
Other nonmetal-based assembly and structural components for aircraft - America	Other Aircraft Parts	236,87	kgCO2e/kUSD
Other nonmetal-based assembly and structural components for spacecraft and missiles - America	Guided missiles and space vehicles	142,00	kgCO2e/kUSD

7.3.3 Examples of products covered in the category 'Aircraft parts other than engines'

The following example demonstrates how different types of products relating to the aerospace industry may be grouped under a NAICS nomenclature.

This category originally entitled ***Other Aircraft Parts*** in the USEEIO database was renamed ***Aircraft parts other than engines*** so that IAEG members better understand it.

NAICS number	Definition
336413	This U.S. industry comprises establishments primarily engaged in (1) manufacturing aircraft parts or auxiliary equipment (except engines and aircraft fluid power subassemblies) and/or (2) developing and making prototypes of aircraft parts and auxiliary equipment. Auxiliary equipment includes such items as crop dusting apparatus, armament racks, inflight refueling equipment, and external fuel tanks.

Here are some examples of products included in this subcategory:

- Aircraft assemblies, subassemblies, and parts (except engines) manufacturing
- Aircraft auxiliary parts (e.g., crop dusting, external fuel tanks, inflight refuelling equipment) manufacturing
- Aircraft brakes manufacturing
- Aircraft control surface assemblies manufacturing
- Aircraft fuselage wing tail and similar assemblies manufacturing
- Aircraft propellers and parts manufacturing
- Aircraft wheels manufacturing
- Airframe assemblies (except for guided missiles) manufacturing
- Developing and producing prototypes for aircraft parts (except engines) and auxiliary equipment
- Joints, universal, aircraft, manufacturing
- Targets, trailer type, aircraft, manufacturing
- Tow targets, aircraft, manufacturing

- Universal joints, aircraft, manufacturing

7.4 Manufactured components and materials group

This group includes all product-related components that are nonstructural such as casting and forging, fan blades, carbon brake pads, cargo equipment (hoisting, tools for cargo activities, etc.) cabin and seats, entertainment equipment and galleys, carpets, propulsion system in space equipment, solar panels, etc.

This group is divided into 3 categories:

- Metallic manufactured components
- Non-metallic manufactured components
- Electrical and electronic equipment

7.4.1 Metallic manufactured components category breakdown

Subcategory	Proxy EF	Value	EF Unit
Air and spacecraft and related machinery - Europe	Air and spacecraft and related machinery	315,61	kgCO2e/kUSD
Air conditioning and industrial refrigeration equipment, unknown material and mass - America	Air-conditioning and warm air heating equipment and commercial and industrial refrigeration equipment manufacturing	184,00	kgCO2e/kUSD
Aircraft engines, engine parts and other propulsion systems, unknown material and mass - America	Aircraft Engines and Parts	156,00	kgCO2e/kUSD
Aluminium, extrusion profile - Casting - Europe	Aluminium, profilé extrudé	2,46	kgCO2e/kg
Aluminium, extrusion profile - Casting - Global or unspecified region	Aluminium, profilé extrudé + Casting - Moulage (impact réduit)	2,86	kgCO2e/kg
Aluminium, extrusion profile - Cold rolling - Europe	Aluminium, profilé extrudé	2,46	kgCO2e/kg
Aluminium, extrusion profile - Cold rolling - Global or unspecified region	Aluminium, profilé extrudé + Cold Rolling - Laminage à froid (impact modéré)	2,46	kgCO2e/kg
Aluminium, extrusion profile - Hot rolling - Europe	Aluminium, profilé extrudé	2,46	kgCO2e/kg
Aluminium, extrusion profile - Hot rolling - Global or unspecified region	Aluminium, profilé extrudé + Hot rolling - Laminage à chaud (impact modéré)	2,46	kgCO2e/kg
Aluminium, extrusion profile - Metal drilling - Europe	Aluminium, profilé extrudé	2,46	kgCO2e/kg

Aluminium, extrusion profile - Metal drilling - Global or unspecified region	Aluminium, profilé extrudé + Metal drilling - Perçage du métal (impact modéré)	2,46	kgCO2e/kg
Aluminium, extrusion profile - Metal sheet stamping - Europe	Aluminium, profilé extrudé	2,46	kgCO2e/kg
Aluminium, extrusion profile - Metal sheet stamping - Global or unspecified region	Aluminium, profilé extrudé + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	2,45	kgCO2e/kg
Aluminium, extrusion profile - Unspecified process - Global or unspecified region	Processed Aluminium extrusion profile	3,69	kgCO2e/kg
Aluminium, sheet - Casting - Europe	Aluminium, tôle	3,22	kgCO2e/kg
Aluminium, sheet - Casting - Global or unspecified region	Aluminium, tôle + Moulage (impact réduit)	3,62	kgCO2e/kg
Aluminium, sheet - Cold rolling - Europe	Aluminium, tôle	3,22	kgCO2e/kg
Aluminium, sheet - Cold rolling - Global or unspecified region	Aluminium, tôle + Cold rolling - Laminage à froid (impact modéré)	3,22	kgCO2e/kg
Aluminium, sheet - Hot rolling - Europe	Aluminium, tôle	3,22	kgCO2e/kg
Aluminium, sheet - Hot rolling - Global or unspecified region	Aluminium, tôle + Hot rolling - Laminage à chaud (impact modéré)	3,22	kgCO2e/kg
Aluminium, sheet - Metal drilling - Europe	Aluminium, tôle	3,22	kgCO2e/kg
Aluminium, sheet - Metal drilling - Global or unspecified region	Aluminium, tôle + Metal drilling - Perçage du métal (impact modéré)	3,22	kgCO2e/kg
Aluminium, sheet - Metal sheet stamping - Europe	Aluminium, tôle	3,22	kgCO2e/kg
Aluminium, sheet - Metal sheet stamping - Global or unspecified region	Aluminium, tôle + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	3,21	kgCO2e/kg
Aluminium, sheet - Unspecified process - Europe	Aluminium sheet	10,77	kgCO2e/kg
Aluminium-based manufactured products, unknown mass - America	Unwrought aluminum including alloys	161,66	kgCO2e/kUSD
Brass - Casting - Europe	Brass (CUZn20) - Laiton	0,60	kgCO2e/kg
Brass - Casting - Global or unspecified region	Brass (CUZn20) - Laiton + Casting - Moulage (impact réduit)	1,01	kgCO2e/kg
Brass - Cold rolling - Europe	Brass (CUZn20) - Laiton	0,60	kgCO2e/kg
Brass - Cold rolling - Global or unspecified region	Brass (CUZn20) - Laiton + Laminage à froid (impact modéré)	0,60	kgCO2e/kg
Brass - Hot rolling - Europe	Brass (CUZn20) - Laiton	0,60	kgCO2e/kg
Brass - Hot rolling - Global or unspecified region	Brass (CUZn20) - Laiton + Hot Rolling - Laminage à chaud (impact modéré)+G35	0,60	kgCO2e/kg
Brass - Metal drilling - Europe	Brass (CUZn20) - Laiton	0,60	kgCO2e/kg

Brass - Metal drilling - Global or unspecified region	Brass (CUZn20) - Laiton + Metal drilling - Perçage du métal (impact modéré)	0,60	kgCO2e/kg
Brass - Metal sheet stamping - Europe	Brass (CUZn20) - Laiton	0,60	kgCO2e/kg
Brass - Metal sheet stamping - Global or unspecified region	Brass (CUZn20) - Laiton + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	0,59	kgCO2e/kg
Brass - Unspecified process - Global or unspecified region	Processed Brass (CuZn20)	0,90	kgCO2e/kg
Copper - Casting - Global or unspecified region	Mix cuivre (99,999% issu de l'électrolyse) + Casting - Moulage (impact réduit)	4,33	kgCO2e/kg
Copper - Cold rolling - Europe	Cold Rolling - Laminage à froid (impact modéré)	0,00	kgCO2e/kg
Copper - Cold rolling - Global or unspecified region	Mix cuivre (99,999% issu de l'électrolyse) + Cold Rolling - Laminage à froid (impact modéré)	3,93	kgCO2e/kg
Copper - Hot rolling - Europe	Hot Rolling - Laminage à chaud (impact modéré)	0,00	kgCO2e/kg
Copper - Hot rolling - Global or unspecified region	Mix cuivre (99,999% issu de l'électrolyse) + Hot Rolling - Laminage à chaud (impact modéré)	3,93	kgCO2e/kg
Copper - Metal drilling - Global or unspecified region	Mix cuivre (99,999% issu de l'électrolyse) + Metal drilling - Perçage du métal (impact modéré)	3,93	kgCO2e/kg
Copper - Metal sheet stamping - Global or unspecified region	Mix cuivre (99,999% issu de l'électrolyse) + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	3,92	kgCO2e/kg
Copper - Unspecified process - Global or unspecified region	Processed Copper mix (99,999% from electrolysis)	5,90	kgCO2e/kg
Copper-based manufactured products, unknown mass - America	Copper rolling/drawing/extruding and alloying	334,00	kgCO2e/kUSD
Hardware, unknown material and mass - America	Hardware manufacturing	191,00	kgCO2e/kUSD
Iron Recycled - Europe	Acier ou fer blanc/recyclé	0,94	kgCO2e/kg
Iron Virgin - Europe	Acier ou fer blanc/neuf	2,21	kgCO2e/kg
Lead - Casting - Europe	Lead (primary)	2,07	kgCO2e/kg
Lead - Casting - Global or unspecified region	Lead (primary) + Casting - Moulage (impact réduit)	2,47	kgCO2e/kg
Lead - Cold rolling - Europe	Lead (primary)	2,07	kgCO2e/kg
Lead - Cold rolling - Global or unspecified region	Lead (primary) + Cold Rolling - Laminage à froid (impact modéré)	2,07	kgCO2e/kg
Lead - Hot rolling - Europe	Lead (primary)	2,07	kgCO2e/kg

Lead - Hot rolling - Global or unspecified region	Lead (primary) + Laminage à chaud (impact modéré)	2,07	kgCO2e/kg
Lead - Metal drilling - Europe	Lead (primary)	2,07	kgCO2e/kg
Lead - Metal drilling - Global or unspecified region	Lead (primary) + Metal drilling - Perçage du métal (impact modéré)	2,07	kgCO2e/kg
Lead - Metal sheet stamping - Europe	Lead (primary)	2,07	kgCO2e/kg
Lead - Metal sheet stamping - Global or unspecified region	Lead (primary) + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	2,06	kgCO2e/kg
Lead - Unspecified process - Global or unspecified region	Processed Lead	3,11	kgCO2e/kg
Machinery and equipment n.e.c. - Europe	Machinery / equipment not specific	329,52	kgCO2e/kUSD
Metal pipes and fittings, unknown material and mass - America	Fabricated pipe and pipe fitting manufacturing (332996)	238,00	kgCO2e/kUSD
Metal-based manufactured components for aircraft (other than engines), unknown material and mass - America	Other Aircraft Parts	170,00	kgCO2e/kUSD
Metal-based propulsion units and parts for space vehicles and guided missiles, unknown material and mass - America	Propulsion units and parts for space vehicles and guided missiles	141,83	kgCO2e/kUSD
Nickel - Casting - Europe	Nickel (virgin)	17,53	kgCO2e/kg
Nickel - Casting - Global or unspecified region	Nickel (virgin) + Moulage (impact réduit)	17,93	kgCO2e/kg
Nickel - Cold rolling - Europe	Nickel (virgin)	17,53	kgCO2e/kg
Nickel - Cold rolling - Global or unspecified region	Nickel (virgin) + Cold rolling - Laminage à froid (impact modéré)	17,53	kgCO2e/kg
Nickel - Hot rolling - Europe	Nickel (virgin)	17,53	kgCO2e/kg
Nickel - Hot rolling - Global or unspecified region	Nickel (virgin) + Hot rolling - Laminage à chaud (impact modéré)	17,53	kgCO2e/kg
Nickel - Metal drilling - Europe	Nickel (virgin)	17,53	kgCO2e/kg
Nickel - Metal drilling - Global or unspecified region	Nickel (virgin) + Metal drilling - Perçage du métal (impact modéré)	17,53	kgCO2e/kg
Nickel - Metal sheet stamping - Europe	Nickel (virgin)	17,53	kgCO2e/kg
Nickel - Metal sheet stamping - Global or unspecified region	Nickel (virgin) + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	17,52	kgCO2e/kg
Nickel - Unspecified process - Global or unspecified region	Processed Monel (nickel alloy)	26,90	kgCO2e/kg
Other non-ferrous metal-based manufactured products, unspecified material and mass - America	Nonferrous metal (except copper and aluminum) rolling/drawing and extruding	431,00	kgCO2e/kUSD
Recycled Copper - Europe	Cuivre/recyclé	1,30	kgCO2e/kg
Recycled Lead - Europe	Plomb/recyclé	2,09	kgCO2e/kg

