

Statement of Verification

BREG EN EPD No.: 000493

Issue 01

This is to verify that the

Environmental Product Declaration

provided by:

METRA SpA



is in accordance with the requirements of:

EN 15804:2012+A2:2019

and

BRE Global Scheme Document SD207

This declaration is for:

1 kg of METRA RE.AL.E alloys

Company Address

METRA SpA
Via Stacca,
1 25050 Rodengo Saiano – Brescia
Italy



Signed for BRE Global Ltd

Emma Baker
Operator

26 May 2023
Date of this Issue

26 May 2023
Date of First Issue

25 May 2028
Expiry Date



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Environmental Product Declaration

EPD Number: 000493

General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to EN 15804+A2 PN 514 Rev 3.0
Commissioner of LCA study	LCA consultant/Tool
METRA SpA Via Stacca, 1 25050 Rodengo Saiano - Brescia – Italy 	Sphera solutions https://www.sphera.com 
Declared/ Unit	Applicability/Coverage
1 kg of METRA RE.AL.E alloys (RE.AL.E - C1, RE.AL.E - C2, RE.AL.E - C3, RE.AL.E - C4, RE.AL.E - C5).	Manufacturer-specific product.
EPD Type	Background database
Cradle to Gate	Managed LCA Content 2022.2
Demonstration of Verification	
CEN standard EN 15804 serves as the core PCR ^a	
Independent verification of the declaration and data according to EN ISO 14025:2010 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	
(Where appropriate ^b)Third party verifier: Nigel Jones	
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)	
Comparability	
Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A2:2019 for further guidance	

Information modules covered

Product			Construction		Use stage							End-of-life				Benefits and loads beyond the system boundary
					Related to the building fabric					Related to the building						
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, Recovery and/or Recycling potential
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: Ticks indicate the Information Modules declared.

Manufacturing site

Foall Srl Via Stacca, 1 25050 Rodengo Saiano - Brescia – Italy.

The 5 products considered for the EPD are produced by Foall Srl, a company located within the boundaries of Metra’s head quarter, precisely in via Provinciale Stacca, 1 - 25050 Rodengo Saiano, Brescia, Italy. Foall Srl is part of the Metra Spa group and completely controlled by Metra Spa which pays a transformation cost to Foall Srl. For these reasons, the developed EPD refers to Metra Spa as the following report.

Construction Product

Product Description

The green future of METRA Building is directly linked to low-carbon alloys: METRA RE.AL.E, produced by METRA in its Brescia headquarters. The name combines the prefix "RE" (recycle) with the suffix "AL" (aluminium) and the letter "E" (extrusion).

METRA RE.AL.E low carbon alloys allow a configuration that comes in 5 proposals as showed in the table below.

Aluminium alloy name	Alloy	Primary Aluminium [%]	Secondary Aluminium [%]	
			Pre-consumer	Post-consumer
RE.AL.E – C1	EN-AW 6005A	-	100	-
RE.AL.E – C2	EN-AW 6082	-	100	-
RE.AL.E – C3	EN-AW 6060 (6063)	rest	>60	-
RE.AL.E – C4	EN-AW 6060 (6063)	rest	>88	-
RE.AL.E – C5	EN-AW 6060 (6063)	11	75	14

The recycled aluminium used to produce the RE.AL.E C1 - C2 - C3 - C4 alloys are made up of aluminium scrapped during the production processes that take place within Metra's plants. Instead, for the RE.AL.E. C5 scenario, a part of the aluminium (primary and secondary) used to make the alloy arrives as an ingot already processed by a supplier, as shown in the table below.

Primary aluminium	Pre-consumer aluminium	Post-consumer aluminium
34%	23%	43%

Technical Information

Billets complying with reference standards for chemical composition (UNI EN 573-3).



Main Product Contents

The main product components of the scenarios analysed are as follows:

METRA RE.AL.E – C1

Material/Chemical Input	%
Primary aluminium	0
Secondary aluminium (pre-consumer)	99.1
Alloy elements	0.9

METRA RE.AL.E – C2

Material/Chemical Input	%
Primary aluminium	0
Secondary aluminium (pre-consumer)	99.1
Alloy elements	0.9

METRA RE.AL.E – C3

Material/Chemical Input	%
Primary aluminium	39.5
Secondary aluminium (pre-consumer)	59.9
Alloy elements	0.6

METRA RE.AL.E – C4

Material/Chemical Input	%
Primary aluminium	11.9
Secondary aluminium (pre-consumer)	87.6
Alloy elements	0.6

METRA RE.AL.E – C5

Material/Chemical Input	%
Primary aluminium	10.7
Secondary aluminium (pre-consumer)	75.1
Secondary aluminium (post-consumer)	13.7
Alloy elements	0.6

