IAI Scope 3 Calculation Tool Guidance

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On behalf of Sphera Solutions, Inc., and its subsidiaries

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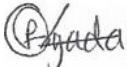
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Table of Contents

List of Figures

List of Tables

List of Acronyms

CCF	Corporate Carbon Footprint
CO_2	Carbon Dioxide
CPC	Calcined Petroleum Coke
CTP	Coal Tar Pitch
EFs	Emission factors
ERP	Enterprise Resource Planning
GHG	Greenhouse gas
HFO	Heavy Fuel Oil
IAI	International Aluminium Institute
LFO	Light Fuel Oil
LPG	Liquified Petroleum Gas

1.   Introduction

1.1.   Purpose

The IAI Scope 3 calculation tool is designed to evaluate Scope 3 emissions for the aluminium value chain based on the GHG Protocol guidelines. This guidance document is to facilitate commonly understood and harmonised Scope 3 GHG emission calculations within the primary aluminium value chain. The document is based on Corporate Value Chain (Scope 3) Accounting and Reporting Standard which can be accessed from GHG Protocol website (Corporate Value Chain (Scope 3) Standard | Greenhouse Gas Protocol (ghgprotocol.org)) [1].

The developed Scope 3 calculation tool can also be used together with aluminium sector specific tools that are available on the GHG Protocol website. The main aluminium sector specific tools are

> Guidance (The Aluminium Sector GHG Protocol) [2]
> Worksheet (Aluminium Sector GHG Workbook - version 2_1_0.xls (live.com))

The following cross-sector tools can also be used to support calculations

GHG Emissions from Purchased Electricity (2015) [3]

> Worksheet (Purchased_Electricity_Tool_Version-4_8_0.xlsx (live.com))

GHG Emissions from Transport or Mobile Sources (2015) [3]

> Worksheet (Transport_Tool_v2_6.xlsx (live.com))

The results generated by this tool are based on user organisation input data and utilisation of publicly available emission factors for some typical goods and services within the aluminium value chain. As such, results generated by the tool should be viewed as indicative and should not be used in isolation to support environmental marketing claims without further documentation and external assurance.

1.2.   Disclaimer

Nothing contained within the calculation tool and this guidance document constitute a warranty, a guarantee of the performance of any organisation, provision of any service, or a waiver of any rights or remedies.

2. Value Chain Positions

2.1. Value Chain Boundaries

The guidance and developed calculation tool covers the different production stages along the primary aluminium value chain for both **IAI** members and non-member companies, that want to evaluate their Scope 3 emissions. The development of the Scope 3 calculation tool considered the following potential value chain integrations

- ➢ Bauxite mining
- ➢ Alumina production
- ➢ Bauxite and alumina production
- ➢ Anode production
- ➢ Smelting
- ➢ Casting/Semi fabrication
- ➢ Anode production, smelting and casting
- ➢ Bauxite mining, alumina production, anode production, smelting, casting/semi-fabrication

The system boundary of the core processes which are within the aluminium value chain are shown in **Figure 2-1**.

2.2. Allocation procedure

When a site or product stage has multiple product outputs within the aluminium value chain, it may become necessary to apply allocation procedures. Allocation may also be required for supplier/partner organisations. The general allocation guidance in Chapter 8 of Corporate Value Chain (Scope 3) Accounting and Reporting Standard is to be utilised and this can be accessed from GHG Protocol website (Corporate Value Chain (Scope 3) Standard | Greenhouse Gas Protocol (ghgprotocol.org)) [1]. The specific guidance for the aluminium value chain in Chapter 7 in Good Practice for Calculation of Primary Aluminium and Precursor Product Carbon Footprints - International Aluminium Institute (international-aluminium.org) [4] are also pertinent.
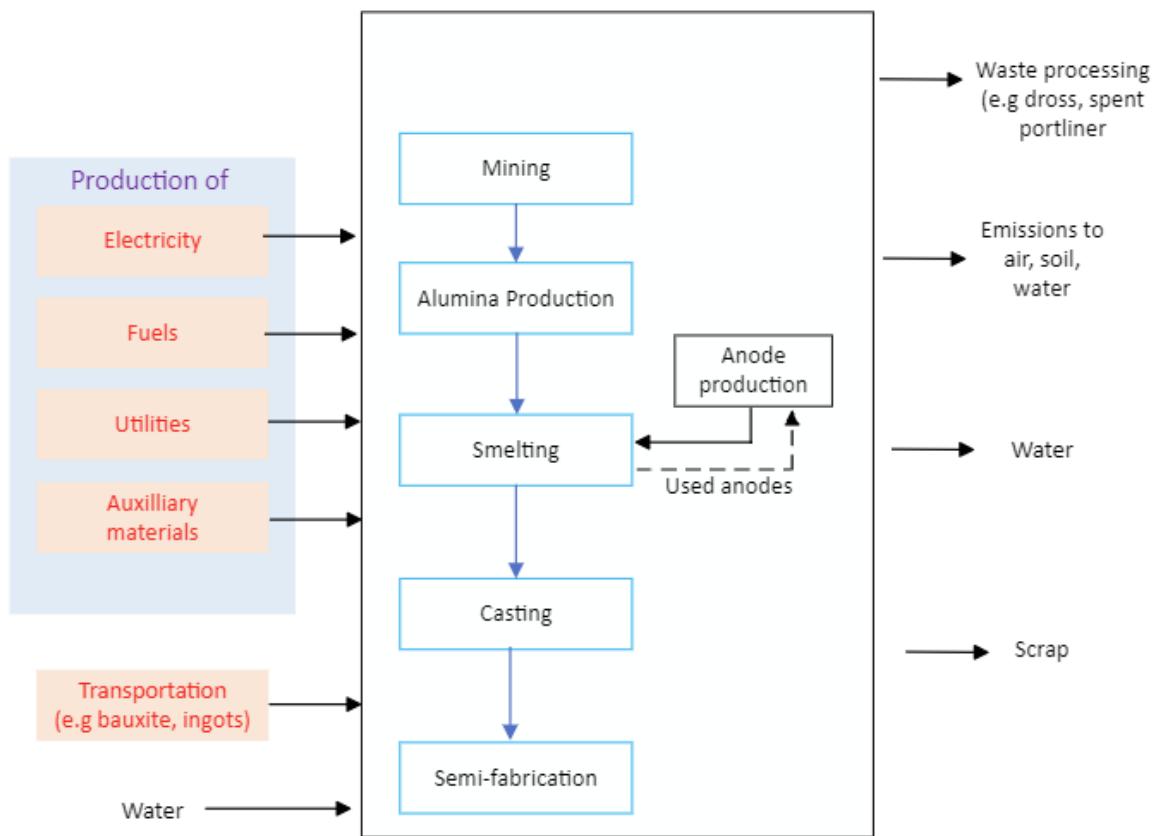
Figure 2-1: Key stages within the primary aluminium value chain