Recycled Nickel - Europe	Nickel/recyclé	9,17	kgCO2e/kg
Recycled Steel - Europe	Acier ou fer blanc/recyclé	0,94	kgCO2e/kg
Recycled Zinc - Europe	Zinc/recyclé	2,93	kgCO2e/kg
Stainless Steel - Steel part turning - Global or unspecified region	Stainless Steel + Steel part turning (5% loss), GLO	0,09	kgCO2e/kg
Stainless Steel - Steel sheet scouring (deburring) - Global or unspecified region	Chariotage de pièces en acier (5% de perte), GLO	0,09	kgCO2e/kg
Stainless Steel - Unspecified process - Global or unspecified region	Processed Stainless Steel	5,34	kgCO2e/kg
Steel - Steel part turning - Global or unspecified region	Chariotage de pièces en acier (5% de perte), GLO	0,09	kgCO2e/kg
Steel - Steel sheet scouring (deburring) - Global or unspecified region	Steel + Steel sheet scouring (deburring), GLO	1,34	kgCO2e/kg
Steel - Galvanisation steel sheet - Europe	Steel sheet (galvanized)	2,28	kgCO2e/kg
Steel - Unspecified process - Europe	Steel	1,30	kgCO2e/kg
Steel-based manufactured components, unknown mass - America	Steel product manufacturing from purchased steel (331200)	582,25	kgCO2e/kUSD
Titanium - Casting - America	Titanium	17,00	kgCO2e/kg
Titanium - Casting - Global or unspecified region	Titanium + Moulage (impact réduit)	17,40	kgCO2e/kg
Titanium - Cold rolling - America	Titanium	17,00	kgCO2e/kg
Titanium - Cold rolling - Europe	Cold rolling - Laminage à froid (impact modéré)	0,00	kgCO2e/kg
Titanium - Cold rolling - Global or unspecified region	Titanium + Cold rolling - Laminage à froid (impact modéré)	17,00	kgCO2e/kg
Titanium - Hot rolling - America	Titanium	17,00	kgCO2e/kg
Titanium - Hot rolling - Europe	Hot rolling - Laminage à chaud (impact modéré)	0,00	kgCO2e/kg
Titanium - Hot rolling - Global or unspecified region	Titanium + Hot rolling - Laminage à chaud (impact modéré)	17,00	kgCO2e/kg
Titanium - Metal drilling - America	Titanium	17,00	kgCO2e/kg
Titanium - Metal drilling - Global or unspecified region	Titanium + Metal drilling - Perçage du métal (impact modéré)	17,00	kgCO2e/kg
Titanium - Metal sheet stamping - America	Titanium	17,00	kgCO2e/kg
Titanium - Metal sheet stamping - Global or unspecified region	Titanium + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	16,99	kgCO2e/kg
Titanium - Unspecified process - Global or unspecified region	Processed Titanium	25,50	kgCO2e/kg
Virgin Ferronickel - Europe	Ferro-alloys - ferro-nickel	3,48	kgCO2e/kg
Virgin Steel - Europe	Acier ou fer blanc/neuf	2,21	kgCO2e/kg
Virgin Titanium - Europe	Titanium	48,33	kgCO2e/kg
Zinc - Casting - Europe	Zamak zinc alloy (ZnAlMgCu)	5,18	kgCO2e/kg

Zinc - Casting - Global or unspecified region	Zamak zinc alloy (ZnAlMgCu) + Moulage (impact réduit)	5,58	kgCO2e/kg
Zinc - Cold rolling - Europe	Zamak zinc alloy (ZnAlMgCu)	5,18	kgCO2e/kg
Zinc - Cold rolling - Global or unspecified region	Zamak zinc alloy (ZnAlMgCu) + Cold rolling - Laminage à froid (impact modéré)	5,18	kgCO2e/kg
Zinc - Hot rolling - Europe	Zamak zinc alloy (ZnAlMgCu)	5,18	kgCO2e/kg
Zinc - Hot rolling - Global or unspecified region	Zamak zinc alloy (ZnAlMgCu) + Hot rolling - Laminage à chaud (impact modéré)	5,18	kgCO2e/kg
Zinc - Metal drilling - Europe	Zamak zinc alloy (ZnAlMgCu)	5,18	kgCO2e/kg
Zinc - Metal drilling - Global or unspecified region	Zamak zinc alloy (ZnAlMgCu) + Metal drilling - Perçage du métal (impact modéré)	5,18	kgCO2e/kg
Zinc - Metal sheet stamping - Europe	Zamak zinc alloy (ZnAlMgCu)	5,18	kgCO2e/kg
Zinc - Metal sheet stamping - Global or unspecified region	Zamak zinc alloy (ZnAlMgCu) + Metal sheet stamping - Emboutissage de tôle (20% de pertes)	5,17	kgCO2e/kg
Zinc - Unspecified process - Global or unspecified region	Processed Zamak zinc alloy (ZnAlMgCu)	7,77	kgCO2e/kg
Zinc Virgin - Europe	Zinc	2,69	kgCO2e/kg

7.4.2 Non-Metallic manufactured components category

Subcategory	Proxy EF	Value	EF Unit
Acrylonitrile-butadiene-styrene (ABS), any process - Oceania	Acrylonitrile-butadiene-styrene copolymer ABS (at plant)	4,51	kgCO2e/kg
Carbon fiber, high strengths, long fibers - Pultrusion - Europe	Fibre de carbone (CF, depuis PAN, haute résistance, fibres longues)	40,80	kgCO2e/kg
Carbon fiber, high strengths, long fibers - Pultrusion - Global or unspecified region	Fibre de carbone (CF, depuis PAN, haute résistance, fibres longues) + Pultrusion	40,80	kgCO2e/kg
Carbon fiber, high strengths, long fibers - Thermocompression - Europe	Fibre de carbone (CF, depuis PAN, haute résistance, fibres longues)	40,80	kgCO2e/kg
Carbon fiber, high strengths, long fibers - Thermocompression - Global or unspecified region	Fibre de carbone (CF, depuis PAN, haute résistance, fibres longues) + Thermocompression	40,80	kgCO2e/kg
Carbon fiber, high strengths, long fibers - Unspecified process - Global or unspecified region	Processed Carbon fiber (CF, from PAN, high strengths, long fibers)	61,20	kgCO2e/kg
Carbon Fiber, short fibers - Pultrusion - Europe	Fibre de carbone (CF, depuis PAN, fibres courtes)	18,40	kgCO2e/kg
Carbon Fiber, short fibers - Pultrusion - Global or unspecified region	Fibre de carbone (CF, depuis PAN, fibres courtes + Pultrusion	18,40	kgCO2e/kg
Carbon Fiber, short fibers - Thermocompression - Europe	Fibre de carbone (CF, depuis PAN, fibres courtes)	18,40	kgCO2e/kg
Carbon Fiber, short fibers - Thermocompression - Global or unspecified region	Fibre de carbone (CF, depuis PAN, fibres courtes) + Thermocompression	18,40	kgCO2e/kg
Carbon Fiber, short fibers - Unspecified process - Global or unspecified region	Processed Carbon Fiber (CF, from PAN, short fibers)	27,60	kgCO2e/kg
Composite-based manufactured products, unknown mass - America	Furniture/other manufactured goods (not elsewhere specified)	335,03	kgCO2e/kUSD
Door - America	Metal window and door manufacturing	221,00	kgCO2e/kUSD
Glass fibers, high strength - Pultrusion - Europe	Fibres de verre (haute résistance)	2,43	kgCO2e/kg
Glass fibers, high strength - Pultrusion - Global or unspecified region	Fibres de verre (haute résistance) + Pultrusion	2,43	kgCO2e/kg
Glass fibers, high strength - Thermocompression - Europe	Fibres de verre (haute résistance)	2,43	kgCO2e/kg
Glass fibers, high strength - Thermocompression - Global or unspecified region	Fibres de verre (haute résistance) + Thermocompression	2,43	kgCO2e/kg
Glass fibers, high strength - Unspecified process - Global or unspecified region	Processed Glass fibers (high strength)	3,65	kgCO2e/kg
Glass fibers, low strength - Pultrusion - Europe	Fibres de verre (faible résistance)	3,22	kgCO2e/kg
Glass fibers, low strength - Pultrusion - Global or unspecified region	Fibres de verre (faible résistance) + Pultrusion	3,22	kgCO2e/kg

Glass fibers, low strength - Thermocompression - Europe	Fibres de verre (faible résistance)	3,22	kgCO2e/kg
Glass fibers, low strength - Thermocompression - Global or unspecified region	Fibres de verre (faible résistance) + Thermocompression	3,22	kgCO2e/kg
Glass fibers, low strength - Unspecified process - Global or unspecified region	Processed Glass fibers (low strength)	4,83	kgCO2e/kg
Glass, refractory, clay, other porcelain and ceramic, stone and abrasive products - Europe	Glass/refractory/clay/other porcelain and ceramic/stone and abrasive products	96,94	kgCO2e/kUSD
Glass-based manufactured products, unknown mass - America	Glass product manufacturing made of purchased glass	597,00	kgCO2e/kUSD
Nonmetal-based aircraft engines, engine parts and other propulsion systems, unknown material and mass - America	Aicraft engines & parts	156,00	kgCO2e/kUSD
Nonmetal-based manufactured components for aircraft (other than engines), unknown material and mass - America	Other aircraft parts and auxiliary equipment manufacturing	170,00	kgCO2e/kUSD
Nonmetal-based propulsion units and parts for space vehicles or missiles, unknown material and mass - America	Propulsion units and parts for space vehicles and guided missiles	141,83	kgCO2e/kUSD
Nylon, any process - Oceania	Nylon 6 (at plant)	9,13	kgCO2e/kg
Phenolic resin, any process - Europe	Résine phénolique (concentration: 45%)	1,68	kgCO2e/kg
Plastic-based manufactured products, unknown mass - America	Other plastic products	498,27	kgCO2e/kUSD
Polycarbonate (PC), any process - Europe	Polycarbonate slab	5,79	kgCO2e/kg
Polyethylene high density (PE-HD), any process - Oceania	High density polyethylene (at plant)	2,39	kgCO2e/kg
Polyethylene low density (PE-LD), any process - Oceania	Polyethylene LLDPE granulate (at plant)	2,54	kgCO2e/kg
Polyethylene terephthalate (PET), any process - Europe	PET	3,20	kgCO2e/kUSD
Polymethylmethacrylate-ball (PMMA), any process - Europe	Polyméthacrylate de méthyle, billes (PMMA), RER	7,29	kgCO2e/kg
Polyoxymethylene (POM), any process - Europe	Polyoxyméthylène, granulés (POM), RER	3,71	kgCO2e/kg
Polypropylene (PP), any process - Europe	Polypropylene plastic profile with glass fiber components (elastic plastic profiles)	2,70	kgCO2e/kg
Polystyrene (PS), any process - Europe	PS (polystyrene)	2,99	kgCO2e/kg
Polyvinylchloride (PVC), any process - Oceania	Polyvinylchloride emulsion polymerised (at plant)	2,53	kgCO2e/kg
Processed Polycarbonate granulate (PC), EU-25 - Europe	Polycarbonate slab	5,94	kgCO2e/kg

Recycled polyethylene high density (PE-HD), any process - Europe	Processed Production of recycled HDPE granules from collected and sorted HDPE packaging waste	0,18	kgCO2e/kg
Recycled polyethylene low density (PE-LD), any process - Europe	Processed Production of recycled LDPE granules from collected and sorted agricultural plastic film waste	0,41	kgCO2e/kg
Recycled polyethylene terephthalate (PET), any process - Europe	Plastique/PET/recyclé	202,00	kgCO2e/ton
Recycled polypropylene (PP), any process - Europe	Processed Production of recycled PP granules from collected and sorted PP waste	0,12	kgCO2e/kg
Recycled polyvinylchloride (PVC), any process - Europe	Construction and demolition waste: Rigid PVC - Recycling	0,14	kgCO2e/kg
Slides - Asia	Polyvinyl Chloride (PVC) Waterproofing	1,25	kgCO2e/kg
Window - America	Metal window and door manufacturing	221,00	kgCO2e/kUSD

