

Environmental Product Declaration

as per ISO 14025 and EN 15804

Owner of the declaration: Officine Maccaferri S.p.A.

Publisher: Kiwa-Ecobility Experts

Programme operator: Kiwa-Ecobility Experts

Registration number: EPD-Kiwa-EE-000384-EN

Issue date: 22.05.2024

Valid to: 22.05.2029



TERRAMESH

PoliMac coated double twist wire mesh units for reinforced soil structures



1. General information**Officine Maccaferri S.p.A.****Programme operator:**

Kiwa-Ecobility Experts
Kiwa GmbH, Ecobility Experts
Wattstraße 11-13
13355 Berlin
Germany

Registration number:

EPD-Kiwa-EE-000384-EN

This declaration is based on the Product Category Rules:

PCR B – Product Category Rules for steel construction products, Requirements on the Environmental Product Declarations for steel construction products; Version 2020-03-13

Issue date

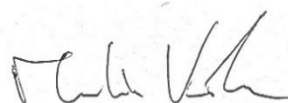
22.05.2024

Valid to

22.05.2029



Raoul Mancke
(Head of programme operations, Kiwa-Ecobility Experts)



Martin Koehrer
(Verification body, Kiwa-Ecobility Experts)

TERRAMESH**Owner of the declaration:**

Officine Maccaferri S.p.A.
Via del Faggiolo, 1/12
40132 Bologna (BO)
Italy

Declared product / declared unit:

1 kg TERRAMESH PoliMac coated double twist wire mesh units for reinforced soil structures, including distribution packaging.

Scope:

The EPD is based on the composition product TERRAMESH PMC 8122 3X3X0.70. The LCA results can also be transferred to other TERRAMESH products.

Kiwa-Ecobility Experts assumes no liability for manufacturer's information, LCA data and evidence.

Verification

The European standard EN 15804+A2:2019 serves as the core PCR.

Independent verification of the declaration and data according to ISO 14025: 2010.

internal

external



Dr.-Ing. Morteza Nikravan
(External verifier of Kiwa GmbH)

2. Product

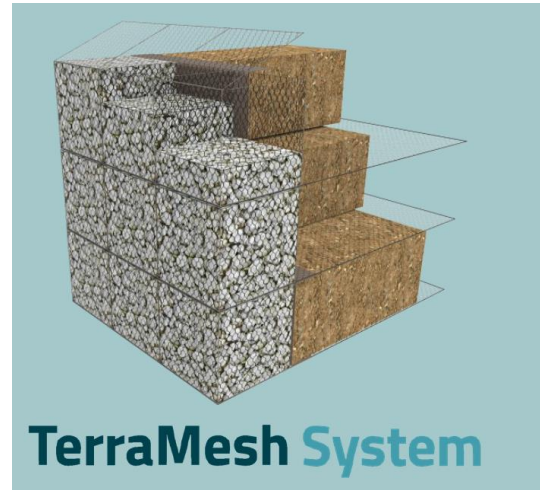
2.1 Product description

TERRAMESH units are manufactured from a continuous element of double twisted hexagonal woven steel wire mesh type 8x10, made of galvanised wires (Zinc Aluminium alloy in accordance with EN 10244-2 and ISO 7989-2 - Class A) with an additional polymer (PoliMac) coating.

Following products name are covered by the present EPD.

TERRAMESH SYSTEM consists of pre-assembled units of double twisted, heavily galvanised and PoliMac coated wire mesh (8x10 type, wire diameter 2.7 mm). The facing section of the unit is formed by connecting a back panel and diaphragms to the main fascia unit, thus creating the rectangular shaped cells used for stone confinement. The tail reinforcement, fascia and lid are all one continuous panel of mesh.

TERRAMESH SYSTEM units are supplied in standard lengths, requiring no cuts on site.



TERRAMESH MINERAL is a preassembled modular system used to build reinforced soil structures with inclined stone facing and specially designed to be environmental friendly. The units are manufactured from a continuous element of double twisted hexagonal woven steel wire mesh (8x10 type, wire diameter 2.2 mm or 2.7 mm) made of PoliMac coated steel wire. The unit is simply erected on site, the bracing angles support the face at the designated angle without the need for any external formwork or shuttering.

GREEN TERRAMESH MINERAL is a preassembled modular system used to build reinforced soil structures with inclined vegetated facing, manufactured from a continuous element of double twisted hexagonal woven steel wire mesh (8x10 type, wire diameter 2.2 mm or 2.7 mm) made of PoliMac coated steel wire.