3.1.   Introduction

Discussions were held with the IAI working group members to identify the most material categories to allow focussed calculation tool development for Scope 3 evaluations for the primary aluminium value chain. The material purchased/sold goods and services were then determined based on data collection from working group members.

3.2.   Methodologies for collection and quantification of data

3.2.1.   Collection of Activity Data

Primary activity data related to purchased/sold goods and services, transportation, waste disposal and energy consumption was collected and utilised to facilitate materiality discussions, assessment and Scope 3 calculation tool development.

3.2.2.   Scope 3 material categories

The materiality of Scope 3 categories was based on both quantitative and qualitative information. The quantitative evaluation was based on data collection templates received from the working group members. The qualitative information was from bilateral meetings with stakeholder clients, aluminium industry reports, Sphera industry insights and materiality discussion with working group members at the kick-off meeting of the project. The materiality of the categorises were evaluated for magnitude, regulatory and reputational risk, procurement choice and sector guidance. Due to the primary aluminium value chain differentiation, integration and activities, Categories 8, 11,12,13,14 and 15 were excluded from the assessment with the reason explained in the exclusions section.

Quantitative assessment - Magnitude

The reported Scope 3 categories data by the working group members is shown **Table 3-1**.. Based on the completed data collection templates from the working group members, the percentage contribution of each category to the total Scope 3 categories for each client is evaluated and then the average contribution from all the clients data for each category determined (horizontal averaging) and the results are shown in **Table 3-2.** The percent data for each category was then assigned a score based on ranges shown in **Table 3-3**. Category 1 (purchased good and services) had the highest contribution towards Scope 3 emissions and this is followed by Category 3 (Fuel and energy related activities). While horizontal averaging assisted with data quality scoring, the categories which had low reporting levels required a weighted qualitative evaluation for their materiality.

Table 3-1: Reported scope 3 categories by working group members

Client No.	1	2	3	4	5	6	7	8
Category 1	✓	✓	✓	✓	✓	✓	✓	✓
Category 2								✓
Category 3	✓	✓	✓	✓	✓	✓	✓	✓
Category 4	✓	✓	✓	✓	✓		✓	✓
Category 5								✓
Category 6				✓				✓
Category 7								✓
Category 9				✓	✓		✓	✓
Category 10				✓	✓		✓	✓

Table 3-2: Percent contribution of reported categories towards total Scope 3 emissions

Category No.	% Contribution (average)
Category 1	58.5
Category 2	0.0
Category 3	20.8
Category 4	8.4
Category 5	0.0
Category 6	0.0
Category 7	0.0
Category 8	0.0
Category 9	12.2
Category 10	0.0

Quantitative assessment – data quality

The quality of the data received was qualitatively assessed with quantities of consumed or sold goods and services by the working group members evaluated as mostly being from primary data gathering activities. The completeness of the data for the categories evaluated is based on some of the information in Table 3-1. As far as was practical possible, the emission factors (EFs) provided by participants were used as a preference with any data gaps using default EFs values from public databases or sources. Geographic representativeness of the data could not be assessed as some members provided aggregated data for their operations and other members submitted only a subset of their entire operations. Each data quality criterion was allocated a score between 0 and 100 with the sum total of the score for each category giving the final data quality indicator. The predefined data ranges were good, fair and poor with total score ranges used to define the quality of data shown **Table 3-3.** The overall data quality evaluation is presented in colour coded format in **Table 3-4**.

Table 3-3: Data quality assessment ranges and colour coding

Score		
Quality	Range	Colour code
Good	> 200	
Fair	100 to 200	
Poor	< 100	

Table 3-4: Data quality assessment criterion and scoring

Scope 3 category									
Criteria	1	2	3	4	5	6	7	9	10
Primary data	90	60	90	85	60	65	60	85	90
Client EF	70	20	50	10	10	15	20	10	25
Completeness	80	5	80	70	10	15	15	60	30
Total	240	85	220	165	80	95	95	155	145

Qualitative assessment – regulatory and reputational risk

Risks to the primary aluminium value chain were evaluated and assigned a score for both regulatory changes and reputational exposure for inaction. The assessment relied on industry knowledge and perspectives from bilateral meetings.

Qualitative assessment –procurement choice

The ability of working group members to change their procurement policies and re-configure supply chains to reduce GHG emissions was assigned a score with the type of relationships the organisations have with suppliers taken into account.

Qualitative assessment – sector guidance

The sector guidance for Scope 3 emissions mitigation specific to the aluminium industry was evaluated together with the guidance for the mining and metals industry in general. Publicly available reports and confidential information were both used to score different categories for evaluation.