7.4.3 Electrical and electronic equipment category breakdown

Subcategory	Proxy EF	Value	EF Unit
Audio and video equipment, unknown quantity - America/Canada	Audio and video equipment and unrecorded media	445,52	kgCO2e/kUSD
Audio and video equipment, unknown quantity - America/USA	Audio and video equipment manufacturing	120,46	kgCO2e/kUSD
Batteries for electricity storage - America	Storage batteries	337,00	kgCO2e/kUSD
Communication or energy wires and cables, unknown quantity - America	Communication and energy wire and cable	428,29	kgCO2e/kUSD
Electrical cable - Europe	Cable Cat 7	0,30	kgCO2e/m
Electronic components (computers, servers) - America	Other electronic component manufacturing	98,00	kgCO2e/kUSD
Electronic components (printed circuits, screens, crystal assemblies, etc.) - America	Printed circuit assembly (electronic assembly) manufacturing	101,00	kgCO2e/kUSD
In Flight entertainment (IFE) - America	Audio and video equipment manufacturing	81,00	kgCO2e/kUSD
Liquid crystal display panel - Europe	Ecran d'ordinateur	9,40	kgCO2e/item
Other communications equipment manufacturing - America	Other communications equipment	110,74	kgCO2e/kUSD
Other electronic equipment - America/Canada	Other electronic components	393,46	kgCO2e/kUSD
Other electronic equipment - America/USA	Other electronic component manufacturing	162,23	kgCO2e/kUSD
Other industrial electric components - America	All other miscellaneous electrical equipment and component manufacturing	170,97	kgCO2e/kUSD
Printed circuit - America	Electronic capacitors/ resistors/coils/ transformers/ connectors and other components (except semiconductors and printed circuit assemblies)	189,42	kgCO2e/kg
Printed Circuit And Electronic Assembly - America	Printed circuit assembly (electronic assembly) manufacturing	101,00	kgCO2e/kUSD
Printed circuit board - America	Printed circuit and electronic assembly	163,29	kgCO2e/kUSD
Printed circuits, unknown quantity - America	Printed circuit assembly (electronic assembly) manufacturing	101,00	kgCO2e/kUSD
Radar - America	Other engine and power transmission equipment	414,80	kgCO2e/kUSD
Search, detection, and navigation instruments (sensors, etc.) - America	Search/detection/navigation/guidance/aeronautical and nautical system and instrument manufacturing	71,00	kgCO2e/kUSD
Time-measuring and controlling devices - America	Watches/clocks and other measuring and controlling devices	100,77	kgCO2e/kUSD
Wireless communication equipment - America	Radio and television broadcasting and wireless communications equipment manufacturing	111,00	kgCO2e/kUSD

7.4.4 Examples of products covered in the category 'Aircraft engines, engine parts and other propulsion systems'

The following example demonstrates how different types of products relating to the aerospace industry may be grouped under a NAICS nomenclature.

This category originally entitled ***Aircraft Engine and Engine Parts*** in the USEEIO database was renamed ***Aircraft engines, engine parts and other propulsion systems*** so that IAEG members better understand it.

NAICS number	Definition
336412	This U.S. industry comprises establishments primarily engaged in one or more of the following: (1) manufacturing aircraft engines and engine parts; (2) developing and making prototypes of aircraft engines and engine parts; (3) aircraft propulsion system conversion (i.e., major modifications to systems); and (4) aircraft propulsion systems overhaul and rebuilding (i.e., periodic restoration of aircraft propulsion system to original design specifications).

Here are some examples of products included in this subcategory:

- Aircraft engine and engine parts (except carburettors, pistons, piston rings, valves) manufacturing
- Aircraft engine overhauling
- Aircraft engine rebuilding
- Aircraft turbines manufacturing
- Developing and producing prototypes for aircraft engines and engine parts
- Engines and engine parts, aircraft (except carburettors, pistons, piston rings, valves), manufacturing
- Gas turbines, aircraft, manufacturing
- Gasoline engine parts (except carburettors, pistons, piston rings, valves), aircraft, manufacturing
- Gasoline engines, aircraft, manufacturing
- Internal combustion engines, aircraft, manufacturing
- Jet propulsion and internal combustion engines and parts, aircraft, manufacturing
- Rocket engines, aircraft, manufacturing

Note: some EF can be found in different Groups (Assembly and structural components, Manufactured components, and materials) because they can cover similar products. This is particularly true in the spend-based approach (because categories / subcategories are very aggregate and then generic).

7.5 Raw materials group

This group includes all raw materials and is composed of 3 categories:

- Metallic raw materials
- Non-metallic raw materials
- Gases and chemicals

7.5.1 Metallic raw materials category breakdown

Subcategory	Proxy EF	Value	EF Unit
Aluminum and aluminum alloys, unknown mass - America	Basic and semi-finished products of aluminum and alloys	976,81	kgCO2e/kUSD
Aluminium Virgin - Asia	Sheet Aluminium Virgin	9,05	kgCO2e/kg
Aluminium Virgin - Europe	Aluminium/neuf	7,80	kgCO2e/kg
Aluminium, extrusion profile - Europe	Aluminium, profilé extrudé	2,46	kgCO2e/kg
Aluminium, sheet - America	Aluminium sheet/plate and foil manufacturing	721,00	kgCO2e/kUSD
Aluminium, sheet - Europe	Aluminium, tôle	3,22	kgCO2e/kg
Aluminium, unspecified - Europe	Aluminium, primary mix	17,17	kgCO2e/kg
Copper - Asia	Copper Pipe	4,81	kgCO2e/kg
Copper - Europe	Cuivre/neuf	1,45	kgCO2e/kg
Copper, unknown mass - Oceania	Copper primary at refinery	2,05	kgCO2e/kg
Ferroalloy - Europe	Ferroalloys	5,88	kgCO2e/kg
Ferronickel - Europe	Ferronickel	5,88	kgCO2e/kg
Iron - Europe	Acier ou fer blanc/neuf	2,21	kgCO2e/kg
Iron - Oceania	Basic iron/steel and other metals	1792,71	kgCO2e/kUSD
Iron, steel and ferro-alloys, unknown mass - America/Canada	Iron and steel basic shapes and ferro-alloy products	918,04	kgCO2e/kUSD
Iron, steel and ferro-alloys, unknown mass - America/USA	Iron and steel mills and ferroalloy manufacturing	787,00	kgCO2e/kUSD
Lead - Europe	Lead (primary)	2,07	kgCO2e/kg
Lead - Oceania	Lead at regional storage	1,22	kgCO2e/kg
Magnesium - Europe	Magnésium	36,00	kgCO2e/kg
Magnesium - Oceania	Magnesium (at plant)	86,84	kgCO2e/kg
Metals, unknown material and mass - Europe/UK	Metals (Primary material production)	3,81	kgCO2e/kg

Metals, unknown material and mass - Europe/France	Basic iron and steel and of ferroalloys and first products thereof	636,93	kgCO2e/kUSD
Monel (nickel alloy) - Europe	Ferro-alloys - ferro-nickel	5,88	kgCO2e/kg
Nickel, unspecified - America	Production high-purity class 1 nickel	13,00	kgCO2e/kg
Other basic metals and casting - Europe	Other basic metals and casting	81,25	kgCO2e/kUSD
Stainless steel, coil, cold rolled (0% recycling) - America	Stainless steel - flat-rolled >600mm cold-rolled annealed	3,56	kgCO2e/kg
Stainless steel, coil, cold rolled (100% recycling) - Europe	Acier inoxydable, rouleaux, laminés à froid (304) pour meuble (100% de recyclage)	3,68	kgCO2e/kg
Stainless steel, coil, cold rolled (50% recycling) - Europe	Stainless steel, coil, cold rolled (304) for EEE (50% recycling)	4,66	kgCO2e/kg
Steel scrap - Europe	Metal waste disposal (steel cans - open-loop)	0,02	kgCO2e/kg
Steel, cold rolled (0% of recycling) - Global or unspecified region	Steel - Cold Rolled Coil	2,47	kgCO2e/kg
Steel, cold rolled (50% of recycling) - Europe	Acier, rouleaux, laminés à froid pour EEE (50% de recyclage)	1,72	kgCO2e/kg
Steel, electrolytic chrome-coated (ECCS) (50% recycling) - Europe	Acier, rouleaux, chromé (ECCS) pour EEE (50% de recyclage)	1,94	kgCO2e/kg
Steel, finished cold rolled (0% recycling) - Global or unspecified region	Steel - finished cold-rolled coil	2,57	kgCO2e/kg
Steel, finished cold rolled (50% recycling) - Europe	Acier, rouleaux, finis laminés à froid pour EEE (50% de recyclage)	1,79	kgCO2e/kg
Steel, hot dip galvanized (50% recycling) - Europe	Acier, rouleaux, à revêtement organique pour EEE (50% de recyclage)	2,01	kgCO2e/kg
Steel, organic coated (50% recycling) - Europe	Acier, rouleaux, à revêtement organique pour EEE (50% de recyclage)	2,21	kgCO2e/kg
Steel, tinplated (39.3% of recycling) - Europe	Acier, rouleaux, étamé pour emballage industriel (39.3% de recyclage)	2,13	kgCO2e/kg
Steel, tinplated (54% of recycling) - Global or unspecified region	Steel - Tinplate	2,70	kgCO2e/kg
Steel, tinplated (66.7% of recycling) - Europe	Acier, rouleaux, étamé pour emballage ménager (66.7% de recyclage)	1,69	kgCO2e/kg
Steel, unspecified - Europe	Steel production	1,30	kgCO2e/kg
Steel, wire rod (50% recycling) - America	Steel, wire rod for EEE (50% recycling)	1,50	kgCO2e/kg

Titanium, FFC electrowinning process - Global or unspecified region	Titanium - FFC electrowinning process	31,00	kgCO2e/kg
Titanium, kroll process - Global or unspecified region	Titanium - kroll process	35,70	kgCO2e/kg
Titanium, plasma powder process - Global or unspecified region	Titanium - plasma powder process	33,20	kgCO2e/kg
Titanium, unspecified - America	Titanium	17,00	kgCO2e/kg
Virgin Ferroalloy - America	Primary iron/steel and ferroalloy products	998,41	kgCO2e/kUSD
Zinc production - Oceania	Zinc primary at regional storage	4,82	kgCO2e/kg
Zinc, concentrate - Global or unspecified region	Zinc concentrate - production of zinc concentrate	0,43	kgCO2e/kg
Zinc, special high-grade (SHG) - Europe	SHGZ - Special High-grade Zinc	3,82	kgCO2e/kg
Zinc, unspecified - Europe	Zinc concentrate	1,12	kgCO2e/kg
Zinc, Zamak - Europe	Zamak zinc alloy (ZnAlMgCu)	5,18	kgCO2e/kg

7.5.2 Non-Metallic raw materials category breakdown

Subcategory	Proxy EF	Value	EF Unit
Carbon fiber, high strengths, long fibers - Europe	Fibre de carbone (CF, depuis PAN, haute résistance, fibres longues)	40,80	kgCO2e/kg
Carbon fiber, short fibers - Europe	Fibre de carbone (CF, depuis PAN, fibres courtes)	18,40	kgCO2e/kg
Drinking water - Europe	Drinking water	0,00	kgCO2e/kg
Drinking water - America	Drinking water and wastewater treatment	506,67	kgCO2e/kUSD
Fabrics for seat, unknown mass and material - America	Vehicle seating and interior trim (upholstery)	403,00	kgCO2e/kUSD
Fabrics for seat, unknown material - Global or unspecified region	Complexe (mousse polyuréthane de 1.5 mm d'épaisseur, support textile polyamide/élasthanne de 75 g/m²)	10,20	kgCO2e/kg
Foam, polystyrene foam - America	Polystyrene foam products	271,00	kgCO2e/kUSD
Foam, polystyrene foam - Europe	Polystyrène expansé, mousse (PS 12)), RER	2,95	kgCO2e/kg
Foam, polyurethane flexible foam (PU) - Oceania	Polyurethane flexible foam (at plant)	5,06	kgCO2e/kg
Foam, polyurethane rigid foam (PU) - Europe	Foam, polyurethane rigid foam (PU)	4,37	kgCO2e/kg
Foam, urea formaldehyde foam - Europe	Urea formaldehyde resin in-situ foam (urea-formaldehyde foam insulation - UFFI)	2,80	kgCO2e/kg
Foams, unknown material and mass - America	Urethane and other foam products (except polystyrene)	360,00	kgCO2e/kUSD