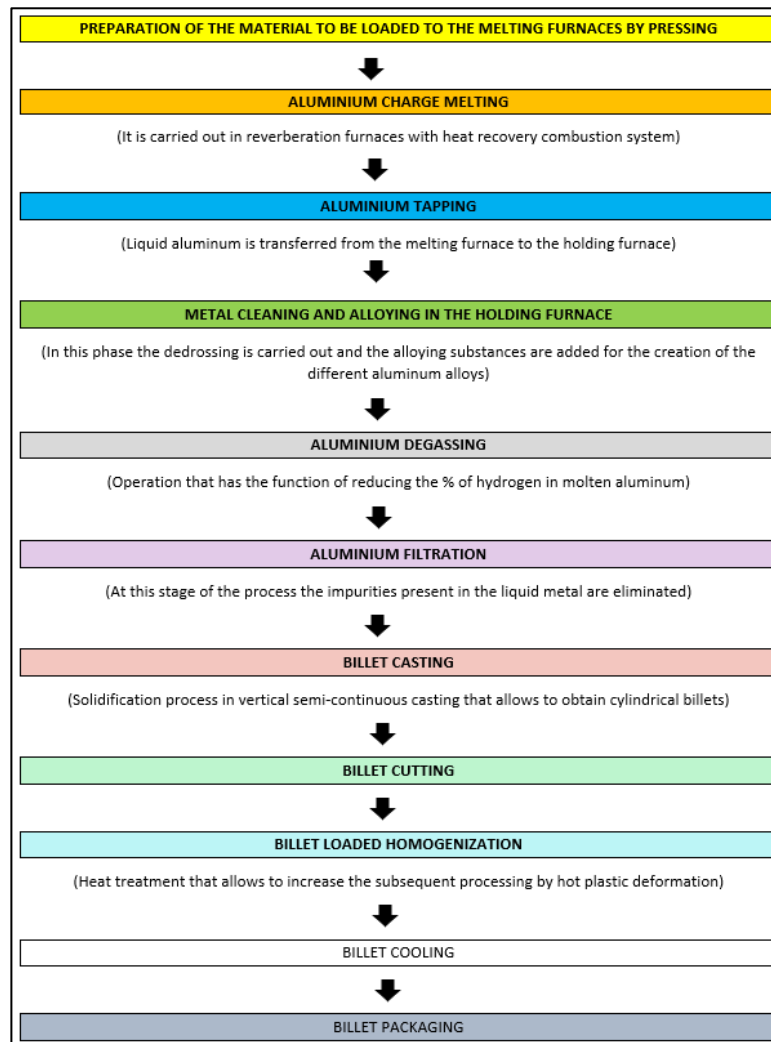
The products do not contain any substances included in the "Candidate List of Substances of Very High Concern for Authorization" compliant with /REACH/.

Manufacturing Process

Both the primary and the secondary aluminium enter the foundry where METRA RE.AL.E alloys are produced; apart from the aluminium and water, auxiliary materials such as argon and oil are used. Billets production is quite energy demanding and requires both electricity from grid and natural gas. Once the billets are produced, they are packed and ready to be sent to the extrusion plant where billets are extruded.

Process flow diagram

The following picture shows the input flows for the production of the METRA RE.AL. E. alloys:



Construction Installation

Installation phase is not considered in this study.

Use Information

Use phase is not considered in this study.

End of Life

End-of-life phase is not considered in this study.

Life Cycle Assessment Calculation Rules

Declared unit description

The calculation refers to the declared unit of 1 kg of METRA RE.AL.E alloys (RE.AL.E - C1, RE.AL.E – C2, RE.AL.E – C3, RE.AL.E – C4, RE.AL.E – C5).

System boundary

According to the EN-15804+A2:2019 the LCA study it's "cradle to gate". Modules included are A1, A2 and A3. All manufacturing activities and packaging/auxiliary's production are in module A3, while energy production and input materials are in A1.

The directive /EN 15804+A2/ outlines three conditions that must be simultaneously met to consider the boundaries of the cradle-to-gate system without considering end-of-life modules.

The three conditions are:

- the product or material is physically integrated with other products during installation so they cannot be physically separated from them at end of life.
- the product or material is no longer identifiable at end of life as a result of a physical or chemical transformation process.
- the product or material does not contain biogenic carbon.

The aluminium alloy billet product undergoes further various mechanical processing (e.g., extrusion) that will lead to the creation of a new product (e.g., window, curtain walls, sliding windows, etc.). Billet processing, however, is to be considered as another system not to be confused with the one under consideration. For this reason, the aluminium alloy billet product is no longer identifiable as such at the end of its life. Furthermore, the product does not contain biogenic carbon as it consists of aluminium and other metals in smaller quantities.

Data sources, quality and allocation

Database: Managed LCA Content 2022.2 (2022)

Software: LCA for Expert 10

Data quality: The foreground data collected by the manufacturer are based on yearly production amounts and extrapolations of measurements on specific machines and plant. The production data refer to an average of the year 2021.

The data quality can be considered as good. The LCA models have been checked and most relevant flows are considered. Technological, geographical, and temporal representativeness is appropriate.

Allocation – Background data: Information about single datasets is documented in <http://database-documentation.gabi-software.com/support/gabi/>.

Allocation – foreground data: Data were only available on an annual basis. Data used for all alloy billets production (except the data for primary and secondary aluminium) have been allocated based on the amount of total annual foundry production and total hours worked, referring manufacturing data to 1kg of product. On the other hand, primary and secondary aluminium for the individual products covered by EPDs were allocated on specific production volumes for the year 2021, again referring to 1kg of product.