Scoring and weighting

Table 3-3 has the criteria for scoring different categories with the weighting associated with each criterion in **Table 3-4**. The quantitative (magnitude) criteria has a higher weighting since data driven materiality evaluation is preferable. However, because of data quality issues, qualitative materiality assessment was also used utilised. Irrespective of value chain position of working group members, procurement choice is a criterion within the influence of these organisations and this is reflected in its weighting. Risk especially from regulation and reputational loss is also important for evaluation as climate change impacts the business landscape. The influence of trade associations and institute was also considered through the sector guidance criteria as most members seek harmonised and consistent approaches for Scope 3 evaluation. The sector guidance had a low weighting as for most categories specific category guidance is still in infant stages.

Table 3-5: Quantitative and qualitative materiality scoring criteria

Score						
Criteria	0	1	3	5	8	10
Magnitude (% of total Scope 3 emissions)	< 1	1 to 5	5.1 to 20	21.1 to 35	35.1 to 50	>50
Risk (regulatory & reputation)	None	Minimal	Low	Medium	High	Adverse
Procurement choice	None	Minimal	Low	Medium	High	Extreme
Sector guidance	None	Developing	Low	Medium	High	Extremely high

The materiality of the different categories was based on comparative scoring of the different categories taking account of the weighting of assessment criterion as shown in **Table 3-4**. Based on comparative scoring, materiality ranges were defined as high (>50), medium (30.1 to 50) and low (<30). The most material categories for the primary aluminium value chain are purchased goods and services, fuel and energy related activities, upstream transportation, downstream transportation and processing of sold goods based on the criterion of magnitude, risk, procurement choice and sector guidance weighted scoring.

However, for completeness the calculation tool was developed to conduct Scope 3 calculation also for Categories 2, 5, 6 and 7 in case a user enters the requisite activity data and emission factors as these categories have no prior defined default emission factors.

Table 3-6: Scope 3 categories comparative materiality scoring

Scope 3 category

Criteria	Weighting (1-5)	1	2	3	4	5	6	7	9	10
Magnitude	4	10	0	3	1	0	0	0	3	1
Risk	2	8	3	5	5	3	1	1	5	10
Procurement choice	3	8	5	8	8	5	8	3	8	5
Sector guidance	1	5	1	5	5	3	3	3	5	3
Comparative score (∑Weighting X score)		85	22	51	43	24	29	14	51	42

Exclusions

Based on the primary aluminium value chain some Scope 3 categories were excluded based on the activities and structural organisation of the aluminium industry sector

➢ Category 8: Upstream leased assets –working group members did not have any upstream leased assets
➢ Category 11: Use of sold products – the project boundary is at intermediate sold goods (Category 10). Additionally, aluminium find usage in a broad range of products and choosing particular products as representative for the sector would be misleading
➢ Category 12: End-of-life treatment of sold products - the project boundary is at intermediate sold goods (Category 10). Additionally, aluminium find usage in a broad range of products and choosing particular products end-of-life treatment as representative would be misleading.
➢ Category 13: Downstream leased assets - working group members did not have downstream leased assets
➢ Category 14: Franchises - working group members did not operate any franchises
➢ Category 15: Investments - working group members did not operate any investments within the project scope boundaries

3.2.3.   Approach to Emission Factors (EF)

Emission factors are representative values that relate a quantity of greenhouse gas emitted to the atmosphere with a particular activity (e.g., the quantity of CO_2 emitted when combusting a unit of natural gas). The emission factors used in the calculations are provided by the user and can either be quantity based (kg CO2eq/ kg product/service) or cost based (kg CO2 eq/ US$). Based on data collection templates, only 12.5% of working group members use cost based EFs. However, the developed tool can still make calculation based on both quantity and cost based EFs.

For Categories 1, 3, 4, 9 and 10, the calculation tool can also use default emission factors for typical goods and services identified to be material for the primary aluminium value chain. Precedence is always given to the user defined emission factors before utilisation of default EFs.

3.2.4. Typical goods and services

The identified typical goods and services for different value chain positions are in Table 3-2. These typical goods and services have default EFs values (ANNEX A) which are from public domain datasets and are used by the calculation tool whenever user defined information is not given (i.e. cell left blank).

Table 3-7: Typical goods and services

Typical goods/services	Value chain position
NPK Fertiliser	Bauxite Mining
Bauxite	Alumina refining
Caustic soda (NaOH)	Alumina refining
Calcined lime	Alumina refining
Sulphuric acid	Alumina refining
Green coke	Anode production
Calcined Petroleum Coke (CPC)	Anode production
Coal Tar Pitch (CTP)	Anode production
Petroleum Pitch	Anode production
Steel rods	Anode production
Alumina	Smelting
Anodes	Smelting
Aluminium fluoride	Smelting
Cathode blocks	Smelting
Steel (cathodes)	Smelting
Sodium carbonate	Smelting
Ramming paste	Smelting
Aluminium liquid metal	Casting/ Semi-fab
Chlorine	Casting/ Semi-fab
Nitrogen	Casting/ Semi-fab
Argon	Casting/ Semi-fab
Casting fluxes – NaCl/KCl	Casting/ Semi-fab
Casting fluxes – MgCl2/KCl	Casting/ Semi-fab
Magnesium	Casting/ Semi-fab

Silicone	Casting/ Semi-fab
Manganese	Casting/ Semi-fab
Copper	Casting/ Semi-fab
Ingots	Casting/ Semi-fab
Billet	Casting/ Semi-fab
Slabs	Casting/ Semi-fab

4. Data and calculation guidance for specific categories

In the following sections, the detailed data collection and entry methods for each category are described for purposes of having a transparent reference for calculations. Table 4-1 shows a summary of the five principles from the GHG Protocol Corporate Standard which guide the accounting and reporting of scope 3 inventory