Glass fibers, high strength - Europe	Fibres de verre (haute résistance)	2,43	kgCO2e/kg
Glass fibers, low strength - Europe	Fibres de verre (faible résistance)	3,22	kgCO2e/kg
Glass, chrystal/Lead glass - Europe	Cristal/Verre au plomb, RER	1,87	kgCO2e/kg
Glass, container glass - America	Glass container manufacturing	0,60	kgCO2e/kg
Glass, curved glass - Europe	Verre plat courbé	2,40	kgCO2e/kg
Glass, flat glass average - Europe	Glass	1,12	kgCO2e/kg
Glass, float flat glass - Europe	Glass (container glass / flat glass)	1,07	kgCO2e/kg
Glass, laminated safety glass - Asia	Laminated Glass	1,54	kgCO2e/kg
Glass, patterned glass - Europe	Verre à motifs, RER	1,17	kgCO2e/kg
Glass, refractory, clay, other porcelain and ceramic, stone and abrasive products - Europe	Glass/refractory/clay/other porcelain and ceramic/stone and abrasive products	96,94	kgCO2e/kUSD
Glass, toughened glass (ESG) - Global or unspecified region	Glass - toughened - per kg. 2.5kg glass per mm thickness per m2	1,67	kgCO2e/kg
Glass, unspecified or unknown mass - America	Glass and glass products	591,05	kgCO2e/kUSD
Natural water - Europe	Natural water / water treatment and supply services	216,01	kgCO2e/kUSD
Other non-metallic mineral - America	Non-metallic mineral products	1077,64	kgCO2e/kUSD
Other non-metallic mineral - Europe	Autres produits minéraux non métalliques - 2023	764,64	kgCO2e/kUSD
Paper - America	Paper office supplies	870,22	kgCO2e/kUSD
Paper - Europe	Paper and paper products	559,14	kgCO2e/kUSD
Plastic - bags, films, and sheets - unknown mass - America	Plastic bags/films and sheets	725,01	kgCO2e/kUSD
Plastic - laminated plates - unknown mass - America	Laminated plastics plate/sheet (except packaging) and shape manufacturing	542,13	kgCO2e/kUSD
Plastic - pipes and fittings - unknown mass - America	Plastic pipe/fittings and sausage casings	626,10	kgCO2e/kUSD
Plastic - unknown material and mass - America	Other plastic products	498,27	kgCO2e/kUSD
Plastic, HDPE pipe - Asia	HDPE Pipe	2,41	kgCO2e/kg
Plastic, HDPE, processed by injection moulding - Europe	HDPE transformé par injection moulage, REF	2,82	kgCO2e/kg
Plastic, packaging film, LDPE - Europe	LPDE	2,79	kgCO2e/kg
Plastic, packaging film, PE - Europe	Plastique PE	5,71	kgCO2e/kg
Plastic, packaging film, PE-EVOH - Europe	Packaging film, PE-EVOH	2,87	kgCO2e/kg
Plastic, packaging film, PET - Europe	Plastic PET (including forming)	3,85	kgCO2e/kg
Plastic, packaging film, PP - Europe	Packaging film, PP	2,70	kgCO2e/kg
Plastic, PET, processed by injection stretch blow moulding - Europe	Packaging: Flexible PET / fossil-based - Average end of life	1,49	kgCO2e/kg
Plastic, PEX pipe - Europe	Drinking water pipe PEX	2,92	kgCO2e/kg
Plastic, plastic film, PA - Europe	Average plastic film (Primary material production)	2,57	kgCO2e/kg

Plastic, PP pipe - Europe	Platics PP including Forming	2,56	kgCO2e/kg
Plastic, PP, processed by injection moulding - Europe	PP transformé par injection moulage, RER	3,08	kgCO2e/kg
Plastic, PVC film - Europe	PVC calandré en film, RER	2,95	kgCO2e/kg
Plastic, PVC pipe - Europe	PVC Neuf	1,87	kgCO2e/kg
Plastic, PVC, processed by injection moulding - Europe	PVC transformé par injection moulage, RER	3,08	kgCO2e/kg
Plastic, thermoforming film, PA-PE - Global or unspecified region	Thermoforming film, PA-PE	6,10	kgCO2e/kg
Plastics, unspecified - America	Plastics	1414,56	kgCO2e/kUSD
Polystyrene foam, unknown mass - America	Polystyrene foam products	490,81	kgCO2e/kUSD
Rubber, epoxy resin - Europe	Epoxy resin	4,99	kgCO2e/kg
Rubber, Isobutylene Isoprene Rubber (IIR) - Europe	Caoutchouc butyle - caoutchouc isobutylène-isoprène (IIR) par polymérisation en émulsion, RER	3,16	kgCO2e/kg
Rubber, Nitrile-Butadiene-Rubber (NBR) - Europe	Caoutchouc Nitrile-Butadiène	5,44	kgCO2e/kg
Rubber, phenolic resin - Europe	Résine phénolique (concentration: 45%)	1,68	kgCO2e/kg
Rubber, polyester resin unsaturated (UP) - Europe	Résine de polyester insaturé (UP), RER	3,07	kgCO2e/kg
Rubber, polyvinylchloride resin (B-PVC) - Europe	Polychlorure de vinyle, résine (B-PVC), RER	1,65	kgCO2e/kg
Rubber, polyvinylpolypyrolidore (PVPP) - Global or unspecified region	Polyvinylpolypyrolidore (PVPP)	1,99	kgCO2e/kg
Rubber, polyvinylpolypyrolidore (PVPP) - Global or unspecified region	Polyvinylpolypyrolidore (PVPP)	1,99	kgCO2e/kg
Rubber, styreneacrylonitrile (SAN) - Europe	Styrène-acrylonitrile (SAN), RER	3,63	kgCO2e/kg
Rubber, styreneacrylonitrile (SAN) - Europe	Styrène-acrylonitrile (SAN), RER	3,63	kgCO2e/kg
Rubber, styrene-Butadiene Rubber (SBR) - Europe	Styrène-butadiène (SBR), mix, RER	3,55	kgCO2e/kg
Rubber, styrene-Butadiene Rubber (SBR) - Europe	Styrène-butadiène (SBR), mix, RER	3,55	kgCO2e/kg
Ruber, Polybutadiene rubber - Europe	Caoutchouc Polybutadiène, RER	4,31	kgCO2e/kg
Ruber, Polybutadiene rubber - Europe	Caoutchouc Polybutadiène, RER	4,31	kgCO2e/kg
Synthetic Rubber and fibers - America	Synthetic rubber and artificial and synthetic fibers	1061,86	kgCO2e/kUSD
Water supply - Europe	Water supply	0,15	kgCO2e/m3
Water supply - Oceania	Water supply	388,05	kgCO2e/kUSD

7.5.3 Gases and chemicals category breakdown

Subcategory	Proxy EF	Value	EF Unit

Basic organic chemicals - America/Canada	Basic organic chemicals	3216,76	kgCO2e/kUSD
Basic organic chemicals - America/USA	All other basic organic chemical manufacturing	1184,00	kgCO2e/kUSD
Chemical treatments - America	All other miscellaneous chemical product and preparation manufacturing	500,00	kgCO2e/kUSD
Explosives - America	Explosives manufacturing	500,00	kgCO2e/kUSD
Fluids, oil, skydrol - America	Basic organic chemicals	244,68	kgCO2e/kUSD
Other chemical products - America	All other miscellaneous chemical product and preparation manufacturing	500,00	kgCO2e/kUSD
Paint and coating - America	Paint and coating manufacturing	271,53	kgCO2e/kUSD

7.6 Services group

This group includes all services and is composed of the following categories:

- Professional services and consulting;
- Financial services and insurance;
- Travel services;
- Telecom services and IT support;
- Materials handling;
- Research, development and testing services;
- Repair and overhaul;
- Miscellaneous.

7.6.1 Professional services and consulting category breakdown

Subcategory	Proxy EF	Value	EF Unit
Advertising, public relations, and related services - America	Advertising / public relations and related services	281,81	kgCO2e/kUSD
Advertising, public relations, and related services - Europe	Services de publicité et d'études de marché - 2023	104,41	kgCO2e/kUSD
Architectural and engineering services; technical testing and analysis services - Europe	Architectural and engineering services/technical testing and analysis services	146,30	kgCO2e/kUSD
Business support services - America/Canada	Business support services	451,14	kgCO2e/kUSD
Business support services - America/USA	All other business support services	111,00	kgCO2e/kUSD
Business support services - Europe	Office administrative / office support and other business support services	149,78	kgCO2e/kUSD

Environmental and other technical consulting services - America	Environmental consulting services	90,00	kgCO2e/kUSD
Facilities support services - America/Canada	Facilities and other support services	318,11	kgCO2e/kUSD
Facilities support services - America/USA	Facilities support services	199,00	kgCO2e/kUSD
Marketing research and other professional, scientific, and technical services - America	Marketing consulting services	78,00	kgCO2e/kUSD
Office administrative services - America/Canada	Office administrative services	434,15	kgCO2e/kUSD
Office administrative services - America/USA	Office administrative services	100,00	kgCO2e/kUSD
Office administrative services - Europe	Office administrative / office support and other business support services	149,78	kgCO2e/kUSD
Other professional services - America	Other professional / scientific and technical services	80,00	kgCO2e/kUSD
Other services - America	Other services (not elsewhere specified)	158,27	kgCO2e/kUSD
Other services - Asia	Other services (not elsewhere specified)	345,38	kgCO2e/kUSD
Other services - Europe	Services d'architecture et d'ingénierie/ services de contrôle et analyses techniques - 2023	94,25	kgCO2e/kUSD

7.6.2 Financial Services and insurance category breakdown

Subcategory	Proxy EF	Value	EF Unit
Financial services, insurance and consulting - America	Accounting/tax preparation/bookkeeping and payroll	48,52	kgCO2e/kUSD

7.6.3 Travel services category breakdown

Subcategory	Proxy EF	Value	EF Unit
Travel services - America	All other travel arrangements and reservation services	88,00	kgCO2e/kUSD
Travel services - Europe	Agences de voyage, voyagistes, réservations	123,21	kgCO2e/kUSD

7.6.4 Telecom services and IT support category breakdown

Subcategory	Proxy EF	Value	EF Unit
Cloud services - America	Data processing / hosting and related services	313,90	kgCO2e/kUSD

Telecom services and IT support - Europe	Telecommunciations services - 2023	125,66	kgCO2e/kUSD

7.6.5 Materials handling category breakdown

Subcategory	Proxy EF	Value	EF Unit
Materials handling - America	Material handling equipment	537,73	kgCO2e/kg
Materials handling - Europe	Services de réparation et installation de machines et d'équipements - 2023	196,00	kgCO2e/kg

7.6.6 Research, development and testing services category breakdown

Subcategory	Proxy EF	Value	EF Unit
Research, development and testing services - America	Scientific research and development	169,82	kgCO2e/kUSD
Research, development and testing services - Asia	Research and development services	990,20	kgCO2e/kUSD
Research, development and testing services - Europe	Research and development services	108,55	kgCO2e/kUSD

7.6.7 Repair and overhaul category breakdown

Subcategory	Proxy EF	Value	EF Unit
Nonresidential Building Repair And Maintenance - Oceania	Non-residential building construction	206,33	kgCO2e/kUSD
Repair and maintenance of aircraft and spacecraft - Europe	Repair and maintenance of aircraft and spacecraft	333,37	kgCO2e/kUSD
Repair, overhaul of machines and equipments - Europe	Services de réparation et installation de machines et d'équipements - 2023	181,10	kgCO2e/kUSD

7.6.8 Miscellaneous category breakdown

Subcategory	Proxy EF	Value	EF Unit
Accommodation and catering - Europe	Services d'hébergement et de restauration - 2023	226,49	kgCO2e/kUSD
Clothing - America	Clothing	175,42	kgCO2e/kUSD
Munitions - America	Guns / ammunition and other munitions	698,29	kgCO2e/kUSD
Munitions - Europe	Weapons and ammunition	346,84	kgCO2e/kUSD
Office furniture - America	Office furniture and custom architectural woodwork and millwork	337,78	kgCO2e/kUSD
Office supplies (paper) - America	Paper office supplies	915,12	kgCO2e/kUSD
Office supplies (stationery and other equipment) - America	Office supplies (except paper) manufacturing	265,00	kgCO2e/kUSD
Paper - America	Paper office supplies	870,22	kgCO2e/kUSD
Paper - Europe	Paper and paper products	559,14	kgCO2e/kUSD
Shoes - Europe	Chaussures/en tissu	17,30	kgCO2e/kg
Shoes and other footwear - America	Footwear manufacturing	282,00	kgCO2e/kUSD
White paper ream - Europe	Ramette de papier blanc/80g/m² A4/Hors utilisation et fin de vie	2,29	kgCO2e / kg

7.7 Capital goods group

Capital goods are final products that have an extended life and are used by the company to manufacture a product, provide a service, or sell, store, and deliver merchandise. In financial accounting, capital goods are treated as fixed assets or as plant, property, and equipment (PP&E). Examples of capital goods include equipment, machinery, buildings, facilities, and vehicles.