As Metra mainly uses own production waste as secondary material, the majority of the secondary aluminium considered comes from Metra's three production plants: Metra Ragusa S.p.a. (Ragusa), IMET S.p.a. (Alessandria) and Metra S.p.a. (Brescia). Since the exact quantity associated with the origin of secondary material divided by alloy produced was not available, but only the total quantity coming from the various plants, we proceeded by allocating the origin of secondary aluminium for the various alloys based on the mass considered for the individual production. This procedure was only done for scenarios C, D and E because for scenarios A and B all secondary aluminium was considered by Metra S.p.a (Brescia).

Cut-off criteria

EN 15804:2012+A2:2019 requires that where there are data gaps or insufficient input data for a unit process the cut-off criteria shall be 1% of renewable and non-renewable primary energy usage and 1% of the total mass of this unit process. The total neglected flows from a product stage must be no more than 5% of product inputs by mass or 5% of primary energy contribution. No flows have been omitted in the study.

LCA Results

METRA RE.AL.E – C1

Parameters describing environmental impacts			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO ₂ eq	kg CO ₂ eq	kg CO ₂ eq	kg CO ₂ eq	kg CFC11 eq	mol H ⁺ eq	kg (PO ₄) ³⁻ eq
Product stage	Raw material supply	A1	2.66E-01	2.65E-01	6.35E-04	4.69E-05	8.43E-13	6.24E-04	9.17E-08
	Transport	A2	4.66E-04	4.62E-04	1.50E-06	3.10E-06	4.52E-17	1.54E-06	1.65E-09
	Manufacturing	A3	2.80E-01	2.80E-01	1.48E-04	1.14E-05	2.08E-13	2.52E-04	4.11E-06

GWP-total = Global warming potential, total;
 GWP-fossil = Global warming potential, fossil;
 GWP-biogenic = Global warming potential, biogenic;
 GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
 AP = Acidification potential, accumulated exceedance; and
 EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

Parameters describing environmental impacts			EP-marine	EP-terrestrial	POCP	ADP-mineral&metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m ³ world eq deprived	disease incidence
Product stage	Raw material supply	A1	1.43E-04	1.56E-03	4.52E-04	2.57E-06	6.84E+00	2.88E-02	9.21E-09
	Transport	A2	7.04E-07	7.88E-06	1.38E-06	4.64E-11	6.05E-03	5.15E-06	8.45E-12
	Manufacturing	A3	9.29E-05	1.03E-03	2.68E-04	5.53E-09	4.16E-01	1.07E-01	1.69E-09

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
 EP-terrestrial = Eutrophication potential, accumulated exceedance;
 POCP = Formation potential of tropospheric ozone;
 ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;

ADP-fossil = Depletion potential of the stratospheric ozone layer;
 WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
 PM = Particulate matter.

LCA Results (continued)

Parameters describing environmental impacts			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U ²³⁵ eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	1.28E-02	6.45E-01	5.07E-11	2.85E-09	7.60E-01
	Transport	A2	1.63E-06	4.11E-03	8.48E-14	5.20E-12	2.46E-03
	Manufacturing	A3	2.51E-03	2.30E-01	3.80E-07	3.01E-07	7.44E-02

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;

HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

Parameters describing resource use, primary energy			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	5.34E-01	0.00E+00	5.34E-01	6.84E+00	0.00E+00	6.84E+00
	Transport	A2	4.19E-04	0.00E+00	4.19E-04	6.07E-03	0.00E+00	6.07E-03
	Manufacturing	A3	1.52E-01	0.00E+00	1.52E-01	4.17E-01	0.00E+00	4.17E-01

PERE = Use of renewable primary energy excluding renewable primary energy used as raw materials;
PERM = Use of renewable primary energy resources used as raw materials;
PERT = Total use of renewable primary energy resources;

PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
PENRM = Use of non-renewable primary energy resources used as raw materials;
PENRT = Total use of non-renewable primary energy resource

Parameters describing resource use, secondary materials and fuels, use of water			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m ³
Product stage	Raw material supply	A1	1.02E+00	0.00E+00	0.00E+00	9.47E-04
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	4.84E-07
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	2.19E-03

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;

NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

Other environmental information describing waste categories			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	1.45E-09	1.01E-02	8.35E-05
	Transport	A2	3.21E-14	9.89E-07	1.13E-08
	Manufacturing	A3	3.65E-11	3.43E-02	1.75E-05

HWD = Hazardous waste disposed;
 NHWD = Non-hazardous waste disposed;
 RWD = Radioactive waste disposed

Other environmental information describing output flows – at end of life			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
 MFR = Materials for recycling

MER = Materials for energy recovery;
 EE = Exported Energy

METRA RE.ALE – C2

Parameters describing environmental impacts									
			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO ₂ eq	kg CO ₂ eq	kg CO ₂ eq	kg CO ₂ eq	kg CFC11 eq	mol H ⁺ eq	kg (PO ₄) ³⁻ eq
Product stage	Raw material supply	A1	2.65E-01	2.64E-01	6.32E-04	4.64E-05	8.39E-13	6.18E-04	8.96E-08
	Transport	A2	4.64E-04	4.59E-04	1.49E-06	3.09E-06	4.50E-17	1.53E-06	1.64E-09
	Manufacturing	A3	2.80E-01	2.80E-01	1.48E-04	1.14E-05	2.08E-13	2.52E-04	4.11E-06