Table 4-1: Principles for GHG accounting and reporting of scope 3 inventory

No.	Principle	Brief outline
1	Relevance	Ensure data appropriately reflects the GHG emissions of the company and serve the decision-making needs of users.
2	Completeness	Account for and report all GHG emissions within the inventory boundary with exclusions disclosed and justified.
3	Consistency	Data gathering, inventory boundaries and methods should be the same over time to allow tracking. Any changes to be transparently documented.
4	Transparency	Clear audit trail with any assumptions disclosed and appropriate referencing of calculation methodologies.
5	Accuracy	Ensure data collected is neither under or over actual emissions to allow sufficient integrity of the reported information

All the calculations and formulas utilised by the developed tool are based on the specific guidance for each category as specified in the technical guidance from GHG [5], for concision purposes the detailed calculation steps are not repeated unless necessary.

4.1. Category 1: Purchased goods and services

This category consists of 2 main parts. These include:

1. Purchased goods to run the operation
2. Purchased refining services by subcontracting

Depending on your organisation's value chain position, at the very least information on your quantities for all typical and goods services listed in Table 3-2 should be completed.

4.1.1. Purchased goods to run the operation

The activity data for purchased goods and services for running the operations can be obtained from your organisation's ERP (Enterprise Resource Planning) system where information on weight, volume as well as pieces is recorded.

As a first step, the share which constitutes 80% of the cost of the overall purchased goods (indicated by weight or volume) per site should be collected. The emission factors (EFs) associated with the purchased goods/service can be obtained from your suppliers, public or commercial databases.

4.1.2. Purchased refining services by subcontracting

This description is for cases when material waste streams are sent to subcontractors to recover aluminium. The EFs (kg CO2 eq./kg recycled) will have to be obtained from the subcontractor. For secondary aluminium recyclers with multiple products appropriate allocation has to be applied for the aluminium proportion.

4.1.3. Data entry

Category 1 information is to be entered in sheet 'Category_1'. The quantity information in kg is entered in column D and the quantity based EFs (kg CO2 eq/ kg product) is to be entered in column F. Should you intend to use default EFs for your typical good and services, you leave the corresponding cell in column F BLANK. If you have cost-based information, the cost (US$) of goods/services is entered in column E and the corresponding emission factor (kg CO2 eq/ US$) is to be entered in column G. The calculation tool can work with mixed quantity and cost-based information for different goods/services. For a single item, when both quantity and cost-based information is provided, the tool will only use the quantity-based information.

4.1.4. Client EFs

Cradle-to-gate emission factors of the purchased goods or services per unit mass of product (kg CO2e/kg) or per economic value (kg CO2e/US$) have to be requested from your suppliers. It is recommended that specific and verified emission factors are sourced. Should the supplier not have a specific EF you will have to collect:

- Cradle-to-gate EFs for the materials used by tier 1supplier[1] to produce the purchased good
- Life cycle EFs for fuel used by incoming transport of input materials to tier 1 supplier
- Direct (process) emissions during the manufacturing stages of the purchased good
- EFs for waste outputs by tier 1 supplier to produce the purchased good.

The total emissions to produce the purchased good can then be obtained from multiplying the quantity consumed and the associated activity EF of the above bullet points and summing all results. Specific exemplar calculations for this scenario are in Chapter 1 of the technical guidance for Category 1 from GHG website (Chapter1.pdf (ghgprotocol.org)) [5]

4.1.5. Default EFs

For most of the typical goods in Table 3-2 , the default EFs and reference sources are listed in Annex A. These values are utilised by the tool whenever a cell in column F is left BLANK, but a quantity value has been assigned in a corresponding cell column D. The default EFs are for cradle-to-gate studies.

4.1.6. Calculation procedure

Depending on user input data and application of appropriate conditional scenarios to this input data the total emissions for Category 1 are evaluated using the average-data method as below:

$$Total\ emissions = \sum_{1}^{m}(mass\ of\ purchased\ good\ \times\ EF_{Client\_input}\ of\ purchased\ good)$$

---

[1] Tier 1 supplier – partners that are direct suppliers of your final product

$$+ \sum_{1}^{n} (mass\ of\ purchased\ good\ \times\ EF_{default\_value}\ of\ purchased\ good)$$

$$+ \sum_{1}^{p} (value\ of\ purchased\ good(\$)$$

$$\times\ EF_{Client\_input}\ of\ purchased\ good\ per\ unit\ of\ economic\ value\ \left(\frac{kgCO_2e}{\$}\right))$$

Where m and n represent number of purchased goods with EF provided by the client and default values respectively. The letter *p* represent number of purchased goods with cost based EFs. The respective units for mass and EF are as detailed in section 4.1.4

4.2. Category 2: Capital Goods

Scope 3 emissions from capital goods for the aluminium value chain are expected to fluctuate from year to year and therefore when reporting this category it is imperative to indicate exceptional or non-recurring capital investments.

The capital goods (fixed assets) calculations are only cost based with the price (US$) of the capital goods to be entered in column E and the corresponding EFs (kg CO2 eq./ US$) to be entered in column F. The required EFs for this category are for the cradle-to-gate emissions to produce the capital goods purchased and is NOT for the use of the capital goods.

The category 2 emissions are evaluated using the average spend-based method as follows:

$$Total\ emissions = \sum_{1}^{n} (value\ of\ capital\ good(US\$)\ \times$$

$$EF_{Client\_input}\ of\ purchased\ capital\ good\ per\ unit\ of\ economic\ value\ \left(\frac{kg\ CO_2e}{US\$}\right))$$

Where n is the number of capital goods purchased.