This group is composed of the following categories:

- Buildings and industrial plants
- Industrial equipment
- Fleet
- Telecom equipment and IT hardware

7.7.1 Buildings and industrial plants category breakdown

Subcategory	Proxy EF	Value	EF Unit
Building and building construction works - Europe	Buildings and building construction work	239,54	kgCO2e/kUSD
Commercial buildings - Africa			
Commercial buildings - America/Canada	Other commercial buildings	491,42	kgCO2e/kUSD
Commercial buildings - America/USA	Commercial structures/including farm structures	246,34	kgCO2e/kUSD
Industrial building, concrete - America	Industrial building construction	239,00	kgCO2e/kUSD
Industrial building, concrete - Europe	Bâtiment industriel - structure en béton	825,00	kgCO2e/m²
Industrial building, metal - America	Prefabricated metal building and component manufacturing	262,00	kgCO2e/kUSD
Industrial building, metal - Europe	Bâtiment industriel/structure métallique	275,00	kgCO2e/kg
Infrastructures - America	Lessors of nonresidential buildings (except miniwarehouses)	246,00	kgCO2e/kUSD
Office building - Europe	Bâtiments de bureaux	650,00	kgCO2e/m2
Renewable energy plant - Biomass plant - Europe	Electricity generated from biomass	0,07	kgCO2e/kWh
Renewable energy plant - Geothermal plant - Europe	Electricity generated from geothermal	0,09	kgCO2e/kWh
Renewable energy plant - Geothermal plant, unknown installed capacity - Europe	Electricity generated from geothermal	3463,66	kgCO2e/kUSD

Renewable energy plant - Solar PV plant - Europe	Electricity generated from solar photovoltaic	0,06	kgCO2e/kWh
Renewable energy plant - Solar PV plant, unknown installed capacity - Europe	Electricity generated from solar photovoltaic	5467,89	kgCO2e/kUSD

7.7.2 Industrial equipment category breakdown

Subcategory	Proxy EF	Value	EF Unit
Air conditioning and industrial refrigeration equipment, unknown mass - America	Air conditioning/refrigeration and warm air heating equipment	432,95	kgCO2e/kUSD
Heating equipment other than warm air furnaces, unknown mass - America	Heating equipment other than warm air furnaces	176,00	kgCO2e/kUSD
Industrial process furnaces and ovens, unknown mass - America	Industrial process furnaces and ovens	177,29	kgCO2e/kUSD
Internal Combustion Engines, unknown mass - America	Other engine equipment manufacturing	297,00	kgCO2e/kUSD
Machinery and equipment n.e.c. - Europe	Machinery / equipment not specific	329,52	kgCO2e/kUSD
Machines and industrial equipment - America	Other industrial machinery manufacturing	185,00	kgCO2e/kUSD
Machines and industrial equipment, unspecified and unknown mass - America	Rental and operating leasing services of commercial and industrial machinery and equipment	600,75	kgCO2e/kUSD
Material handling equipment, unknown mass - America/Canada	Material handling equipment	697,06	kgCO2e/kUSD
Material handling equipment, unknown mass - America/USA	Material handling equipment	277,13	kgCO2e/kUSD
Metalworking machines, unknown mass - America	Cutting tool and machine tool accessory manufacturing	207,00	kgCO2e/kUSD
Metalworking machines, unknown mass - America	Cutting tool and machine tool accessory manufacturing	207,00	kgCO2e/kUSD
Other machines and industrial equipment, unknown mass - Europe	Machines et équipements - 2023	247,33	kgCO2e/k€
Plasticworking machines, unknown mass - America	Plastics packaging film and sheet (including laminated) manufacturing	544,00	kgCO2e/kUSD

7.7.3 Fleet category breakdown

Subcategory	Proxy EF	Value	EF Unit
Aircrafts and jets - America	Aircraft	139,00	kgCO2e/kUSD
Air and spacecraft and related machinery - Europe	Air and spacecraft and related machinery	315,61	kgCO2e/kUSD
Heavy-duty vehicles and mobile machinery - Europe	Véhicules - fabrication	5500,00	kgCO2e/ton
Heavy-duty vehicles and mobile machinery (SB) - America	Heavy duty trucks	328,00	kgCO2e/kUSD
Light-duty vehicles and mobile machinery - Europe	Transport de marchandises en véhicule utilitaire léger - flotte mixte (essence et gazole)	1,58	kgCO2e/ton.km
Light-duty vehicles and mobile machinery (SB) - America	Light-duty trucks / vans and sport utility vehicles (suvs)	395,66	kgCO2e/kUSD
Munitions - America	Guns / ammunition and other munitions	698,29	kgCO2e/kUSD
Munitions - Europe	Weapons and ammunition	346,84	kgCO2e/kUSD

7.7.4 Telecom equipment and IT hardware category breakdown

Subcategory	Proxy EF	Value	EF Unit
Desktop - Asia	Desktop	830,80	kgCO2e/item
Desktop - Europe	Ordinateur/fixe/Bureautique	169,00	kgCO2e/item
Desktop, high performance - Europe	Ordinateur/fixe/haute performance	296,00	kgCO2e/item
Electronics and optical products - Europe	Computer/electronic and optical products	298,81	kgCO2e/kUSD
Hard drive - America	AWS HDD Storage	0,00	kgCO2e/TB-Hour
Hard drive - Global or unspecified region	Baies de disques	15,50	kgCO2e/item
Heavy-duty vehicles and mobile machinery - America	Heavy duty truck manufacturing	272,00	kgCO2e/kUSD
IT server - Asia	Server	778,90	kgCO2e/item
Laptop - Asia	Laptop 14 inches	482,00	kgCO2e/item
Laptop - Europe	Ordinateur/portable	156,00	kgCO2e/item
Light-duty vehicles and mobile machinery - America	Light truck and utility vehicle manufacturing	268,00	kgCO2e/kUSD
Printer, laser - Europe	Imprimante - laser	197,00	kgCO2e/item
Printer, laser - Europe	Imprimante - laser	197,00	kgCO2e/item
Printer, multi-function - Europe	Imprimante/multi-fonction	87,90	kgCO2e/item
Smartphone, < 5 inchs - Europe	Smartphone/de plus de 5,5 pouces	39,10	kgCO2e/item
Smartphone, < 5 inchs - Europe	Smartphone/de plus de 5,5 pouces	39,10	kgCO2e/item
Smartphone, > 5 inchs - Europe	Smartphone/de 5 pouces	32,80	kgCO2e/item
Smartphone, > 5 inchs - Europe	Smartphone/de 5 pouces	32,80	kgCO2e/item
Tablet, classic - Asia	Tablet	177,80	kgCO2e/item
Tablet, classic - Europe	Tablette - classique - 9 à 11 pouces	63,20	kgCO2e/item
Video projector - Europe	Vidéo projecteur	145,00	kgCO2e/item

8. Methodology specific features

8.1 General comments on the accuracy

Scope 3 emissions calculations usually have a high level of uncertainty, sometimes as high as 50%. The high level of uncertainty is mainly due to the following two factors:

- **Activity data**: This type of data is usually the result of approximations or aggregation of sectoral data. They serve as an alternative to more costly and precise information.
- **Emission factors:** While both spend-based and mass-based factors have relatively high levels of uncertainty, spend-based EF have higher levels of uncertainty. This is mainly because these EF are estimates that do not take account for variables such as country of production or the specific industrial processes involved.
- **Emission factors calculation:** Emission factors derived through internal calculations (processed metals and metals and their related processes) carry a high level of uncertainty compared to values directly sourced from standardized databases. This is due to the use of proxy ratios or estimations in the absence of detailed process-specific data. While these factors provide a practical and transparent basis for emissions estimation, their results should be interpreted with appropriate caution.

The levels of uncertainty of EF within a sector can vary widely from one source to another. These uncertainties are rarely assessed in detail and there is little information on the disparity within a sector. Consequently, this methodology does not quantify the uncertainties associated to PG&S/CG emissions. Focus is directed to providing a breakdown of GHG emissions between spend-based and mass-based factors, which provides an indication of the result's uncertainty.

In addition, the use of public EF as proxies for specific products brings a fair number of uncertainties. Although likely more representative of sector specificities (product price, type of materials used, etc.), supplier specific EF were not included in the methodology for practical reasons.

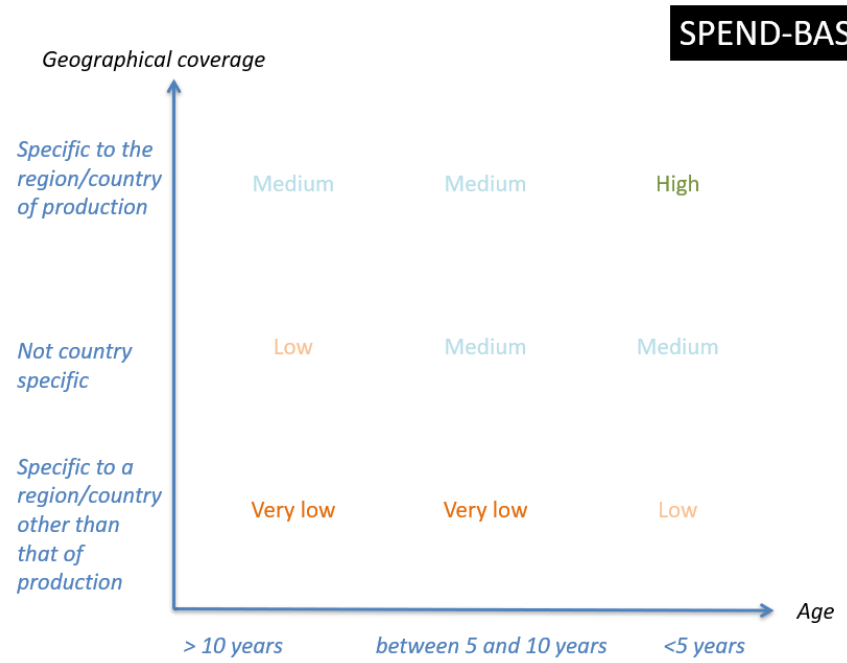
The adoption of this tool will allow users to select the level of accuracy that best corresponds to their available resources while retaining methodological consistency.

8.2 Influence of location and release dates on EF level of certainty

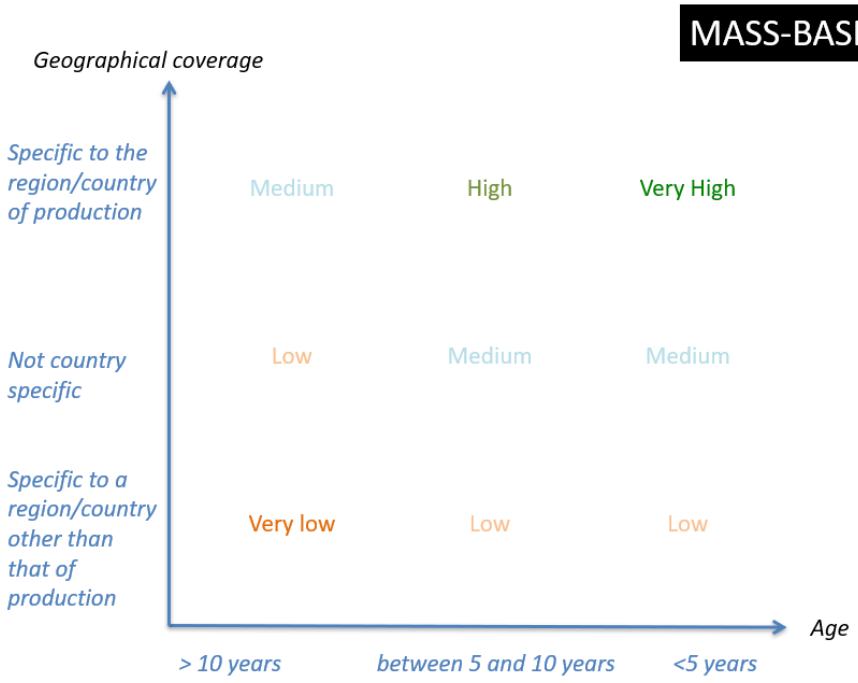
The level of confidence for a factor is derived from a combination between:

- the age of the EF
- the specificity of its geographical data

Figure 1 and Figure 2 indicate the level of certainty based on geographical coverage and on the age of the EF.



