System boundary:

The scope of the study is cradle to gate with options, described as A1-A3, A4, C1-C4 and D. The study takes into consideration the life cycle stages from the extraction of raw materials, production and disposal, including all transport stages. The flowchart (Figure 1) illustrates the different stages of the product's life cycle considered. Module D includes the loads of melting and casting used aluminum and steel together with the potential benefits for the use of secondary aluminum outside the system boundary for the next product life cycle.

Figure 1: Life cycle stages of Alu Mast System ®

Cut-off criteria:

All major raw materials and all the essential energy is included. The production process for raw materials and energy flows that are included with very small amounts (<1%) are not included.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

The transport scenario considered for Alu Mast system ® is based on the distribution of sales in 2021 and corresponding transport data. Datasets from ecoinvent were referred to.

Transport from production place to assembly/user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	value (l/t)
Truck	53%	lorry >32 metric ton, EURO6	300	0,02285 l/t.km Diesel	7,02

End of Life (C1, C3, C4)

	Unit	Value
Hazardous waste disposed	Kg	-
Collected as mixed construction waste	Kg	-
Reuse	Kg	-
Recycling	Kg	0,95
Energy recovery	Kg	-
To landfill	Kg	0,05

Recycling rates of aluminum from European Aluminium[1]

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	value (l/t)
Truck	37%	lorry 16-32 metric ton, EURO5	300	0,045 l/t.km Diesel	12,03

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Substituted wrought aluminum	Kg	0,88

The Alu Mast System ® is assumed to be recycled after being cut to shorter units and added as aluminum scarp in ingot production which could for different purposes have a varied degree of recycled aluminum content and therefore the recycled material minus recycled content in the materials are credited with a dataset for recycled aluminum.

[1]European Aluminum - ENVIRONMENTAL PROFILE REPORT

LCA: Results

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Benefits & loads beoyond system boundary
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

The Alu Mast system ® is produced in Lena Metal facilities in Bilitt, Norway. This includes goods reception, cutting of alu-profiles, assembly and shipment. The system is sold under different size-profiles. The scenarios for modules beyond the factory gate (A4, C and D), are based on recommended practices for installation and maintenance as well as expected service life and guidelines for waste treatment from NCPR 013 supplemented by European Aluminum GPI[2].

Core environmental impact indicators

Indicator	Unit	A1	A2	A3	A1-A3	A4
GWP-total	kg CO2 eq.	4,55E+00	6,02E-01	2,65E-01	5,42E+00	4,89E-02
GWP-fossil	kg CO2 eq.	4,56E+00	6,00E-01	2,14E-01	5,37E+00	4,88E-02
GWP-biogenic	kg CO2 eq.	-1,90E-02	1,02E-03	4,98E-02	3,18E-02	8,69E-05
GWP-LULUC	kg CO2 eq.	1,52E-03	2,50E-04	4,70E-04	2,24E-03	1,96E-05
ODP	kg CFC11 eq.	5,13E-07	1,38E-07	3,70E-08	6,88E-07	1,13E-08
AP	mol H^+ eq.	2,47E-02	2,59E-03	1,52E-03	2,88E-02	1,40E-04
EP-freshwater	kg P eq.	9,20E-04	3,86E-05	6,67E-05	1,03E-03	3,22E-06
EP-marine	kg N eq.	7,80E-04	5,70E-04	4,40E-04	1,79E-03	2,82E-05
EP-terrestial	mol N eq.	7,56E-03	6,29E-03	4,51E-03	1,84E-02	3,10E-04
POCP	kg NMVOC eq.	5,09E-03	2,04E-03	1,24E-03	8,37E-03	1,10E-04
ADP-M&M	kg Sb eq.	8,52E-06	1,98E-06	9,07E-06	1,96E-05	1,66E-07
ADP-fossil	MJ	9,80E+00	6,79E-01	7,46E-01	1,12E+01	5,65E-02
WDP	m^3	6,81E-01	4,29E-02	3,40E+00	4,12E+00	3,60E-03

[2] 22-02-16-epd-programme-rules-3rd-rev-european-aluminium.pdf

Indicator	Unit	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	8,16E-03	4,89E-02	3,40E-02	2,70E-04	-4,39E-01
GWP-fossil	kg CO2 eq.	8,14E-03	4,88E-02	1,76E-02	2,70E-04	-4,54E-01
GWP-biogenic	kg CO2 eq.	1,45E-05	8,69E-05	1,64E-02	6,39E-07	1,56E-02
GWP-LULUC	kg CO2 eq.	3,26E-06	1,96E-05	8,77E-06	1,20E-07	-5,20E-04
ODP	kg CFC11 eq.	1,89E-09	1,13E-08	7,52E-10	4,77E-11	-4,53E-08
AP	mol H^+ eq.	2,31E-05	1,40E-04	7,77E-05	2,52E-06	-8,26E-03
EP-freshwater	kg P eq.	5,37E-07	3,22E-06	4,22E-06	3,26E-08	-6,40E-04
EP-marine	kg N eq.	4,71E-06	2,82E-05	1,78E-05	1,04E-06	-6,30E-04
EP-terrestial	mol N eq.	5,12E-05	3,10E-04	2,10E-04	1,13E-05	-7,72E-03
POCP	kg NMVOC eq.	1,91E-05	1,10E-04	5,17E-05	3,08E-06	-2,24E-03
ADP-M&M	kg Sb eq.	2,77E-08	1,66E-07	6,69E-07	1,64E-10	-1,60E-04
ADP-fossil	MJ	9,41E-03	5,65E-02	3,50E-02	7,40E-04	-7,01E+00
WDP	m^3	6,00E-04	3,60E-03	7,91E-03	2,25E-05	-5,98E-01