4.3. Category 3: Fuel- and energy related activities (not included in scope 1 or scope 2)

This category is for the extraction, production and transportation of fuels/electricity purchased and consumed by your organisation including transmission and distribution (T&D) losses. This also applies even if your organisation has a captive power plant (CPP).

For avoidance of doubt, when completing category 3, it is recommended to refer to category 3 specific guidance from the GHG website (Chapter3.pdf (ghgprotocol.org)) [5]

4.3.1. Activity data

The activity data required are fuel types used, quantities, and respective EFs. The EFs can be obtained from suppliers or recommended databases which are listed on the GHG website (Life Cycle Databases | Greenhouse Gas Protocol (ghgprotocol.org)) [6]

4.3.2.   Data Entry

In sheet Category_3, the fuel or electricity consumption quantities (MJ) are to be entered in column E, data for T&D losses is captured in column G and upstream EFs (kg CO2 eq./MJ) for the respective fuel or electricity is to be entered in column H. Should you intend to use default EFs for specific fuels or electricity source you leave the corresponding cell in column H BLANK. For electricity, the 'mixed sources' option is typically for a national grid mix.

4.3.3.   Client EFs

For Category 3, careful consideration is required for emission factors that are sourced from suppliers of fuels or electricity. The EF required is the upstream emission factor (i.e excludes combustion or generation related emissions), and if the supplier gives life cycle emission factors, then the upstream emission factor can be calculated as follows

$$Upstream\ EF = Life\ cycle\ EF - combustion\ EF$$

The life cycle and combustion EFs should be from the same temporal, technical and geographic representativeness.

If EFs are sourced from databases, it should be ensured that these EFs are upstream EFs (i.e they exclude combustion/generation related emissions). T&D losses have to be accounted for in Scope 3 calculation and therefore appropriate values must be entered in column G.

4.3.4.   Default EFs

The default EFs and reference sources for fuels and electricity are listed in Annex B. These values are utilised by the tool whenever a cell in column H is left BLANK, but a quantity value has been assigned in a corresponding cell in column E. The default EFs for fuels are well-to-tank values that exclude emissions from combustion. The default EFs for electricity are well-to-tank values that exclude emissions from generation as well as transmission and distribution (T&D) losses. As electricity transmission and distribution losses must be considered for Scope 3 calculation, an appropriate T&D factor has to be entered in column G.

4.3.5.   Calculation procedure

Depending on user input data and application of appropriate conditional scenarios to this input data the total emissions for Category 3 are evaluated as follows:

$$
\begin{aligned}
Total\ emissions = & \sum_{1}^{m} (fuel\ consumed\ \times\ upstream\ fuel\ EF_{Client\_input} \\
& + \sum_{1}^{n} (fuel\ consumed\ \times\ upstream\ fuel\ EF_{default\_value}) \\
& + \sum_{1}^{p} (electricity\ consumed\ \times\ upstream\ electricity\ EF_{client\_input}) \\
& + \sum_{1}^{q} (electricity\ consumed\ \times\ upstream\ electricity\ EF_{default\_value})
\end{aligned}
$$

Where m and p represent number of sources for fuels and electricity with EF provided by the client respectively. The letter n and q represent number of sources for fuels and electricity utilising default EF respectively. The respective units for fuel, electricity and EFs are as detailed in section 4.3.2

For all calculations, the client input EFs are given precedence ahead of default EF.

4.4. Category 4: Upstream Transportation and Distribution

This category is for transportation of goods and services by third party (not owned by your organisation) and when your organisation pays for the transportation. The category also includes transportation of materials between your organisation own sites.

The developed calculation tool uses the distance-based method to execute category 4 evaluation.

4.4.1. Activity data

The required activity data required consists of quantity transported (kg), distance for transportation (km) and mode of transportation. Most of this information can be found in purchase orders of your organisation.

4.4.2. Data Entry

In sheet Category 4 Transport, the user needs to enter the number of transportation modes which are used for the considered goods in column D (please only enter the transport modes of the 3 longest distances, in case a particular goods gets transported by more than 3 transportation means). The transportation modes can be selected in columns E, H and K with respective distances entered in columns F, I and L. It is important to select who pays for costs of transportation in columns G, J and M. For consideration in category 4, the transportations costs must have been paid by the Reporting Company.

4.4.3. Emission factors

The EFs and reference sources for transportation (freight) of goods are listed in Annex C. These values are utilised by default to execute category 4 calculations.

4.4.4. Calculation procedure

Depending on user input data and application of appropriate conditional scenarios to this input data the total emissions for Category 4 are evaluated as follows:

$$
\begin{aligned}
Total\ emissions = &\sum_{1}^{m}(mass\ of\ goods\ purchased\ \times distance\ travelled \\
&\times road\ transport\ EF_{default\_value}) \\
&+ \sum_{1}^{n}(mass\ of\ goods\ purchased\ \times distance\ travelled \times rail\ transport\ EF_{default\_value}) \\
&+ \sum_{1}^{p} mass\ of\ goods\ purchased\ \times distance\ travelled \times air\ transport\ EF_{default\_value}) \\
&+ \sum_{1}^{q} mass\ of\ goods\ purchased\ \times distance\ travelled \times water\ transport\ EF_{default\_value})
\end{aligned}
$$

Where m, n, p and q represent number of good types transported by road, rail, air and water transport respectively. The respective units for mass and distance travelled are as detailed in section 4.4.2

4.5.   Category 5: Waste generated in operations

In this category, only emissions from waste treatment facilities owned or operated by third parties are to be included. In sheet Cat 5, the quantity (kg) of waste disposed is entered in column C and the respective emission factor (kg CO_2 eq./ kg waste disposed) of the waste disposal method is to be entered in column E.