Level of certainty for different levels of geographical specificity and age for spend-based factors



Level of certainty for different levels of geographical specificity and age for mass-based factors

8.3 EF validity periods

Although the methodology aims for EF to be released within five years of the reporting date, the methodology does include older EF since some of the public databases use older yet useful comprehensive data. Also, some EF couldn't be found with updated data and are kept with Version 2 values. Such consideration is accounted for in an EF's confidence level and the procedure allows for the application of data in the absence of better alternatives. Therefore, the methodology does not prescribe a mandatory validity period for the EF but recommends the use of the most recent reliable EF available.

8.4 Spend-based approach specific features

8.4.1 Consideration for inflation

The EF values in the spend-based approach are given in $kgCO_2/k\$$, kCAD, kNZD and $kgCO_2/k€$. A drawback of this type of data is the yearly variability associated with economic factors such as inflation. Using a series of American and European inflation rates allows for more reliable results.

A correction functionality located in the "conversion" tab mitigates the variability associated to inflation. Data for a few past years has already been incorporated, and additional fields are left blank to integrate future yearly inflation rates. Today, the conversion data are updated from 2000 to 2025. See Chapter 9.1 for more information on how to integrate annual inflation data into the tool.

The following example demonstrates how the inflation rate is applied to correct spend-based EF.

Considering that the inflation rate is 2% between year N and year N+1, then:

$$EF_{(year\ N+1)} = EF_{(year\ N)}/(1+2\%)$$

8.4.2 Consideration for exchange rate

Most EF is obtained from a limited number of geographical locations and expressed in the corresponding currencies. To make them applicable in other geographies and currencies, the use of an exchange rate functionality is integrated in the tool ('conversion' tab)

Users can collect currency exchange data through public websites such as IRS, OFX, or using other reputable sources.

The following example demonstrates how the exchange rate is taken into consideration. As an example, in 2024, US$1 was worth, on average, €0.92. Therefore, for the year 2024, if the reporting company expenses are in €, EF shall be converted as follows:

$$EF\ (in\ €) = EF\ (in\ US\$) \times 0.92$$

8.4.3 Accuracy

The considerable reliance on EEIO EF also brings uncertainty to the users' assessments. The values are based on averages within a category, they do not distinguish between products within a sector, assume linear proportionality between economic activity and environmental burden, usually do not distinguish between domestically produced goods and imports, and are very sensitive to price fluctuation. The reliance on these values also makes it impossible to bring specific adjustments or refinements in the emissions calculations, such as for differentiating between different types of materials.

8.4.4 Other effects for currency

The reliance on currency has significant effects on the accuracy of spend-based factors. Any element that will affect purchasing prices will affect the accuracy of the EF. Among these elements are:

- Year-on-year price variability due to market price variations
- Supplier discounts policies

It is not possible to adjust spend-based calculations to remove these variabilities. Hence, consideration of these limitations is required when selecting the appropriate quantification approach. Users seeking a higher level of accuracy should consider the hybrid-based approach and mass-based approach for their higher level of certainty.

8.5 Specific metals processes methodology

This section presents the methodological framework applied to account for emissions linked to metal transformation processes. It includes a structured decomposition approach that distinguishes between base metals, processing steps and their combined impact, as well as standardized estimation method for cases where process details are unspecified. The methodology is fully pre-integrated into the dataset, no calculation is required from the user, who simply selects the emission factor that best fits their activity and available data.

These methods enhance transparency, enable consistent year-on-year comparison, and ensure accurate representation of emissions in the absence of granular data.

8.5.1 Metals and related processes

To ensure full transparency and enable meaningful tracking of emissions evolution, the treatment of metals and their associated processes has been updated using a structured three-layers approach within the GHG Calculation Tool.

For each metal, three-line items are included:

1. A line reflects the combined emission factor of the metal and its transformation process.
2. A line isolates the metal itself (e.g. Nickel, Zinc, Aluminium)
3. A line isolated the specific processing step (e.g. casting, rolling, pultrusion)

This structured approach allows for a clear breakdown of contributions to the total emission factor in kgCO2e and facilitates year-on-year comparisons, updates or methodological refinements, all while maintaining traceability and clarity in the dataset.

Aluminium, extrusion profile - Casting (kgCO_2e) = Aluminium, extrusion profile + Casting (low impact)

In the calculation tool, the mention “IAEG calculation” has been added and an associated comment details the emissions factors ID to sum to get the right calculation.

17	Aluminium, extrusion profile - Casting - Global or unspecified region	3	Aluminium, profilé extrudé + Casting - Moulage (impact réduit)	Mass-based	IAEG Calculation	2,86	kgCO2e	kg
18	Aluminium, extrusion profile - Casting - Europe	3	Aluminium, profilé extrudé	Mass-based	Base empreinte	2,46	kgCO2e	kg
19	Aluminium, extrusion profile - Casting - Global or unspecified region	3	Casting - Moulage (impact réduit)	Mass-based	Base empreinte	0,403	kgCO2e	kg

Screenshot of the Aluminium Extrusion Profile - Casting with detailed calculation

The example above shows the split of the calculation to get the Aluminium Extrusion Profile – Casting total amount, by sum Aluminium Extrusion Profile and Casting. This process is flagged under the Database name “IAEG Calculation”.

8.5.2 Processed Metals Calculation

For processed metals (unspecified), where the transformation type is not specified, previous data comparison shows that processed variants generally exhibit emission factors approximately 1.5 times higher than their unprocessed counterparts.

Based on this historical ratio, the emission factors of the relevant base metal have been multiplied by 1.5 to estimate the impact of generic processing. This provides a consistent and pragmatic proxy in the absence of detailed process-level data, while maintaining comparability and methodological alignment across datasets.

Aluminium, extrusion profile – Unspecified process (kgCO_2e) = Aluminium, extrusion profile * 1,5

30	Aluminium, extrusion profile - Metal sheet stamping - Europe	3	Aluminium, profilé extrudé	Mass-based	Base empreinte	2,46	kgCO2e	kg
31	Aluminium, extrusion profile - Metal sheet stamping - Global or unspecified region	3	Metal sheet stamping - Emboutissage de tôle (20% de pertes)	Mass-based	Base empreinte	-0,0116	kgCO2e	kg
32	Aluminium, extrusion profile - Unspecified process - Global or unspecified region	3	Processed Aluminium extrusion profile	Mass-based	IAEG Calculation	3,6900	kgCO2e	kg

Screenshot of the detailed calculation of Aluminium Extrusion Profile Unspecified process

The example above shows the detail of the calculation to get the Aluminium Extrusion Profile – Unspecified Process total amount, by multiplied Aluminium Extrusion Profile by 1,5. This process is flagged under the Database name "IAEG Calculation".

8.6 Other specific products methodology

This section outlines methodological choices applied to a subset of emission factors that required special treatment due to data limitations, sector misalignment, or transitional considerations. It includes:

- **Generic emission factors** flagged for further investigation (Door, Window), where additional aerospace-specific research is recommended.
- **Non-updated factors** from version 2, maintained due to the absence of updated values, but associated with higher uncertainty.
- **Intentionally duplicated factors:** designed to offer methodological flexibility (e.g. mass-based vs spend-based or varied units) to better match the diversity of available user data.

These approaches ensure transparency while supporting the gradual improvement of emission factor quality over time.

8.6.1 Duplicated Emission Factors

Certain emission factors appear in duplicate within the dataset to accommodate different user needs and data contexts. In some cases, the same activity or material is associated with two methodological approaches: mass-based and spend-based, to allow users to select the factor most aligned with their available data.

Aluminium, sheet: Mass-based Emission Factor OR **Aluminium, sheet**: Spend-based Emission Factor

In other cases, duplication reflects the use of different measurements units (e.g. kg, unit, m3) ensuring flexibility for users to apply the emission factor that matches their operational data structure. This intentional duplication promotes adaptability and accuracy in emissions reporting.

Aluminium-based manufactured products, unknown mass: Spend-based Emission Factor – k€ unit OR **Aluminium-based manufactured products, unknown mass:** Spend-based Emission Factor – kCAD unit

8.6.2 Further Investigation Emission Factors

Some emission factors included in the dataset have been identified as highly generic and may not accurately reflect the specific characteristics of the aerospace sector. These factors have been retained for transparency and completeness but should be treated with caution. Further investigation and especially sector-specific research are recommended to refine the emission estimates for these items and ensure greater alignment with actual industrial processes and supply chains. This flag does not require user action immediately but serves as an indicator for future methodological enhancement.

Window: Metal window and door manufacturing (Emission factor label highly generic)

8.6.3 Non-updated Emission Factors

A limited number of emission factors have been retained from the previous version (GHG Calculation Tool V2) without recent updates. These factors were not revised in the current version due to their high specificity or the lack of robust, up-to-date data sources, making reliable recalculation difficult. While these values remain available for use, they should be considered with a higher level of uncertainty, and are flagged accordingly in the Emission Factors Tab. Their inclusion ensures continuity and coverage, while acknowledging the need for future refinement as more accurate or sector-specific data becomes available.

Recycled polypropylene (PP), any process - Europe	3	Processed Production of recycled PP granules from collected and sorted PP waste	Mass-based	Base Impacts	0.12	kgCO2e	kg	kgCO2e/kg	2011

Screenshot of the Recycled Polypropylene Process Emission Factor from V2 dataset

8.6.4 Unfound Emission Factors

Several emission factors from the new commodities list introduced in this version are currently missing from the database. These items represent newly added categories for which no reliable or representative data could be identified at this stage. As they are not part of the previous version of the tool, no historical values were available to ensure continuity.

To maintain transparency while avoiding confusion for users, these entries have been intentionally hidden in the Excel tool. However, they are retained in the dataset structure to ensure traceability and to facilitate inclusion in future updates, as more robust data becomes available.

9. Maintaining the database

9.1 Adding several regions/countries associated to one emission factor

Version 3 of the GHG Calculation Tool introduces a significant improvement in the regional granularity of emission factors. Each factor is now associated with up to six regions (Africa, America, Asia, Europe, Oceania and Global/Unspecified). While not every factor has data for all regions, several include 2 or 3 options, enabling users to choose the most relevant value based on the subcategory's geographic origin and improving overall data reliability.

In certain cases, multiple country-level datasets exist within the same region. These are clearly flagged in the tool using the format [Subcategory – Region/Country], helping users make informed selections.

Basic organic chemicals - America/USA	3	All other basic organic chemical manufacturing	Spend-based	EPA	1184	kgCO2e	kUSD
Basic organic chemicals - America/Canada	3	Basic organic chemicals	Spend-based	OpenIO v2.9	2348	kgCO2e	kCAD

Screenshot of the duplicate of subcategory "Basic organic Chemicals" from same regions/different country

To support this structure:

- The "GHG Emission Factors" tab displays all emissions factors across all six regions, including duplicates. Where no value is available for a region, "N/A" appears to transparently indicate data gaps.

Aluminium Virgin - Africa		Mass-based
Aluminium Virgin - America		Mass-based
Aluminium Virgin - Asia	*3*	*Mass-based*
Aluminium Virgin - Europe	*3*	*Mass-based*
Aluminium Virgin - Global or unspecified region		Mass-based
Aluminium Virgin - Middle East		Mass-based
Aluminium Virgin - Oceania		Mass-based

Screenshot of the Aluminium Virgin detailed by region

- The "Emission Factors" tab presents only the subcategories for which regional values have been found, making it easier to browse validated data without duplication.

Aluminium Virgin - Europe	3	Aluminium/neuf	Mass-based	Base empreinte	7,80	kgCO2e	kg
Aluminium Virgin - Asia	3	Sheet Aluminium Virgin	Mass-based	SEFR	9,05	kgCO2e	kg

Screenshot of the Aluminium Virgin in Emission factors tab

Currently **32 emissions factors** benefit from this multi-region approach. This setup also allows for future enrichment, for instance, if a supplier provides a region-specific factor not yet in the dataset (e.g. Aluminium virgin – America), it can be added alongside existing values (Asia, Europe), further improving precision and adaptability.

9.2 Adding the annual average inflation rate

The EF values for the spend-based approach are given in $kgCO_2e$/k$, /kCAD, /kNZD and /k€. The tool contains already past inflation rates for converting the EF to the current reporting date. In case the

average inflation rate is not displayed in the "conversion" tab for the reporting year, the user must collect inflation data using the OECD Inflation tool or using other reputable sources.