As all components are factory fitted, GREEN TERRAMESH is rapid to install. The unit is simply erected on site, the bracing angles support the face at the designated angle without the need for any external formwork or shuttering.



TERRAMESH complies with EN 10223-3:2013 and EN 14475.



2.2 Application (Intended Use of the product)

TERRAMESH PoliMac coated double twist wire mesh unit for reinforced soil structures, are intended to be used for Earth retaining structures (vertical battered or inclined walls, bridge abutments, bulk storage facilities, with a facing retain fill placed between the reinforcing layers; reinforced steel slopes with built-in deformable facing units; self-standing embankments.

On taller slopes and structures, TERRAMESH units can be used in conjunction with high performance primary geogrids, PARALINK, PARAGRID and PARAGRID W.

TERRAMESH PoliMac coated double twist wire mesh unit for reinforced soil structures are CE marked in compliance with Regulation (EU) 305/2011, according to EAD 200026.



2.3 Reference Service Life (RSL)

The typical service life is up to 120 years, according to related Declaration of Performance. Durability of the products are defined as per EN 10223-3 and tested accordingly.

2.4 Technical data

Characteristics (*)	Unit	Value
Tensile Strength (EN 10223-3:2013) MD	≥ 35	kN/m
Production route (EAF or BOF)	%	75.39 EAF – 24.61 BOF
Durability (EN 10223-3:2013)		120 years in environmental conditions C2, C3, C4 and C5 as per Annex A of EN 10223-3:2013

(*) Further Performances are detailed in Declaration of Performance according to Regulation (EU) 305/2011.

2.5 Substances of very high concern

TERRAMESH PoliMac coated do not contain SVHC.

2.6 Base materials / Ancillary materials

The composition of the reference products is reported in Table below. The products are implemented with galvanized steel wire (for the mesh, for the edges and for additional components), PoliMac coated (coating thickness 0.5 mm).

PoliMac is an extruded polymer specifically developed by Maccaferri.

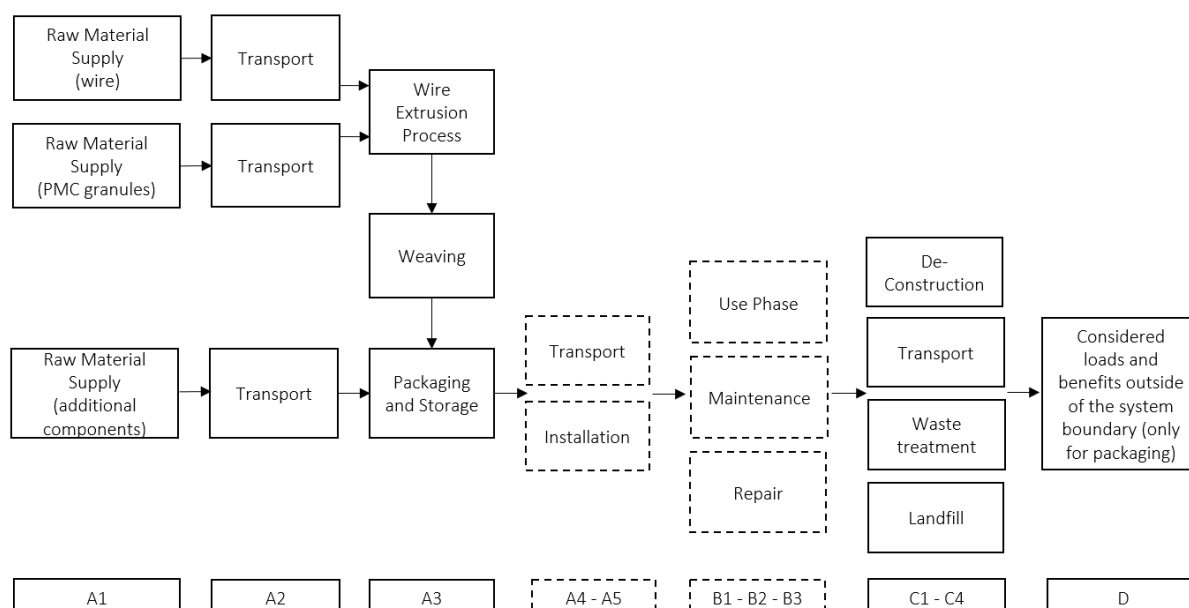
Raw material	Unit	Value
PoliMac	kg	0.055
Steel (galvanized steel)	kg	0.459
Welded mesh	kg	0.420
Tie	kg	0.042
Bracket	kg	0.042
Geotextile	kg	0.010

The reference CPC code is 412 “Products of iron or steel”.