GWP-total = Global warming potential, total;
 GWP-fossil = Global warming potential, fossil;
 GWP-biogenic = Global warming potential, biogenic;
 GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
 AP = Acidification potential, accumulated exceedance; and
 EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

Parameters describing environmental impacts									
			EP-marine	EP-terrestrial	POCP	ADP-mineral&metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m ³ world eq deprived	disease incidence
Product stage	Raw material supply	A1	1.42E-04	1.55E-03	4.49E-04	7.39E-08	6.82E+00	2.84E-02	9.13E-09
	Transport	A2	7.00E-07	7.84E-06	1.37E-06	4.62E-11	6.01E-03	5.13E-06	8.41E-12
	Manufacturing	A3	9.29E-05	1.03E-03	2.68E-04	5.53E-09	4.16E-01	1.07E-01	1.69E-09

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
 EP-terrestrial = Eutrophication potential, accumulated exceedance;
 POCP = Formation potential of tropospheric ozone;
 ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;

ADP-fossil = Depletion potential of the stratospheric ozone layer;
 WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
 PM = Particulate matter.

LCA Results (continued)

Parameters describing environmental impacts			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U ²³⁵ eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	1.27E-02	6.27E-01	4.99E-11	2.77E-09	7.46E-01
	Transport	A2	1.62E-06	4.09E-03	8.43E-14	5.17E-12	2.44E-03
	Manufacturing	A3	2.51E-03	2.30E-01	3.80E-07	3.01E-07	7.44E-02

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;

HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

Parameters describing resource use, primary energy			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	5.31E-01	0.00E+00	5.31E-01	6.82E+00	0.00E+00	6.82E+00
	Transport	A2	4.17E-04	0.00E+00	4.17E-04	6.04E-03	0.00E+00	6.04E-03
	Manufacturing	A3	1.52E-01	0.00E+00	1.52E-01	4.17E-01	0.00E+00	4.17E-01

PERE = Use of renewable primary energy excluding renewable primary energy used as raw materials;
PERM = Use of renewable primary energy resources used as raw materials;
PERT = Total use of renewable primary energy resources;

PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
PENRM = Use of non-renewable primary energy resources used as raw materials;
PENRT = Total use of non-renewable primary energy resource

Parameters describing resource use, secondary materials and fuels, use of water			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m ³
Product stage	Raw material supply	A1	1.02E+00	0.00E+00	0.00E+00	9.35E-04
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	4.82E-07
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	2.19E-03

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;

NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

Other environmental information describing waste categories				HWD	NHWD	RWD
				kg	kg	kg
Product stage	Raw material supply	A1		1.45E-09	9.39E-03	8.29E-05
	Transport	A2		3.20E-14	9.84E-07	1.12E-08
	Manufacturing	A3		3.65E-11	3.43E-02	1.75E-05

HWD = Hazardous waste disposed;
 NHWD = Non-hazardous waste disposed;
 RWD = Radioactive waste disposed

Other environmental information describing output flows – at end of life								
			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
 MFR = Materials for recycling

MER = Materials for energy recovery;
 EE = Exported Energy

METRA RE.ALE – C3

Parameters describing environmental impacts			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO ₂ eq	kg CO ₂ eq	kg CO ₂ eq	kg CO ₂ eq	kg CFC11 eq	mol H ⁺ eq	kg (PO ₄) ₃ ⁻ eq
Product stage	Raw material supply	A1	3.98E+00	3.97E+00	7.01E-03	6.25E-04	4.11E-12	2.54E-02	9.23E-07
	Transport	A2	5.77E-02	5.73E-02	1.42E-04	2.43E-04	4.75E-15	8.97E-04	1.33E-07
	Manufacturing	A3	2.80E-01	2.80E-01	1.48E-04	1.14E-05	2.08E-13	2.52E-04	4.11E-06

GWP-total = Global warming potential, total;
 GWP-fossil = Global warming potential, fossil;
 GWP-biogenic = Global warming potential, biogenic;
 GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
 AP = Acidification potential, accumulated exceedance; and
 EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

Parameters describing environmental impacts			EP-marine	EP-terrestrial	POCP	ADP-mineral&metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m ³ world eq deprived	disease incidence
Product stage	Raw material supply	A1	4.68E-03	5.13E-02	1.38E-02	3.68E-07	6.00E+01	6.26E-01	4.61E-07
	Transport	A2	2.61E-04	2.87E-03	6.82E-04	4.39E-09	7.24E-01	4.41E-04	1.39E-08
	Manufacturing	A3	9.29E-05	1.03E-03	2.68E-04	5.53E-09	4.16E-01	1.07E-01	1.69E-09

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
 EP-terrestrial = Eutrophication potential, accumulated exceedance;
 POCP = Formation potential of tropospheric ozone;
 ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;

ADP-fossil = Depletion potential of the stratospheric ozone layer;
 WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
 PM = Particulate matter.