OECD inflation tool: to collect yearly inflation rate data, the user can use the inflation indicator chart on OECD's website. In the 'Time' Panel, in the middle-right section of the page, select the **yearly** option. The user can collect the appropriate data by hovering its mouse over the charts for different countries.

Once the yearly inflation rate is known, open the "conversion" tab and enter the appropriate information in the blank field of the "inflation rate" table.

9.3 Adding the currency exchange rate

Results will likely depend on spend-based EF using euros, CAD, NZD and USD. It is therefore important to update the currency exchange rate between these currencies to reflect the latest monetary tendencies.

The users must first collect inflation data using the OECD Inflation tool or using other reputable sources.

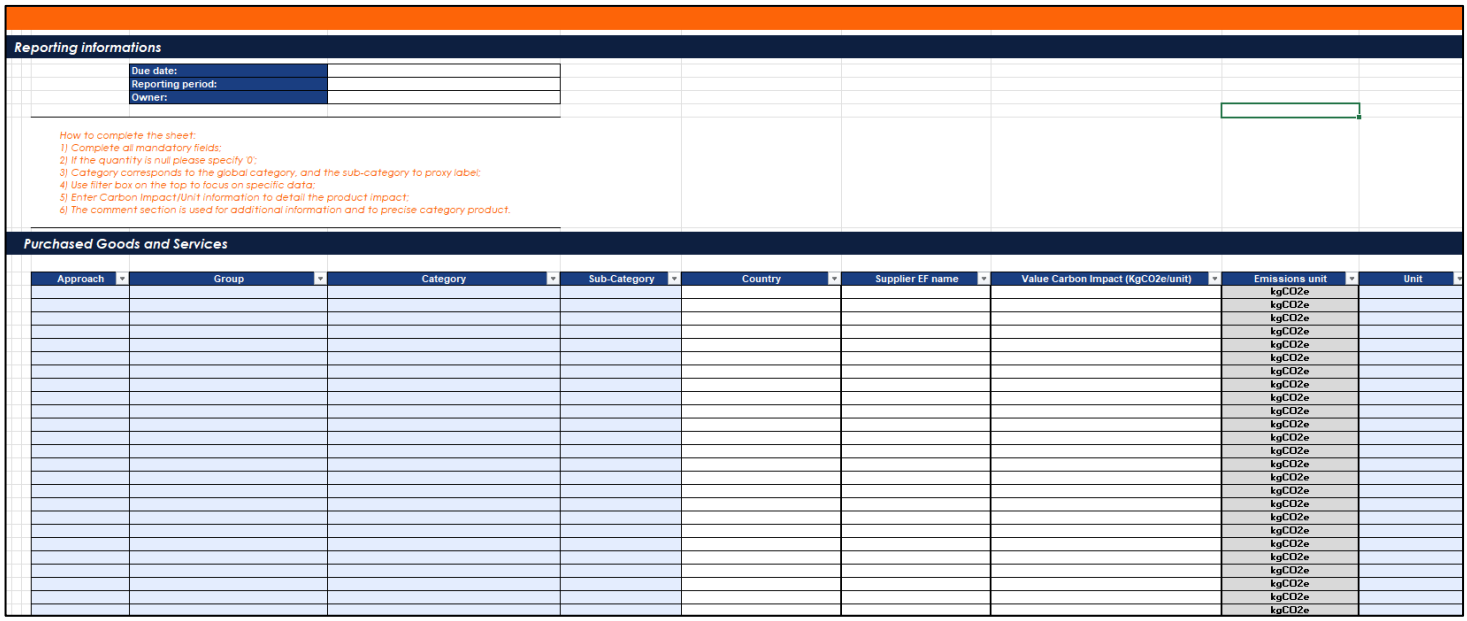
- IRS: Known as the United States' Internal Revenue Service, the institution provides an annual average exchange rate with many national and international currencies.
- OFX: An entity that provides conversions between major currencies. It can also offer specific data depending on the frequency and reporting period.

To integrate the data in the tool, ensure that the year reporting year is entered in the "import data" tab. Open the "conversion" tab and enter the appropriate information in the blank fields of the "currency rate" section.

9.4 Adding supplier specific emission factor

A dedicated 'Supplier Data' tab has been integrated into the tool to facilitate the collection of specific supplier information, which then feeds into the 'GHG emissions calculations' tab. Data entry in this 'Supplier Data' tab should adhere to the established Group/Category and Sub-Category breakdown. Users also have the option to provide supplier's data by country and specify a regional or location tag for each added emission factor.

In such instances, particular attention must be paid to duplicating the corresponding line in the 'GHG emissions calculations' tab for each regional entry pertaining to the same sub-category. This ensures proper alignment and accuracy in region-specific emission factor application.



Reporting informations

Due date:	
Reporting period:	
Owner:	

How to complete the sheet:
1) Complete all mandatory fields;
2) If the quantity is null please specify '0';
3) Category corresponds to the global category, and the sub-category to proxy label;
4) Use filter box on the top to focus on specific data;
5) Enter Carbon Impact/Unit information to detail the product impact;
6) The comment section is used for additional information and to precise category product.

Purchased Goods and Services

Approach	Group	Category	Sub-Category	Country	Supplier EF name	Value Carbon Impact (KgCO2e/unit)	Emissions unit	Unit
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	
							kgCO2e	

Supplier Emission Tab in the GHG Calculation Tool

9.5 Recommendations for future updates

Future updates of the methodology could target the following three topics:

- The emission factors, especially specific ones difficult to find.
- Integration of user feedback and calculation principles.
- Technological Limitations, especially with the 'GHG emissions calculations' tab.
- GHG emissions calculations.

9.5.1 Emission Factors Update

The EF updates should follow the data source's updates. IAEG should monitor these sources' updates on a yearly basis and, if needed, decide the opportune timing for the internal database update. During this yearly review of database updates, IAEG should also keep a look out for new public databases that may complement or replace data in the tool. A new version of the tool with updated EF tables should be communicated to members in accordance with annual reporting timelines in mind.

9.5.2 Integration of user feedback and update of calculation principles

Feedback should be collected from tool users over time to identify opportunities to adjust certain methodological features. Except for a major change requiring rapid action, the necessary changes can be addressed on an annual basis.

Moreover, calculation principles such as product categorization, specific rules, inflation adjustments, etc. should be addressed at the same frequency.

9.5.3 Technological Limitation with the tool

It is important to note that the current tool is an Excel-based solution, specifically designed for use within the Microsoft Excel environment. It was not developed or optimized for functionality within collaborative online spreadsheet platforms such as Google Sheets. Should the tool be used in Google Sheets©, there is a significant risk that certain formulas and functionalities may become corrupted or cease to operate correctly, rendering the tool non-functional. This limitation is inherent to the distinct technical architectures of the platforms and is not attributable to the IAEG's design or development of the tool.

9.5.4 GHG Emission tab

A current limitation of the "GHG Emissions Calculations" tab is that it does not support the automatic integration of multiple emissions factors for the same sub-category when these factors come from the

same region but are differentiated at country-level. For example, if both country-specific emissions factors exist under the “Europe” region for a given sub-category, the tool will only integrate one by default. This constraint may be addressed in future updates to enhance flexibility and support more granular geographic differentiation.

10. Frequently Asked Questions (FAQs)

This section answers a few questions that commonly arise when dealing with the accounting of GHG emissions for PG&S and CG.

Is the buy-to-fly ratio considered by the methodology for transformed raw materials?

The methodology does not take into consideration any buy-to-fly[1] ratio. In cases where specific EF are provided by product suppliers, they should respect GHGP's specific requirements regarding consideration of waste and recycled material as discussed in Appendix 3: Compliance to international standards to properly account for the potential buy-to-fly ratio.

What to expect when undergoing a change in approach?

While spend-based EF are convenient and provide a basis for calculating scope 3 emissions, mass-based EF will help users identify more accurately their company's emissions. Hence, it is expected that users will, over time, progress from the spend-based approach to the mass-based approach. The overall reported results might differ significantly in the years when such changes occur due to the sudden increase in EF specificity. This might occur if the company consumes a large quantity of material for which the more specific mass-based EF differs considerably from the more general spend-based EF. Should a company identify PG&S as a major source of GHG emissions, it is encouraged to use the mass-based approach due to its higher accuracy.

Which EF to select if there are two EF for a single sub-category?

The rules below were used during the development phase of the methodology and are applicable in this context. The user should select the one that best aligns with their available data, operational context, and reporting needs. When more than one factor is available for a given item, the user should determine the relevant action through the following steps:

1. If the EF are associated with different geographical locations, the user should enter the appropriate amount of material (in currency or mass) from each of these different locations.
2. If the EF targets the same geographical location and are very similar, priority should be given to the EF with the latest release date.
3. If the EF targets the same geographical location and has a discrepancy greater than 30% then the most reliable[2] database must be selected.

Ideally, only the most recent EF should be considered in the IAEG methodology (typically less than 5 years old). However, older public databases are used because they provide useful EF in a few cases.

[1] For composite and metallic materials, between the upstream of the value chain (production of the raw material) and the delivery of finished parts to an OEM or a manufacturer, many "losses" of material are accumulated: the "buy-to-fly" ratio explicates the amount of material included in a finished product (purchased and installed by a manufacturer on an A/C for example) compared to the total amount of material used to manufacture this product along the value chain.

[2] This judgment is made by the authors of the methodology.

Can the emissions of capital goods be amortized over several reporting years?

As directed in the GHG Protocol, the emissions from the production of capital goods must be entirely accounted for in the year of acquisition.

11. Appendices

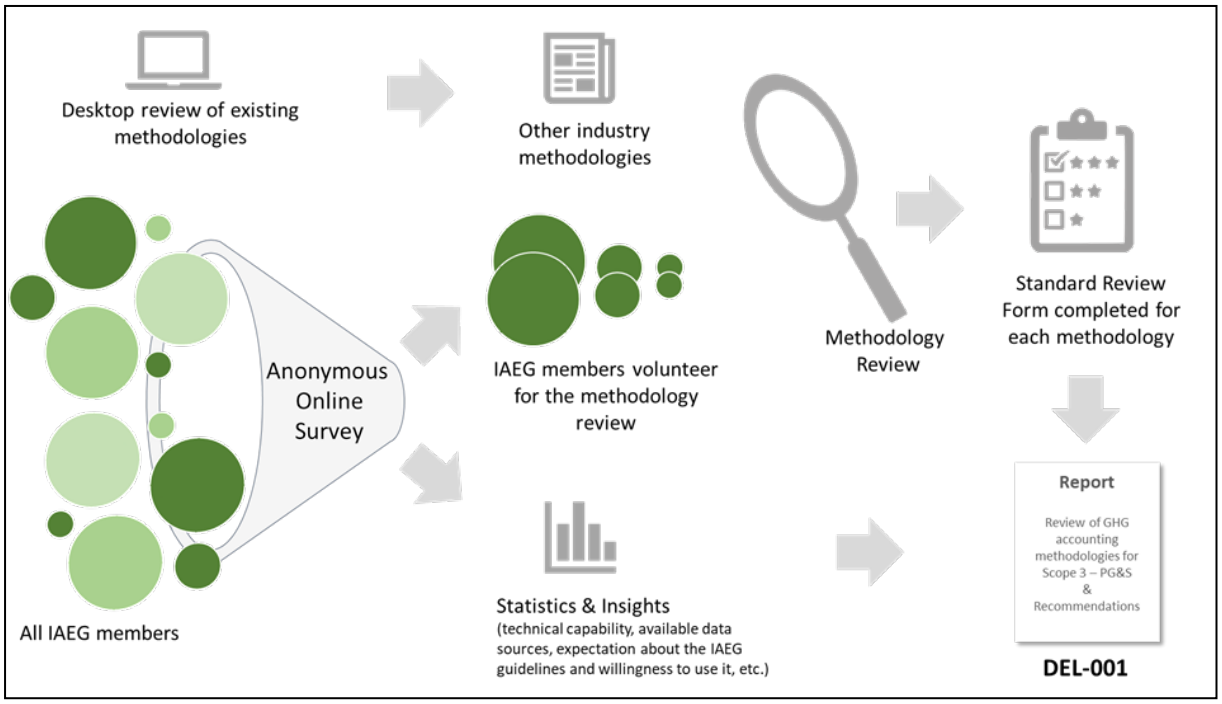
11.1 Appendix 1: The process leading to the creation of this document

The present document is the result of collaborative work completed over three key phases.