The total emissions for Category 5 are evaluated as follows:

$$Total\ emissions = \sum_{1}^{n}(waste\ produced\ \times waste\ treatment\ EF_{client\_input})$$

Where n is the number of waste types disposed.

4.6.   Category 6: Business travel

This category is for emissions from business related transportation and accommodation of employees by third party organisations. The requisite information for this category is captured in sheet Cat 6

4.6.1.   Data entry – business travel

In sheet Cat 6, on the appropriate mode of transportation enter the total distance (km) travelled in column B and the emission factor (kg CO_2 eq./km) associated with the mode of transportation in column C.

4.6.2.   Data entry – hotel accommodation

Under the heading hotel accommodation, enter the total number of nights spend in either mid-scale or upscale hotels in column B and the corresponding emission factors (kg CO_2 eq./day) for the mid-scale and upscale accommodation.

4.6.3.   Emission factors

Specific client EFs are required for this category, however, should these not be available the default values from employee commuting (Category 7) in Annex C can be utilised as a starting point.

4.6.4.   Calculation procedure

Depending on user input data and application of appropriate conditional scenarios to this input data the total emissions for Category 7 are evaluated as follows:

$$Total\ emissions = \sum_{1}^{m}(Total\ distance\ travelled\ using\ mode\ of\ transport$$
$$\times EF_{client\_input}\ of\ mode\ of\ transport)$$
$$+ \sum_{1}^{n}(annual\ number\ of\ hotel\ nights \times EF_{client\_input}\ of\ hotel\ class)$$

Where m and n represent transport mode and hotel classification respectively. The respective units for distance travelled and EFs are as detailed in section 4.6.1 and 4.6.2.

4.7. Category 7: Employee commuting

The category covers emissions from employee commuting between their residential home and worksite. The Scope 3 calculation tool utilises the distance-based method and requires activity data in the form of mode of transportation and distance travelled. The activity data is generally gathered from employee surveys and then creating the requisite employee commuting profile that is required to make calculations for this category.

4.7.1. Data entry

In sheet Cat 7, enter the total number of employees using a specific mode of transport in column A, Total travelled distance (passenger-km) for the specific transportation mode in column C and the specific transportation mode emission factor (kg CO2 eq./ passenger-km) in column E. Should you intend to use default EFs for a specific mode of transport you leave the corresponding cell in column E BLANK

4.7.2. Calculation procedure

Depending on user input data and application of appropriate conditional scenarios to this input data the total emissions for Category 7 are evaluated using the average-data method as below:

$$Total\ emissions = \sum_{1}^{n}(Total\ distance\ travelled\ using\ mode\ of\ transport$$
$$\times\ EF_{Client\_input}\ of\ mode\ of\ transport)$$

$$+ \sum_{1}^{n}(Total\ distance\ travelled\ using\ mode\ of\ transport \times EF_{default\_value}\ of\ mode\ of\ transport)$$

Where n represent the specific mode of transportation. The respective units for total distance travelled and transportation EFs are as detailed in section 4.7.1

4.7.3. Determination of Total Distance Travelled

The total distance to be used in section 4.7.2 is determined by creating an employee commuting profile based on employee survey. Key information required include number of employees using the specific mode transport and their average one-way commute distance (km). The following formula can then be used to calculate total distance travelled for each specific mode of transport

$$Total\ distance\ travelled = \sum_{1}^{n} No.of\ employees\ using\ mode\ of\ transport\ \times\ Average\ travelled\ distance$$

$$(single\ journey\ in\ km)\ \times\ 2\ \times\ working\ days\ for\ the\ specific\ country$$

Where *n* represent the specific mode of transportation.

4.8. Category 8: Upstream leased assets

This category was established to be inapplicable to the aluminium value chain based on the Scope 3 steering working group members' feedback.

4.9.   Category 9: Downstream Transportation and Distribution

This category is for transportation and distribution of intermediate products sold by your organisation using third party (not owned by your organisation) transport and when the customer pays for the transportation. The category also includes storage of goods, however, storage emissions within the aluminium value chain were considered immaterial for the aluminium value chain.

The developed calculation tool uses the distance-based method to execute category 9 evaluation.

4.9.1.   Activity data

The required activity data required consists of quantity transported (kg), distance for transportation (km) and mode of transportation.

4.9.2.   Data Entry

In sheet Category 9 Transport, the user needs to enter the number of transportation modes which are used for the considered goods in column D (please only enter the 3 longest distances transport modes should the particular goods be transported by more than 3 transportation means). The transportation modes can be selected in columns E, H and K with respective distances entered in columns F, I and L. It is important to select who pays for costs of transportation in columns G, J and M. For consideration in category 9, the transportations costs must have been paid by the Customer.

4.9.3.   Emission factors

The EFs and reference sources for transportation (freight) of goods are listed in Annex C. These values are utilised by default to execute category 9 calculations.

4.9.4.   Calculation procedure

Depending on user input data and application of appropriate conditional scenarios to this input data the total emissions for Category 9 are evaluated as follows:

$$
\begin{aligned}
Total\ emissions = &\sum_{1}^{m}(mass\ of\ goods\ purchased\ \times distance\ travelled \\
&\times road\ transport\ EF_{default\_value}) \\
&+ \sum_{1}^{n}(mass\ of\ goods\ purchased\ \times distance\ travelled \times rail\ transport\ EF_{default\_value}) \\
&+ \sum_{1}^{p} mass\ of\ goods\ purchased\ \times distance\ travelled \times air\ transport\ EF_{default\_value}) \\
&+ \sum_{1}^{q} mass\ of\ goods\ purchased\ \times distance\ travelled \times water\ transport\ EF_{default\_value})
\end{aligned}
$$

Where m, n, p and q represent number of good types transported by road, rail, air and water transport respectively. The respective units for mass and distance travelled are as detailed in section 4.9.1.