LCA Results (continued)

Parameters describing environmental impacts			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U ²³⁵ eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	1.39E-01	1.74E+01	1.34E-09	4.03E-08	1.69E+00
	Transport	A2	1.77E-04	5.14E-01	1.02E-11	5.80E-10	2.04E-01
	Manufacturing	A3	2.51E-03	2.30E-01	3.80E-07	3.01E-07	7.44E-02

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;

HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

Parameters describing resource use, primary energy			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	8.91E+00	0.00E+00	8.91E+00	6.01E+01	0.00E+00	6.01E+01
	Transport	A2	3.38E-02	0.00E+00	3.38E-02	7.27E-01	0.00E+00	7.27E-01
	Manufacturing	A3	1.52E-01	0.00E+00	1.52E-01	4.17E-01	0.00E+00	4.17E-01

PERE = Use of renewable primary energy excluding renewable primary energy used as raw materials;
PERM = Use of renewable primary energy resources used as raw materials;
PERT = Total use of renewable primary energy resources;

PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
PENRM = Use of non-renewable primary energy resources used as raw materials;
PENRT = Total use of non-renewable primary energy resource

Parameters describing resource use, secondary materials and fuels, use of water			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m ³
Product stage	Raw material supply	A1	6.13E-01	0.00E+00	0.00E+00	3.10E-02
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	3.94E-05
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	2.19E-03

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;

NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

Other environmental information describing waste categories			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	6.23E-09	1.41E+00	7.70E-04
	Transport	A2	3.56E-12	1.01E-04	1.17E-06
	Manufacturing	A3	3.65E-11	3.43E-02	1.75E-05

HWD = Hazardous waste disposed;
 NHWD = Non-hazardous waste disposed;
 RWD = Radioactive waste disposed

Other environmental information describing output flows – at end of life			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
 MFR = Materials for recycling

MER = Materials for energy recovery;
 EE = Exported Energy

METRA RE.ALE – C4

Parameters describing environmental impacts			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO ₂ eq	kg CO ₂ eq	kg CO ₂ eq	kg CO ₂ eq	kg CFC11 eq	mol H ⁺ eq	kg (PO ₄) ₃ ⁻ eq
Product stage	Raw material supply	A1	1.37E+00	1.37E+00	2.54E-03	2.16E-04	1.80E-12	8.00E-03	3.36E-07
	Transport	A2	3.18E-02	3.15E-02	8.89E-05	1.69E-04	2.83E-15	3.18E-04	9.10E-08
	Manufacturing	A3	2.80E-01	2.80E-01	1.48E-04	1.14E-05	2.08E-13	2.52E-04	4.11E-06

GWP-total = Global warming potential, total;
 GWP-fossil = Global warming potential, fossil;
 GWP-biogenic = Global warming potential, biogenic;
 GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
 AP = Acidification potential, accumulated exceedance; and
 EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

Parameters describing environmental impacts			EP-marine	EP-terrestrial	POCP	ADP-mineral&metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m ³ world eq deprived	disease incidence
Product stage	Raw material supply	A1	1.50E-03	1.64E-02	4.44E-03	1.28E-07	2.27E+01	2.05E-01	1.44E-07
	Transport	A2	1.00E-04	1.11E-03	2.48E-04	2.76E-09	4.05E-01	2.92E-04	4.47E-09
	Manufacturing	A3	9.29E-05	1.03E-03	2.68E-04	5.53E-09	4.16E-01	1.07E-01	1.69E-09

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
 EP-terrestrial = Eutrophication potential, accumulated exceedance;
 POCP = Formation potential of tropospheric ozone;
 ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;

ADP-fossil = Depletion potential of the stratospheric ozone layer;
 WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
 PM = Particulate matter.

LCA Results (continued)

Parameters describing environmental impacts			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U ²³⁵ eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	4.95E-02	5.63E+00	4.34E-10	1.40E-08	9.93E-01
	Transport	A2	1.10E-04	2.96E-01	6.00E-12	3.53E-10	1.46E-01
	Manufacturing	A3	2.51E-03	2.30E-01	3.80E-07	3.01E-07	7.44E-02

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;

HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

Parameters describing resource use, primary energy			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	3.00E+00	0.00E+00	3.00E+00	2.27E+01	0.00E+00	2.27E+01
	Transport	A2	2.31E-02	0.00E+00	2.31E-02	4.06E-01	0.00E+00	4.06E-01
	Manufacturing	A3	1.52E-01	0.00E+00	1.52E-01	4.17E-01	0.00E+00	4.17E-01

PERE = Use of renewable primary energy excluding renewable primary energy used as raw materials;
PERM = Use of renewable primary energy resources used as raw materials;
PERT = Total use of renewable primary energy resources;

PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
PENRM = Use of non-renewable primary energy resources used as raw materials;
PENRT = Total use of non-renewable primary energy resource

Parameters describing resource use, secondary materials and fuels, use of water			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m ³
Product stage	Raw material supply	A1	8.98E-01	0.00E+00	0.00E+00	9.83E-03
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	2.68E-05
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	2.19E-03