The presented process leading to the creation of this document refers to the first version of this document's creation.

11.1.1 Phase 1

The first phase is described in Figure 3.



Overview of the steps taken in Phase 1 of the project

Phase 1 consisted of 4 main steps:

1. Online survey conducted among voluntary IAEG members
2. Interviews with a selection of IAEG members having previously worked on PG&S emissions assessment
3. Desktop review of non-IAEG methodologies comprising a specific section on PG&S and/or CG;
4. Interviews with selected non-A&D companies.

A multi-criteria analysis grid was specifically developed to better characterize the different approaches observed, to identify their strengths and weaknesses, and to compare them to IAEG members' main expectations. This approach allowed:

- Perform a review of the different tactics and practices that IAEG members and other industries use to address Scope 3 PG&S and CG;

- Assess the level of technical capabilities and expectations of IAEG members with regards to Scope 3 PG&S and CG;
- Draft recommendations of methodology requirements & parameters.

11.1.2 Phase 2

A second phase was devoted to establishing final requirements for the methodology.

11.1.3 Phase 3

Phase 3 integrated the results from Phase 1 and Phase 2 to develop the user guide and the methodology, to clarify the categorizations and approaches, and to assemble the required emission factor.

The user guide and this document – the methodology - are the main deliverables for phase 3 and are complemented by a simple tool for users to perform the calculations.

11.2 Appendix 2: Description of the main databases

11.2.1 Base Empreinte database

Launched in 2022, the Empreinte® database is the new name for what was formerly known as the Base Carbone®, reflecting its expanded scope beyond carbon to a broader range of environmental impacts. Developed and managed by ADEME (France's Environment and Energy Management Agency), the Empreinte® Database integrates high-quality life cycle inventory data licensed from ecoinvent, offering robust, standardized environmental impact factors for public and private use.

Empreinte® Database provides verified data on greenhouse gas emissions, energy consumption, and other environmental indicators, supporting carbon footprint calculations, sustainability reporting, and life cycle assessments.

Governed by ADEME, the database is protected under French intellectual property law and subject to strict licensing terms. ADEME retains full rights to update its structure, content, and access rules to ensure scientific rigor and regulatory alignment.

11.2.2 EPA database

The GHG Emission Factors Hub, managed by the U.S. Environmental Protection Agency (EPA), is a centralized and authoritative source of default greenhouse gas emission factors. It was launched in 2011 to support consistent and transparent GHG reporting by organizations in the United States and beyond.

This database provides standardized emission factors for a wide range of activities and sources, including:

- Stationary fuel combustion

- Electricity use (using eGRID regional factors)
- Mobile combustion and transportation
- Waste management (via WARM model inputs)
- Purchased goods and services (Scope 3)

The Hub is designed primarily for organizations conducting voluntary GHG inventories, but it is increasingly referenced in regulatory reporting frameworks, corporate climate disclosures, and carbon foot printing tools.

Updated annually, it integrates the most recent available data from multiple EPA programs and international sources like the IPCC (for global warming potentials). Each factor is documented with metadata, calculation methodology, and scope applicability (Scope 1, 2, or 3), ensuring traceability and scientific robustness.

By standardizing emission data, the Hub helps organizations align with frameworks such as the GHG Protocol, CDP, and TCR, and contributes to greater transparency and comparability across climate-related disclosures.

11.2.3 GEMIS database

GEMIS (Global Emission Model for Integrated Systems) is a comprehensive life cycle inventory (LCI) and environmental impact assessment database and modeling tool developed by the Oeko-Institut, a German environmental research institute. First released in the early 1990s, GEMIS provides detailed data on energy use, emissions, and environmental impacts across a wide range of energy and material flows, technologies, and sectors.

Designed to support integrated environmental assessments, GEMIS covers:

- Energy supply and conversion (renewable and fossil fuels)
- Industrial processes and product systems
- Transport systems and infrastructure
- Waste management and recycling processes
- Land use and agriculture

The database includes extensive emission factors for greenhouse gases, air pollutants, water pollutants, and resource consumption, enabling life cycle assessments, scenario analyses, and sustainability studies.

GEMIS is widely used by policymakers, researchers, and consultants to evaluate the environmental performance of technologies and policy options at local, national, and international scales. It supports scenario modeling for climate mitigation, energy transitions, and sustainable development.

The database and modeling tools are regularly updated to incorporate new scientific findings, technological advancements, and changing regulatory requirements. GEMIS outputs are compatible with international LCA standards, helping ensure transparency and comparability.

GEMIS is often used in conjunction with other databases such as ecoinvent or GaBi, offering a complementary European perspective with a focus on integrated system modeling.

11.3 Appendix 3: Compliance with international standards

The table below summarizes the basic principles of GHG Protocol[4], ISO14064-1, and ISO/TR 14069[vi] requirements and explains how the methodology complies with these requirements.

Compliance of the methodology with key ISO 14064-1, ISO 14069, and GHG Protocol requirements

Source	Requirement	This methodology
GHG Protocol	"Extraction, production, and transportation of goods and services purchased or acquired by the reporting company in the reporting year, not otherwise included in Categories 2 – 8" Minimum boundary: "all upstream (cradle-to-gate) emissions of PG&S)" (p. 34)	Transportation-related emissions between the Tier 1 supplier and the company's gate are accounted for in the other category #4 "Upstream transportation and distribution". Upstream, transport-related emissions should be included in the EF.
GHG Protocol	"This category [purchased goods and services] includes emissions from all purchased goods and services not otherwise included in the other categories of upstream scope 3 emissions (i.e., category 2 through category 8). Specific categories of upstream emissions are separately reported in category 2 through category 8 to enhance the transparency and consistency of scope 3 reports."	All expenses related to energy, transportation of people (either through business travel or employee commuting), and transportation of goods are excluded from the current methodology, as they were already addressed by IAEG.
GHG Protocol	"A company's purchases can be divided into two types: Production-related procurement & non-production-related procurement" (p. 38)	Supported by the methodology.
GHG Protocol	"Capital goods are final goods that are not immediately consumed or further processed by the company but are used in their current form by the company […]. Scope 3 emissions from capital goods are reported in category 2 (Capital Goods), rather than category 1 (PG&S)." (p. 39)	Supported by the methodology.
GHG Protocol	"For purposes of accounting for scope 3 emissions, companies should not depreciate, discount, or amortize the emissions from the production of capital goods over time. Instead, companies	The methodology respects this prescription from GHG Protocol.

	should account for the total cradle-to-gate emissions of purchased capital goods in the year of acquisition, the same way the company accounts for emissions from other purchased products in category 1."	
GHG Protocol	"To avoid double counting of emissions from recycling processes by the same company, companies should account for upstream emissions from recycling processes in category 1 and category 2 when the company purchases goods or materials with recycled content. »	The aerospace industry uses minimal amounts of recycled content for safety reasons; this specific issue is thus not considered in the methodology. Should a company wish to add a specific EF for a given material, they shall respect this GHG Protocol requirement in their calculation.
GHG Protocol	***Examples of primary data*** *[for « Purchased Goods and Services]* • Product-level cradle-to-gate GHG data from suppliers calculated using site-specific data • Site-specific energy use or emissions data from suppliers » ***Examples of secondary data*** • Industry average emission factors per material consumed from life cycle inventory databases »	The current tool is based on the use of secondary data from public sources for convenience, but it encourages the use of primary data from suppliers, under specific conditions.
GHG Protocol	"Waste may be generated from production processes included in category 1 (Purchased Goods and Services) […]. If a facility produces waste during production, no emissions from the facility should be allocated to the waste. All emissions from the facility should instead be allocated among the facility's other outputs. If waste becomes useful and marketable for use, it is no longer considered waste and should be treated like other types of outputs.	This recommendation applies only to suppliers willing to provide specific EF for their products manufactured from raw materials. In such a case, the supplier will pay attention to this GHG Protocol requirement addressing allocation.
ISO14064-1	« Examples of emission sources and sinks: Emissions from purchased goods and associated with the fabrication of the product. As this could encompass a wide range of products, further	The present methodology proposes subcategorization in line with this requirement (raw materials, product or non-product related, etc.).

	subcategorization may be defined by the intended user. For example, subcategorization may distinguish products by type of materials (steel, plastic, glass, electronic, etc.) or by function in the value chain (production-related product versus non-production-related product). This subcategory includes emissions associated with the production of energy purchased (i.e., upstream emissions associated with oil and electricity production) that are not otherwise included in the category for indirect GHG emissions from energy sources.	Upstream emissions associated with oil products or electricity production are not accounted for in the "Purchased goods and services" category, but in the "Fuel- and energy-related activities "category, to remain in line with the GHG Protocol.
ISO14064-1	"Indirect GHG emissions from services used by the organization occur from sources located outside the organizational boundaries. Those emissions might cover a very wide range of services and associated processes. Emissions should be calculated in a "cradle to supplier output gate" approach. Subcategorization may be used by the intended user to differentiate and quantify emissions linked to different types of services used by an organization as described in the examples below: a) Emissions from the disposal of solid and liquid waste b) Emissions from the use of assets are generated through equipment leased by the reporting organization in the reporting year c) Emissions from the use of services that are not described in the above subcategories include consulting, cleaning, maintenance, mail delivery, bank services, etc."	The methodology only considers the emissions derived from Purchased Goods & Services and Capital Goods (as defined by the Technical Guide for Calculating Scope 3 Emissions[vii]).

ISO/TR 14069	"Purchased products include upstream franchises. A franchisee (i.e., an organization that operates franchises and pays fees to a franchisor) reports the franchisor's activity in this category, including all activities of the franchisor (i.e. an organization that grants licenses to other organizations to sell or distribute their goods or services, in return for payments, such as royalties for the use of trademarks and other services). The franchisor is asked to specify how it has allocated the GHG emissions of its services.	The aerospace and defense industry does not typically operate under a franchise model. Therefore, this requirement is not considered in this methodology.
ISO/TR 14069	"Organizations often have incomplete records, of purchased goods. This is why the organization should clearly describe which purchased goods and services are considered and neglected and how this can affect the total GHG emissions. The possible ways to select a certain percentage of the goods purchased or services to be considered are the following: embedded GHG emissions of the purchased product. monetary value of purchased amount. weight of purchased amount.	The methodology described here aims at the clear definition of which purchased goods and services are to be considered (refer to Chapter 7 for more details). The choice was made to cover all PG&S that could be material for an aerospace company. Within the categories prescribed by the methodology, the reporting company may decide to neglect the emissions of some goods or services. If so, it will have to justify the exclusion by respecting the requirements set in ISO/TR 14069.

12. Bibliographical Sources

[i] **Make business sense of Scope 3**, Tom Cumberlege, April 2013, Carbon Trust https://www.carbontrust.com/news/2013/04/make-business-sense-of-scope-3-carbon-emissions/

[ii] ***GHG Reporting Guidance for the Aerospace Industry – A Supplement to the GHG Protocol Corporate Accounting and Reporting Standard***, IAEG, May 2019, version 3
http://www.iaeg.com/elements/pdf/IAEG_GHG_Reporting_Guidance_Version3_Final.pdf

[iii] ***ISO14064-1:2018 GREENHOUSE GASES -- PART 1: SPECIFICATION WITH GUIDANCE AT THE ORGANIZATION LEVEL FOR QUANTIFICATION AND REPORTING OF GREENHOUSE GAS EMISSIONS AND REMOVALS***, ISO/TC 207/SC 7, December 2018
https://www.iso.org/standard/66453.html

[iv] ***Greenhouse Gas Protocol - A Corporate Accounting and Reporting Standard,*** WRI, WBCSD, March 2004
http://ghgprotocol.org/corporate-standard

[v] ***Greenhouse Gas Protocol -Technical Guide for Calculating Scope 3 Emissions,*** WRI, WBCSD, 2013
https://ghgprotocol.org/sites/default/files/standards/Scope3_Calculation_Guidance_0.pdf

[vi] **ISO/TR 14069:2013 GREENHOUSE GASES -- QUANTIFICATION AND REPORTING OF GREENHOUSE GAS EMISSIONS FOR ORGANIZATIONS -- GUIDANCE FOR THE APPLICATION OF ISO 14064-1,** ISO/TC 207/SC 7, May 2013 (under revision)
https://www.iso.org/standard/43280.html

[vii] ***Greenhouse Gas Protocol -Technical Guide for Calculating Scope 3 Emissions,*** WRI, WBCSD, 2013
https://ghgprotocol.org/sites/default/files/standards/Scope3_Calculation_Guidance_0.pdf