4.10. Category 10: Processing of sold products

This category evaluates emissions from processing of sold intermediate goods by third parties (your organisation's customers). The emissions for this category include the scope 1 and 2 of your immediate downstream value chain partners.

Depending on your organisation's value chain position, at the very least, information on your quantities of sold intermediate goods from the typical and goods services listed in Table 3-2 should be completed.

4.10.1. Data collection

The type and quantities of sold intermediate goods can be collected internally from your organisation's ERP systems. The reference flows and EFs associated with processing of these sold intermediates can be obtained from your downstream partners. Databases and industry associations can also be used as a source for the EFs. The GHG website (Life Cycle Databases | Greenhouse Gas Protocol (ghgprotocol.org) [6]list some third-party databases that users can also use to gather EFs of products.

4.10.2. Data entry

Category 10 information is to be entered in sheet 'Category_10'. The quantity information in kg is entered in column D and the quantity based EFs (kg CO2 eq/ kg product) is to be entered in column F. Should you intend to use default EFs for your typical good and services, you leave the corresponding cell in column F BLANK. If you have cost-based information, the cost (US$) of sold intermediate goods is entered in column E and the corresponding emission factor (kg CO2 eq/ US$) is to be entered in column G. The calculation tool can work with mixed quantity and cost-based information for different sold intermediate goods. For a single item, when both quantity and cost-based information is provided, the tool will only use the quantity-based information.

4.10.3. Client based EFs

For category 10 evaluation, careful consideration is required for emission factors to be used with the calculation tool to avoid double counting. It is likely the customer will give EFs of their processed good (i.e kg CO2 eq/ kg of processed good). For example, if you are a bauxite producer it is likely the refiner would give you an emission factor with units as kg CO_2eq/kg alumina. To use these values with the calculation tool you will need to convert either the quantity of the goods you sold or the EFs. For equivalent amount conversion of sold goods to processed goods you will need a reference flow (taking the bauxite an example, you would like to calculate the amount of alumina produced from the amount of bauxite you sold to the customer) if you want to use the customer provided EF. For the EF conversion approach, you convert the kg CO_2eq/kg processed goods to an equivalent EF with units as kg CO_2eq/ kg sold goods if you want to use the quantities of goods you sold. **Annex E** shows a demonstration calculation for the two approaches starting with EFs as provided by IAI which are based on kg CO2 eq/ kg aluminium and these are initially converted to kg CO_2 eq/ kg of product (specific value chain position).

4.10.4. Default EFs

For typical sold goods for the aluminium value chain, default EFs and reference sources are listed in Annex D. These values are utilised by the tool whenever a cell in column F is left BLANK, but a quantity value has been assigned column D.

4.10.5. Calculation procedure

Depending on user input data and application of appropriate conditional scenarios to this input data the total emissions for Category 10 are evaluated using the average-data method as below:

$$Total\ emissions = \sum_{1}^{m}(equivalent\ mass\ of\ processed\ good\ from\ amount\ sold$$

$$\times\ EF_{Client\_input}\ of\ processed\ good)$$

$$+\sum_{1}^{n}(equivalent\ mass\ of\ processed\ good\ from\ amount\ sold\ \times\ EF_{default\_value}\ of\ processed\ good)$$

$$+\sum_{1}^{p}(value\ of\ sold\ good(\$)\ \times\ EF_{Client\_input}\ of\ sold\ good\ \left(\frac{kgCO_2e}{\$}\right))$$

Where *m* and *n* represent number of sold goods with EF provided by the client and default values respectively. The letter *p* represent number of sold goods with cost based EFs. The respective units for mass and EF are as detailed in section 4.10.2.

4.11. Category 11 to 15

These categories were determined as being inapplicable to the aluminium value chain based on the Scope 3 steering working group members' feedback.

4.12. Executing Scope 3 Calculations

The developed Scope 3 calculation tool is based on a VBA[2] code. When you have completed data input, press **CTRL** and **S** keys simultaneously from your keyboard. This is the short-cut key that automatically runs the macro for performing the Scope 3 calculations for the completed template. New run results are logged in sheet "Summary_Results". If the sheet "Summary_Results" already exists it is renamed SR_date/time-of-last-run.

Please note the Scope 3 calculation tool has prefilled validation quantities and EFs for each Scope 3 category worksheet and these require **deleting** so that you enter your own organization data in these worksheets.

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[2] VBA – Visual Basic for Applications

5. Quality control, documentation and reporting

5.1. Quality control and assurance

It is important to have a formal quality control and assurance (QA/QC) system to identify errors and omissions. This will facilitate confidence in decision making processes for various stakeholders who utilise your Scope 3 inventory results. It is recommendable to have a data management plan and the guidelines in Appendix C of Data Management Plan of the Corporate Value Chain (Scope 3) Accounting and Reporting Standard (Corporate Value Chain (Scope 3) Standard | Greenhouse Gas Protocol (ghgprotocol.org)) [1] could be a starting point.

5.2. Documentation and reporting

The principles of relevance, accuracy, completeness, consistency and transparency should guide information presentation. The full requirements and guidance for reporting Scope 3 are in Chapter11 of the Corporate Value Chain (Scope 3) Accounting and Reporting Standard (Corporate Value Chain (Scope 3) Standard | Greenhouse Gas Protocol (ghgprotocol.org)) [1].