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;

NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

Other environmental information describing waste categories			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	2.88E-09	4.30E-01	2.83E-04
	Transport	A2	2.06E-12	6.10E-05	7.00E-07
	Manufacturing	A3	3.65E-11	3.43E-02	1.75E-05

HWD = Hazardous waste disposed;
 NHWD = Non-hazardous waste disposed;
 RWD = Radioactive waste disposed

Other environmental information describing output flows – at end of life			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
 MFR = Materials for recycling

MER = Materials for energy recovery;
 EE = Exported Energy

METRA RE.ALE – C5

Parameters describing environmental impacts									
			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO ₂ eq	kg CO ₂ eq	kg CO ₂ eq	kg CO ₂ eq	kg CFC11 eq	mol H ⁺ eq	kg (PO ₄) ₃ ⁻ eq
Product stage	Raw material supply	A1	1.41E+00	1.40E+00	2.74E-03	3.81E-04	8.34E-12	6.80E-03	6.77E-07
	Transport	A2	1.51E-02	1.50E-02	4.86E-05	1.01E-04	1.47E-15	5.00E-05	5.34E-08
	Manufacturing	A3	2.80E-01	2.80E-01	1.48E-04	1.14E-05	2.08E-13	2.52E-04	4.11E-06

GWP-total = Global warming potential, total;
 GWP-fossil = Global warming potential, fossil;
 GWP-biogenic = Global warming potential, biogenic;
 GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
 AP = Acidification potential, accumulated exceedance; and
 EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

Parameters describing environmental impacts									
			EP-marine	EP-terrestrial	POCP	ADP-mineral&metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m ³ world eq deprived	disease incidence
Product stage	Raw material supply	A1	1.19E-03	1.31E-02	3.56E-03	2.62E-07	2.15E+01	1.75E-01	9.03E-08
	Transport	A2	2.29E-05	2.56E-04	4.49E-05	1.51E-09	1.96E-01	1.67E-04	3.05E-10
	Manufacturing	A3	9.29E-05	1.03E-03	2.68E-04	5.53E-09	4.16E-01	1.07E-01	1.69E-09

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
 EP-terrestrial = Eutrophication potential, accumulated exceedance;
 POCP = Formation potential of tropospheric ozone;
 ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;

ADP-fossil = Depletion potential of the stratospheric ozone layer;
 WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
 PM = Particulate matter.

LCA Results (continued)

Parameters describing environmental impacts							
			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U ²³⁵ eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	1.61E-01	4.87E+00	3.01E-10	1.02E-08	1.31E+00
	Transport	A2	5.88E-05	1.48E-01	3.05E-12	1.87E-10	8.85E-02
	Manufacturing	A3	2.51E-03	2.30E-01	3.80E-07	3.01E-07	7.44E-02

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;

HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

Parameters describing resource use, primary energy								
			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	6.10E+00	0.00E+00	6.10E+00	2.15E+01	0.00E+00	2.15E+01
	Transport	A2	1.36E-02	0.00E+00	1.36E-02	1.97E-01	0.00E+00	1.97E-01
	Manufacturing	A3	1.52E-01	0.00E+00	1.52E-01	4.17E-01	0.00E+00	4.17E-01

PERE = Use of renewable primary energy excluding renewable primary energy used as raw materials;
PERM = Use of renewable primary energy resources used as raw materials;
PERT = Total use of renewable primary energy resources;

PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
PENRM = Use of non-renewable primary energy resources used as raw materials;
PENRT = Total use of non-renewable primary energy resource

Parameters describing resource use, secondary materials and fuels, use of water							
			SM	RSF	NRSF	FW	
			kg	MJ net calorific value	MJ net calorific value	m ³	
Product stage	Raw material supply	A1	9.21E-01	0.00E+00	0.00E+00	1.47E-02	
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	1.57E-05	
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	2.19E-03	

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;

NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

Other environmental information describing waste categories			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	1.59E-08	3.60E-01	8.87E-04
	Transport	A2	1.04E-12	3.21E-05	3.66E-07
	Manufacturing	A3	3.65E-11	3.43E-02	1.75E-05

HWD = Hazardous waste disposed;
 NHWD = Non-hazardous waste disposed;
 RWD = Radioactive waste disposed

Other environmental information describing output flows – at end of life			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
 MFR = Materials for recycling

MER = Materials for energy recovery;
 EE = Exported Energy

Scenarios and additional technical information

For the products covered by this EPD, being in line with the three conditions specified in EN15804+A2, cradle-to-gate system boundaries were considered, that is, they consider the stage of raw material extraction, transportation and product creation. Specifically:

- Module A1 refers to all raw materials' impacts production, pre-products manufacturing and all types of energy inputs
- Module A2 includes the raw materials (also auxiliary's and packaging) transports to factory gate
- Module A3 comprises all production activities, wastes treatment and process emissions (both to air and to water).

All subsequent modules (A4, A5, C1-C4 and D) are not considered in this study.