2.7 Manufacturing

The manufacturing is managed in Senica plant (Slovakia) by Maccaferri Manufacturing Europe s.r.o., in Shijak plant (Albania) by Maccaferri Balkans Sh.p.k., both subsidiaries of Officine Maccaferri S.p.A.

The production process includes the weaving of the double twist wire mesh, starting from steel wire, onto which the PoliMac coating can be applied at the plant through an extrusion process of the polymer.



2.8 Other Information

Further technical characteristics and information of the TERRAMESH are detailed and available on the Maccaferri website (<https://www.maccaferri.com/>).

According to Construction Product Regulation (EU) 305/2011 the essential technical characteristics, as per Harmonized Documents EAD 200026, are reported in the Declaration of Performances (DOP).

3. LCA: Calculation rules

3.1 Declared unit

In accordance with the PCR B, 1 kg of TERRAMESH PoliMac coated double twist wire meshes is chosen as the declared unit.

Product	Unit weight (kg)
GREEN TERRAMESH PMC GL 8122 3X3X0.70	1

3.2 Scope of declaration and system boundaries

This a cradle to gate with modules C1-C4 and module D. More precisely, the following processes were accounted for each module:

A1 - Production of raw materials used in the products, as well as the production of energy carriers used in the production process.

A2 - Transport of raw materials to the manufacturing site and internal handling

A3 - Manufacturing of the Officine Maccaferri TERRAMESH which includes the manufacturing steps reported in section 2.7 as well as the production of the distribution packaging and of the ancillary material. In addition, the treatment of waste generated from the distribution packaging are accounted for.

C1 - Disassembly of the packaging was considered to be insignificant and equal to zero.

C2 - Transport from collection point to waste processing and disposal site.

C3 - Shredding and sorting of fractions for recycling.

C4 - Landfill of material fractions not recycled.

D - Benefit and load beyond the product system.

Description of the system boundary																
Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from manufacturer to place of use	Construction-installation process	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	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

X=Module declared | MND=Module not declared

3.3 Geographical reference area

All process-specific data was collected for the operating year 2022-2023. Geographical reference area is global.

3.4 Cut-off Criteria

The cut-off applied are related to the packaging of chemicals products and lubricating oil used in the production process.

3.5 Allocation

A mass allocation based on the weight of the production volumes has been applied.

3.6 Data collection and reference time period

Specific data were collected at Senica plant (Slovakia) and at Shijak plant (Albania) considering an annual average referred to 2022-2023, whereas the most updated selected generic datasets available in the LCI databases were used for the other modules. Thus, in line with PCR A requirements, manufacturer-specific data is not older than 5 years and generic data is not older than 10 years.

3.7 Estimates and assumptions

The main assumptions are related to distances of inbound and background transportations. It was also assumed that liquid and gas auxiliaries are unpacked and supplied in tanker trucks.

3.8 Comparability

In principle, a comparison or assessment of the environmental impacts of different products is only possible if they have been prepared in accordance with EN 15804. For the evaluation of the comparability, the following aspects have to be considered in particular: PCR used, functional or declared unit, geographical reference, definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs and general program instructions of different EPDs programs may differ. A comparability needs to be evaluated. For further guidance see EN 15804+A2 (5.3 Comparability of EPD for construction products) and ISO 14025 (6.7.2 Requirements for comparability).

4. LCA: Scenarios and additional technical information

As these products are used as structural components for retaining walls, channel linings, embankment protection, hydraulic control structures, erosion protection, drapery systems that control and prevent rock fall and the flow of loose debris, soil nailing systems and earth retaining structures: they are therefore intended to be embedded in a permanent manner in the engineering work in which they are used. For this reason, an end of life equal to zero was assumed.

Regarding the end of life of packaging components, the following scenarios were applied:

- The end-of-life plastic component was, conservatively, incinerated.
- The end of life of the wooden pallet was taken from the PEF Guidance.
- The end-of-life steel component was recycled.