6.   References

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ANNEX A: Default Emission Factors for Typical Purchased Goods (Category 1)

Typical goods/services	Value chain position	Emission factor [kg CO2 eq. / kg product]	Reference
NPK Fertiliser	Bauxite Mining	1.112	[7]
Bauxite	Alumina refining	0.0084	[8]
Caustic soda (NaOH)	Alumina refining	1.12	[9]
Calcined lime	Alumina refining	0.79	[10]
Calcined Petroleum Coke (CPC)	Anode production	1.88	[11]
Coal Tar Pitch (CTP) (proxy carbon black)	Anode production	2.62	[10]
Alumina	Smelting	1.2648	[8]
Anodes	Smelting	1.7499	[8]
Steel (cathodes)	Smelting	1.89	[12]
Sodium carbonate	Smelting	0.415	[10]
Aluminium liquid metal	Casting/ Semi-fab	13.0056	[8]
Magnesium	Casting/ Semi-fab	21.8	[13]
Silicone	Casting/ Semi-fab	11.2	[14]
Manganese	Casting/ Semi-fab	13.9	[15]
Copper	Casting/ Semi-fab	4.1	[16]
Aluminium Ingots	Casting/ Semi-fab	16.4777	[8]

ANNEX B: Default Emission Factors for Fuel and Electricity (Category 3)

	Emission factor [kg CO2 eq. / MJ]	Reference
Thermal Energy		
Natural gas	0.00871	[17]
Coal	0.01470	[17]
HFO	0.01120	[7]
LFO	0.00703	[7]
LPG	0.00703	[17]
Diesel	0.01636	[17]
Gasoline	0.01729	[17]
Propane	0.00695	[17]
Electricity		
Mixed sources	0.02362	[17]

ANNEX C: Default Emission Factors for Transportation (Category 4, 7 and 9)

Transportation of goods (category 4 & 9)

Mode of transport	Name and definition in source	Emission factor [g CO2 eq./ tonne-km]	Reference
Road	HGV (all diesel), Articulated (>33 t), average laden	78.75	[17]
Rail	Rail, Freight train	27.82	[17]
Sea	Average from all Sea tankers	13.23	[17]
Air	Freight flights, with RF. Based on average distance	1018.9	[17]

Transportation of employees (category 7)

Mode of transport	Name and definition in source	Emission factor [kg CO2eq./ passenger-km]	Reference
Road	Car (medium size-diesel)	0.1650	[17]
Rail	National railway	0.0355	[17]
Water	Ferry	0.0187	[17]
Air	Domestic, to/from UK	0.2459	[17]

ANNEX D: Default Emission Factors for Typical Sold Goods (Category 10)

Typical goods/services	Value chain position	Emission factor [kg CO2 eq. / kg product]	Reference
Bauxite	Mining	0.0084	[8]
Alumina	Alumina refining	1.2648	[8]
Anodes	Smelting	1.7499	[8]
Aluminium liquid metal	Smelting	13.0056	[8]
Aluminium Ingot	Casting/ Semi-fab	16.4777	[8]
Aluminium sheets/plates	Casting/ Semi-fab	0.6800	[18]

Sold good	Emission Factors (EFs) conversion				
	IAI values ton CO_2 eq./ ton aluminium	IAI values for reference flow	ton CO_2 eq./ ton product	kg CO_2 eq./ ton product	Units
Bauxite	0.043	5.13	0.0084	8.45	kg CO_2 eq./ton of bauxite
Alumina	2.415	1.91	1.2648	1264.84	kg CO_2 eq./ton of alumina
Anodes	0.874	0.50	1.7499	1749.92	kg CO_2 eq./ton of anode
Aluminium liquid (electrolysis)	13.006	1.00	13.0056	13005.57	kg CO_2 eq./ton of aluminium
Casting	0.139	1.00	0.1395	139.46	kg CO_2 eq./ton of aluminium
Primary aluminium (ingot)	16.478	1.00	16.4777	164777.69	kg CO_2 eq./ton of aluminium

Example: If you are a bauxite producer and you sold 200 tonnes of bauxite to a refiner

1.0 Quantity based conversion

The EF from the customer (refiner) will be kg CO2 eq/ ton alumina but the quantities you will have have sold are for bauxite. To use the customer EFs you will need to convert the bauxite amount sold to an equivalent amount of alumina using reference flows.

$$Amount\ processed\ good\ made\ = Amount\ produced\ (sold)good * \left(\frac{reference\ flow\ of\ processed\ good}{reference\ flow\ of\ produced\ (sold)\ good}\right)$$

$$Amount\ processed\ good\ made\ (alumina) = \frac{200 \times 1.91}{5.13}$$

$Amount\ processed\ good\ made\ (alumina) = 74.43\ ton$

$$GWP\ from\ processing\ of\ sold\ good = Amount\ processed\ good\ made\ x\ Emission\ Factor\ of\ processed\ good$$

$Global\ Warming\ Potential\ (GWP)from\ sold\ good\ processing = 74.43\ \times 1264.85$

$Global\ Warming\ Potential\ (GWP)from\ sold\ good\ processing = 94\ 144.03\ kg\ CO2\ eq$

2.0 Emission Factor based conversions

The EF from the customer (refiner) will be kg CO2 eq/ ton alumina from the customer is converted to kg CO2 eq./ton bauxite

$$Converted\ processed\ good\ EF = EF\ of\ processed\ good * \left(\frac{reference\ flow\ of\ processed\ good}{reference\ flow\ of\ produced\ (sold)\ good}\right)$$

$$Converted\ processed\ good\ EF = \frac{1264.84 \times 1.91}{5.13}$$

$Converted\ processed\ good\ EF = \ 470.72\ kg\ CO2\ eq./ton\ bauxite$

$GWP\ from\ processing\ of\ sold\ good = Amount\ produced\ (sold) good\ x\ Converted\ Emission\ Factor - on\ sold\ good\ quantity\ basis$

$Global\ Warming\ Potential\ (GWP) from\ sold\ good\ processing = 200 \times 470.72$

$Global\ Warming\ Potential\ (GWP) from\ sold\ good\ processing = 94\ 144.03\ kg\ CO2\ eq$