Summary, comments and additional information

Interpretation

METRA RE.AL.E. – C1

The figure below shows that for the majority of the categories the highest impacts are given by A1 and A3 modules. In particular A3 is the major responsible of the impact water scarcity (WDP), whilst A1 module is the principal responsible for abiotic depletion potential element (ADPe) and abiotic depletion potential fossil (ADPf).

The higher contributions to the different impact indicators are presented below:

- Natural gas consumption in A3 is the principal contributor for GWP.
- Alloying elements production in A1 is the principal contributor for AP, EP-marine, EP-terrestrial, POCP and ADPe
- Electricity consumption is the major contributor for ODP
- Manufacturing is the major contributor for EP-freshwater
- Natural gas production in A1 is the major contributor for ADPf
- Manufacturing is the major contributor for WDP

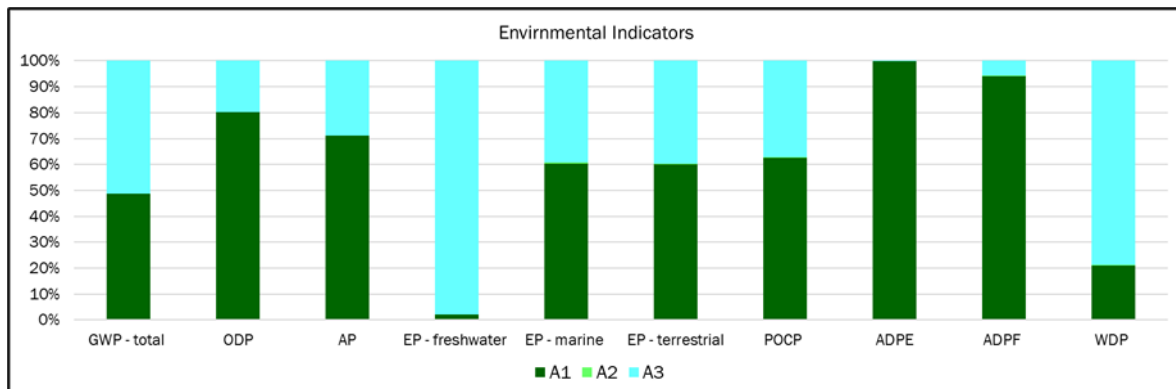


Figure 1: Relative contribution of declared modules to EN 15804 +A2 environmental indicators (METRA RE.AL.E. – C1)

METRA RE.AL.E. – C2

The figure below shows that for the majority of the categories the highest impacts are given by A1 and A3. In particular A3 is the major responsible of the impact water scarcity (WDP), whilst A1 module is the principal responsible for abiotic depletion potential element (ADPe) and abiotic depletion potential fossil (ADPf).

The higher contributions of the different impact indicators are presented below:

- Natural gas consumption in A3 is the principal contributor for GWP.
- Alloying elements production in A1 is the principal contributor for AP, EP-marine, EP-terrestrial, POCP and ADPe
- Electricity consumption is the major contributor for ODP

- Manufacturing is the major contributor for EP-freshwater
- Natural gas production in A1 is the major contributor for ADPF
- Manufacturing is the major contributor for WDP

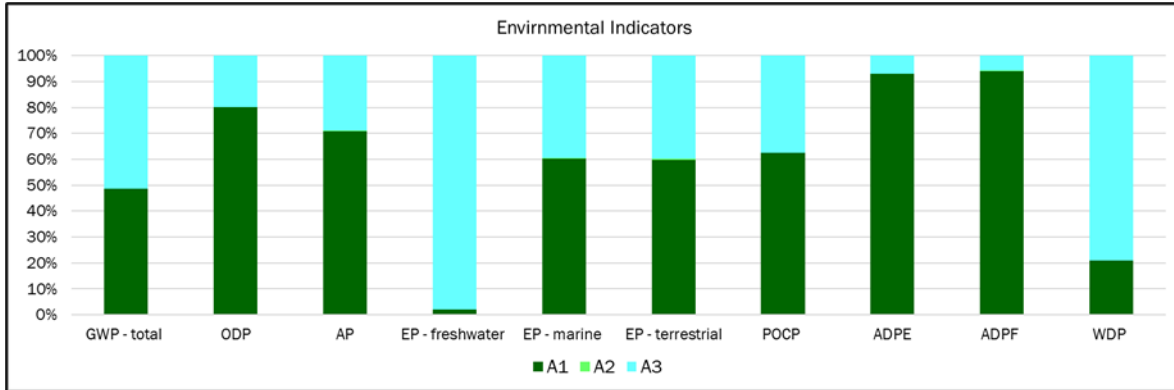


Figure 2: Relative contribution of declared modules to EN 15804 +A2 environmental indicators (METRA RE.AL.E. – C2)

METRA RE.AL.E. – C3

The figure below shows that for the majority of the categories the highest impacts are given by A1. Indeed, A1 is the major responsible of all impact categories indicators. This is due to the primary aluminium production. It is worth to note that for the environmental indicator EP-freshwater the module A3 provides a high relative impact.