Processes	Unit (expressed per FU or DU of components, products or materials and by type of material)	GREEN TERRAMESH PMC GL 8122 3X3X0.70
Collection process specified by type	Kg collected separately	Polymer: 5.14E-04 kg
		Wood: 3.29E-03 kg
		Steel: 6.17E-04 kg
Recovery system specified by type	Kg for reuse	Wood: 9.87E-04 kg
	Kg for recycling	Steel: 6.17E-04 kg
	Kg for energy recovery	Wood: 1.04E-03 kg Polymer: 5.14E-04 kg
Disposal specified by type	Kg product or material for final deposition	Landfill (Wood): 1.23E-03 kg

5. LCA: Results

The following tables show the results of the impact assessment indicators, resource use, waste and other output streams. The results presented here refer to the declared average product.

LCA results - Indicators describing environmental impacts based on the impact assessment (LCIA): 1 kg GREEN TERRAMESH PMC GL 8122 3X3X0.70 (EN 15804+A2)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Core environmental impact indicators (EN 15804+A2)							
GWP-total	kg CO2 eqv.	1.43E+00	0.00E+00	3.71E-05	1.68E-03	3.66E-03	-1.22E-03
GWP-f	kg CO2 eqv.	1.43E+00	0.00E+00	3.73E-05	2.85E-05	1.37E-03	-1.22E-03
GWP-b	kg CO2 eqv.	5.86E-03	0.00E+00	-5.51E-07	1.65E-03	2.29E-03	-3.95E-06
GWP-luc	kg CO2 eqv.	1.13E-03	0.00E+00	3.45E-07	6.55E-09	9.11E-08	-1.68E-07
ODP	kg CFC 11 eqv.	1.16E-11	0.00E+00	3.26E-18	1.67E-16	3.94E-16	-6.67E-15
AP	mol H+ eqv.	4.25E-03	0.00E+00	1.96E-07	2.76E-07	6.95E-07	-1.77E-06
EPfr	kg P eqv.	3.94E-06	0.00E+00	1.36E-10	4.72E-11	3.79E-09	-1.55E-09
EPmar	kg N eqv.	1.27E-03	0.00E+00	9.46E-08	7.93E-08	8.58E-07	-4.89E-07
EPter	mol N eqv.	1.37E-02	0.00E+00	1.05E-06	1.14E-06	2.84E-06	-5.25E-06
POCP	kg NMVOC eqv.	4.37E-03	0.00E+00	1.85E-07	2.18E-07	1.47E-06	-1.44E-06
ADP-e	kg Sb-eqv.	1.83E-05	0.00E+00	2.42E-12	1.56E-12	4.47E-12	-7.06E-11
ADP-f	MJ	2.61E+01	0.00E+00	5.06E-04	4.22E-04	1.84E-03	-1.97E-02
WU	m3 world eqv.	1.86E-01	0.00E+00	4.29E-07	1.85E-04	1.32E-04	-9.29E-05
Additional environmental impact indicators (EN 15804+A2)							
PM	disease incidence	5.47E-08	0.00E+00	9.15E-13	1.85E-12	7.07E-12	-1.85E-11
IR	kBq U235 eqv.	2.71E-01	0.00E+00	9.47E-08	3.83E-06	5.04E-06	-2.19E-04
ETP-fw	CTUe	8.36E+00	0.00E+00	3.57E-04	1.74E-04	2.91E-03	-2.72E-03
HTP-c	CTUh	7.37E-10	0.00E+00	7.20E-15	1.79E-14	7.53E-14	-5.89E-13
HTP-nc	CTUh	1.99E-08	0.00E+00	3.18E-13	9.87E-13	9.01E-12	-4.55E-12
SQP	Pt	1.10E+01	0.00E+00	2.11E-04	1.29E-04	2.46E-04	-3.15E-03
<p>ADP-e= Abiotic depletion potential for non-fossil resources ADP-f=Abiotic depletion for fossil resources potential AP= Acidification potential, Accumulated Exceedance EPfr= Eutrophication potential, fraction of nutrients reaching freshwater end compartment EPmar= Eutrophication potential, fraction of nutrients reaching marine end compartment EPter= Eutrophication potential, Accumulated Exceedance GWP-b=Global Warming Potential biogenic GWP-f=Global Warming Potential fossil fuels GWP-luc=Global Warming Potential land use and land use change GWP-total=Global Warming Potential total ODP=Depletion potential of the stratospheric ozone layer POCP=Formation potential of tropospheric ozone WU=Water (user) deprivation potential, deprivation- weighted water consumption ETP-fw=Potential Comparative Toxic Unit for ecosystems HTP-c=Potential Toxic Unit for Humans toxicity, cancer HTP-nc= Potential Toxic Unit for humans, non-cancer IRP=Potential Human exposure efficiency relative to U235, human health PM=Potential incidence of disease due to Particulate Matter emissions SQP=Potential soil quality index</p>							

Disclaimer on ADP-e, ADP-f, WU, ETP-fr, HTP-c, HTP-nc, SQP: The results of these environmental impact indicators must be used with caution, as the uncertainties in these results are high or as there is limited experience with the indicator.