GWP-total: *Global Warming Potential;* ***GWP-fossil:*** *Global Warming Potential fossil fuels;* ***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;* ***EP-freshwater:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional Norwegian requirements" for indicator given as PO4 eq.* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP****: Formation potential of tropospheric ozone;* ***ADP-M&M****: Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water counsumption*

ILCD class	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD type / level 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Share of nutrients to freshwater end compartment (EP-fw)	None
	Eutrophication potential, Share of nutrients to marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

Resource use

Parameter	Unit	A1	A2	A3	A1-A3	A4
RPEE	MJ	1,07E+01	9,47E-02	1,07E+01	2,15E+01	7,96E-03
RPEM	MJ	2,14E-01	3,13E-02	2,14E-01	4,59E-01	2,61E-03
TPE	MJ	1,09E+01	1,26E-01	1,09E+01	2,19E+01	1,06E-02
NRPE	MJ	1,43E+00	8,64E-01	1,43E+00	3,72E+00	7,21E-02
NRPM	MJ	2,30E+00	8,22E+00	2,30E+00	1,28E+01	6,73E-01
TRPE	MJ	3,73E+00	9,08E+00	3,73E+00	1,65E+01	7,45E-01
SM	Kg	2,73E-02	9,11E-03	2,73E-02	6,37E-02	7,60E-04
RSF	MJ	6,05E-03	2,67E-03	6,05E-03	1,48E-02	2,30E-04
NRSF	MJ	4,04E-02	1,08E-02	4,04E-02	9,16E-02	9,20E-04
W	m^3	7,95E-02	1,02E-03	7,95E-02	1,60E-01	8,57E-05

Parameter	Unit	C1	C2	C3	C4	D
RPEE	MJ	1,33E-03	7,96E-03	3,33E-02	7,51E-05	-1,00E+00
RPEM	MJ	4,40E-04	2,61E-03	9,88E-03	1,78E-05	0,00E+00
TPE	MJ	1,76E-03	1,06E-02	4,32E-02	9,29E-05	-1,00E+00
NRPE	MJ	1,20E-02	7,21E-02	6,86E-02	8,70E-04	-7,85E+00
NRPM	MJ	1,12E-01	6,73E-01	5,15E-02	2,99E-03	0,00E+00
TRPE	MJ	1,24E-01	7,45E-01	1,20E-01	3,86E-03	-7,85E+00
SM	kg	1,30E-04	7,60E-04	1,02E+00	4,25E-06	0,00E+00
RSF	MJ	3,77E-05	2,30E-04	9,00E-04	1,12E-06	0,00E+00
NRSF	MJ	1,50E-04	9,20E-04	1,20E-04	1,51E-06	0,00E+00
W	m^3	1,43E-05	8,57E-05	1,90E-04	5,34E-07	-1,40E-02

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non renewable primary energy resources used as energy carrier; NRPM Non renewable primary energy resources used as materials; TRPE Total use of non renewable primary energy resources; SM Use of secondary materials; RSF Use of renewable secondary fuels; NRSF Use of non renewable secondary fuels; W Use of net fresh water

End of life - Waste

Parameter	Unit	A1	A2	A3	A1-A3	A4
HW	KG	6,04E+02	1,99E-01	4,05E-01	6,05E+02	1,66E-02
NHW	KG	4,98E+02	4,49E-01	1,54E-01	4,99E+02	3,84E-02
RW	KG	3,30E-01	1,80E-04	4,50E-04	3,31E-01	1,49E-05

Parameter	Unit	C1	C2	C3	C4	D
HW	KG	2,77E-03	1,66E-02	2,50E-02	1,60E-04	0,00E+00
NHW	KG	6,41E-03	3,84E-02	2,42E-02	3,79E-06	0,00E+00
RW	KG	2,48E-06	1,49E-05	2,11E-05	1,03E-07	0,00E+00

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

End of life – output flow

Parameter	Unit	A1	A2	A3	A1-A3	A4
CR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MR	kg	3,63E+02	7,59E-03	1,59E-02	3,63E+02	6,30E-04
MER	kg	2,89E+00	2,17E-03	1,70E-03	2,89E+00	1,70E-04
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Parameter	Unit	C1	C2	C3	C4	D
CR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MR	kg	1,10E-04	6,30E-04	2,04E-03	3,02E-06	0,00E+00
MER	kg	2,89E-05	1,70E-04	2,60E-04	1,12E-06	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	0
Biogenic carbon content in the accompanying packaging	kg C	-

Additional Norwegian requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase

National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process(A3).

National electricity grid	Unit	Value
Norwegian mix (market for electricity, ecoinvent 3.8)	kg CO2 -eq/kWh	0,01713

Additional environmental impact indicators required in NPCR Part

In order to increase the transparency of biogenic carbon contribution to climate impact, the indicator for GWP is also given as GWP-IOBC, being climate impacts calculated according to the principle of instantaneous oxidation of bio-carbon. This is however not relevant to calculate in this EPD and could be considered equal to GWP-fossil.

Hazardous substances

The declaration is based upon reference to threshold values and/or test results and/or material safety data sheets provided to EPD verifiers. Documentation available upon request to EPD owner.

- ■ The product contains no substances given by the REACH Candidate list or the Norwegian priority list.
- □ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
- □ The product contains dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
- □ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Indoor environment

Not relevant for outdoor products.

Carbon footprint

Carbon footprint has not been worked out for the product.

Bibliography

ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products
ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products

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