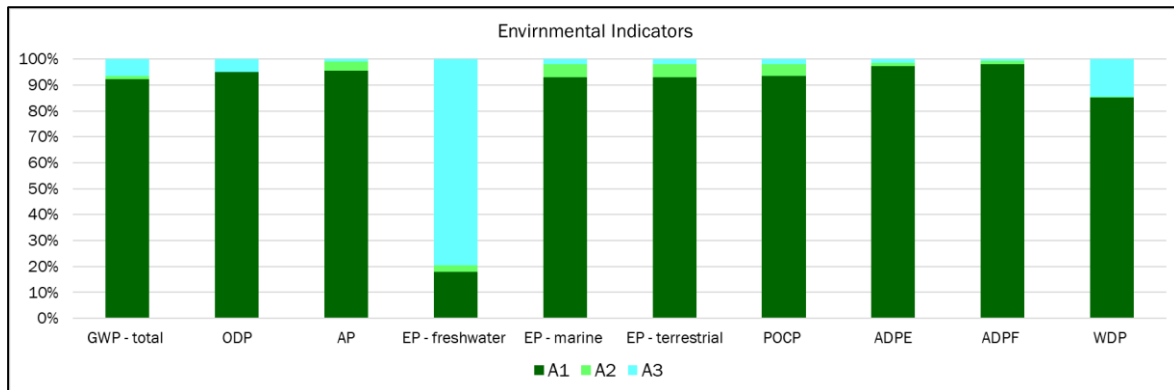


Figure 3: Relative contribution of declared modules to EN 15804 +A2 environmental indicators (METRA RE.AL.E. – C3)

METRA RE.AL.E. – C4

The figure below shows that for the majority of the categories the highest impacts are given by A1. In fact, A1 is the major contributor in all impact categories indicators due to the primary aluminium production. It is worth to note that for the environmental indicator EP-freshwater the module A3 provides a high relative impact.

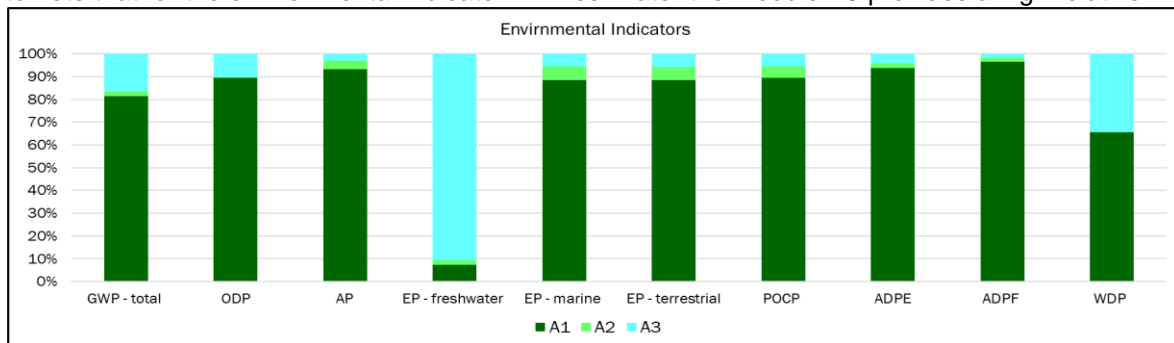


Figure 4: Relative contribution of declared modules to EN 15804 +A2 environmental indicators (METRA RE.AL.E. – C4)

METRA RE.AL.E. – C5

The figure bellow shows that the majority of the categories the highest impacts are given by A1. In fact, A1 is the major contributor in all impact categories indicators due to the aluminium production. It is worth to note that for the environmental indicator EP-freshwater the module A3 provides a high relative impact.

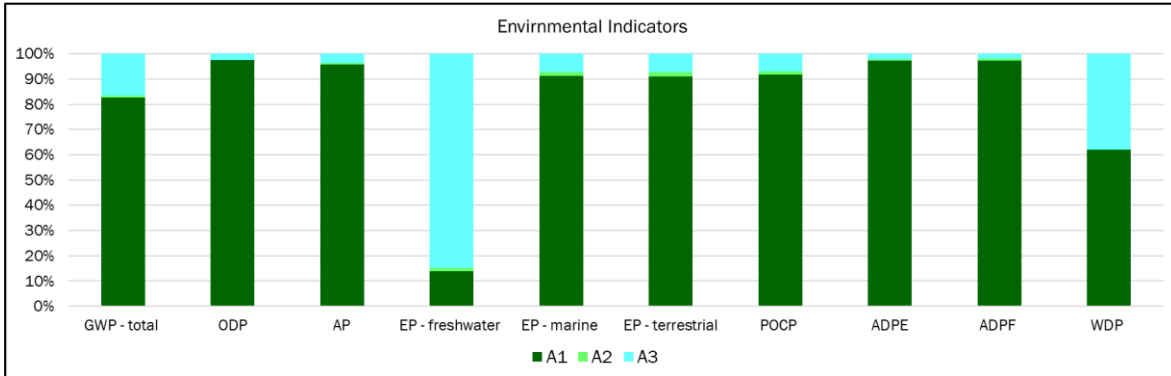


Figure 5: Relative contribution of declared modules to EN 15804 +A2 environmental indicators (METRA RE.AL.E. – C5)

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