Disclaimer on IR: This impact category mainly addresses the potential effect of low dose ionizing radiation on human health in the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents and occupational exposures, nor does it consider radioactive waste disposal in underground facilities. Potential ionizing radiation from soil, radon, and some building materials is also not measured by this indicator.

LCA results - Indicators describing resource use and environmental information derived from life cycle inventory (LCI): 1 kg GREEN TERRAMESH PMC GL 8122 3X3X0.70 (EN 15804+A2)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	8.04E+00	0.00E+00	3.58E-05	1.05E-04	2.52E-04	-4.75E-03
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	8.04E+00	0.00E+00	3.58E-05	1.05E-04	2.52E-04	-4.75E-03
PENRE	MJ	2.59E+01	0.00E+00	5.08E-04	4.23E-04	1.84E-03	-1.97E-02
PENRM	MJ	2.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	2.61E+01	0.00E+00	5.08E-04	4.23E-04	1.84E-03	-1.97E-02
SM	Kg	3.67E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	M3	8.92E-03	0.00E+00	3.95E-08	4.35E-06	3.17E-06	-4.26E-06
HWD	Kg	2.32E-07	0.00E+00	1.88E-15	9.55E-15	1.11E-13	-9.99E-13
NHWD	Kg	4.76E-02	0.00E+00	7.32E-08	3.31E-05	8.48E-04	-1.25E-05
RWD	Kg	2.22E-03	0.00E+00	6.56E-10	2.39E-08	3.55E-08	-1.31E-06
CRU	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	Kg	2.12E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.17E-04
MER	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.33E-03
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.17E-03

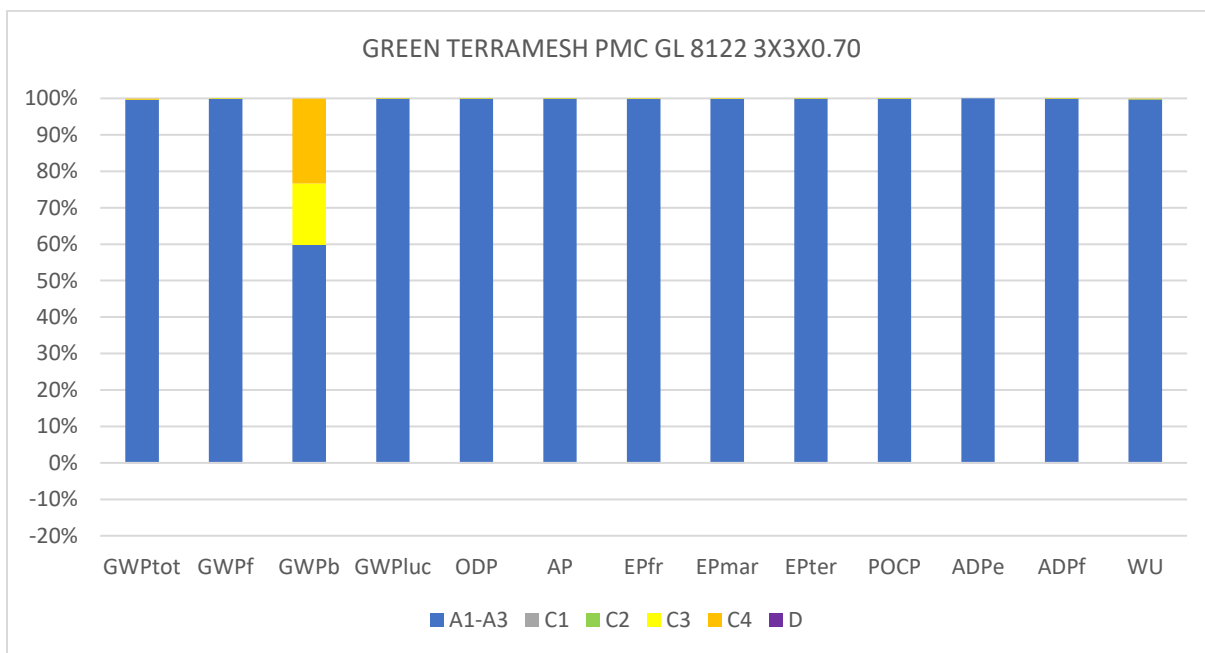
PERE=Use of renewable primary energy excluding renewable primary energy resources used as raw materials | PERM= Use of renewable primary energy resources used as raw materials | PERT=Total use of renewable primary energy resources | PENRE= Use of non-renewable primary energy excluding non-renewable primary 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 resources | SM=Use of secondary material | RSF=Use of renewable secondary fuels | NRSF=Use of non-renewable secondary fuels | FW=Use of fresh water | HWD=Hazardous waste disposed | NHWD=Non-hazardous waste disposed | RWD=Radioactive waste disposed | CRU=Components for re-use | MFR=Materials for recycling | MER=Materials for energy recovery | EET=Exported energy, thermal | EE=Exported energy, electrical

LCA results - information on biogenic carbon content at the factory gate: 1 kg GREEN TERRAMESH PMC GL 8122 3X3X0.70 (EN 15804+A2)

Parameter	Unit	Value
biogenic carbon content in product	kg C	0
biogenic carbon content in accompanying packaging	kg C	1.31E-03
NOTE 1 kg biogenic carbon is equivalent to 44/12 kg CO2		

6. LCA: Interpretation

The analysis of the contribution of each module to the impacts of GREEN TERRAMESH PMC GL 8122 3X3X0.70 is shown in the graph below. It can be observed that the impacts are driven by modules A1-A3, while the contribution of the other modules is about 1% for all impact categories analyzed, except for biogenic GWP, whose impacts are driven by the disposal of wood waste of distribution packaging. The contribution of module D is negligible (<1%) compared to modules A1-A3.



7. References

Ecoinnovazione; 2024. Technical report: LCA study of plastic-coated Double Twist Products for Geoen-gineering works.

ISO 14040:2006, Environmental management - Life cycle assessment - Principles and framework

ISO 14044:2006, Environmental management - Life cycle assessment - Requirements and guidelines

ISO 14025:2010: Environmental labels and declarations — Type III environmental declarations — Principles and procedures EN 13249

EN 15804:2012+A2:2019/AC:2021 Sustainability of construction works — Environmental Product Decla-rations — Core rules for the product category of construction products

PCR A: General Program Category Rules for Construction Products from the EPD program Kiwa-Ecobil-ity Experts, R.0_2021-07-16

PCR B: Kiwa-Ecobility Experts, Berlin, 2020: PCR B – Product Category Rules for steel construction prod-ucts, Requirements on the Environmental Product Declarations for steel construction products; Ver-sion 2020-03-13 (draft)

 <p>kiwa Ecobility Experts -VERIFICATION BODY-</p>	<p>Publisher Kiwa-Ecobility Experts Kiwa GmbH, Ecobility Experts Wattstraße 11-13 13355 Berlin Germany</p>	<p>Mail Web</p>	<p>DE.Ecobility.Experts@kiwa.com https://www.kiwa.com/de/de/themes/ecobility-experts/ecobility-experts/</p>
 <p>kiwa Ecobility Experts -VERIFICATION BODY-</p>	<p>Programme operator Kiwa-Ecobility Experts Kiwa GmbH, Ecobility Experts Wattstraße 11-13 13355 Berlin Germany</p>	<p>Mail Web</p>	<p>DE.Ecobility.Experts@kiwa.com https://www.kiwa.com/de/de/themes/ecobility-experts/ecobility-experts/</p>
 <p>ecoinnovazione spin off ENEA</p>	<p>LCA Practitioner Ecoinnovazione Srl Via della Liberazione 6/C 40128 Bologna (BO) Italy</p>	<p>Tel. Web</p>	<p>+39 328 987 0609 www.ecoinnovazione.it</p>
	<p>Owner of the declaration Officine Maccaferri S.p.A. Via del Faggiolo, 1/12 40132 Bologna (BO) Italy</p>	<p>Tel. Fax. Mail Web</p>	<p>+39 051 6436000 +39 051 6436201 info@maccaferri.com www.maccaferri.com</p>

Kiwa-Ecobility Experts -
established member of

