Environmental Product Declaration (EPD)
According to ISO 14025 and EN 15804+A2:2019

E'GRID® xxxR geogrid - High performance geogrid used for soil reinforcement solutions

Registration number:	EPD-Kiwa-EE-197476-EN
Issue date:	01-07-2025
Valid until:	01-07-2030
Declaration owner:	BOSTD Geosynthetics Qingdao Ltd.
Publisher:	Kiwa-Ecobility Experts
Programme operator:	Kiwa-Ecobility Experts
Status:	verified

1 General information

1.1 PRODUCT

E'GRID® xxxR geogrid - High performance geogrid used for soil reinforcement solutions

1.2 REGISTRATION NUMBER

EPD-Kiwa-EE-197476-EN

1.3 VALIDITY

Issue date: 01-07-2025

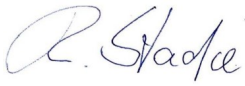
Valid until: 01-07-2030

1.4 PROGRAMME OPERATOR

Kiwa-Ecobility Experts
Wattstraße 11-13
13355 Berlin
DE

Raoul Mancke

(Head of programme operations, Kiwa-Ecobility Experts)



Dr. Ronny Stadie

(Verification body, Kiwa-Ecobility Experts)

1.5 OWNER OF THE DECLARATION

Manufacturer: BOSTD Geosynthetics Qingdao Ltd.

Address: No. 8 Ronghai 1st Road, Qingda Industrial Zone, Chengyang District, 266111 Qingdao, Shandong, CN

E-mail: info@bostd.com

Website: http://www.bostd.com/

Production location: BOSTD Geosynthetics Qingdao Ltd.

Address production location: No. 8, Ronghai 1st Road, Qingda Industrial Zone, Chengyang District, 266111 Qingdao, Shandong, CN

1.6 VERIFICATION OF THE DECLARATION

The independent verification is in accordance with the ISO 14025:2011. The LCA is in compliance with ISO 14040:2006 and ISO 14044:2006. The EN 15804+A2:2019 serves as the core PCR.

☐ Internal ☒ External

Patrick Wortner, PeoplePlanetProfit GmbH & Co. KG.

1.7 STATEMENTS

The owner of this EPD shall be liable for the underlying information and evidence. The programme operator Kiwa-Ecobility Experts shall not be liable with respect to manufacturer data, life cycle assessment data and evidence.

1.8 PRODUCT CATEGORY RULES

PCR A
Kiwa-Ecobility Experts, General Programme Instructions “Product Level” – Annex B1 Environmental Information Programme according to EN 15804 / ISO 21930, SOP EE 1203_R. 2.0 (27.02.2025)

PCR B
Kiwa-Ecobility Experts (Kiwa-EE) - Product Category Rules for Geosynthetic Products (2023-07-21)

1 General information

1.9 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+A2:2019. For the evaluation of the comparability, the following aspects have to be considered in particular: PCR used, functional or declared unit, geographical reference, the 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 EPD program operators may differ. Comparability needs to be evaluated. For further guidance, see EN 15804+A2:2019 and ISO 14025.

1.10 CALCULATION BASIS

LCA method R<THINK: Ecobility Experts | EN15804+A2

LCA software*: Simapro 9.6

Characterization method: R<THINK characterization method (see references for more details)

LCA database profiles: ecoinvent (for version see references)

Version database: v3.19 (20250306)

** Simapro is used for calculating the characterized results of the Environmental profiles within R<THINK.*

1.11 LCA BACKGROUND REPORT

This EPD is generated on the basis of the LCA background report 'E'GRID® xxxR geogrid - High performance geogrid used for soil reinforcement solutions' with the calculation identifier ReTHiNK-97476.

2 Product

2.1 PRODUCT DESCRIPTION

This EPD represents an Average-EPD, applicable when the environmental impacts of the declared products differ by less than 10%. The declared products refer to E'GRID® xxxR uniaxial geogrids which are made from select grades of high-density polyethylene (HDPE) resins. The polymer structure is highly oriented to resist elongation (creep) under sustained tensile load. The products are resistant to installation damage and chemical and biological long-term degradation.

Dimensions

Product	Roll length (m)	Roll width (m)
E'GRID 50R	50	1.3
E'GRID 60R	50	1.3
E'GRID 70R	50	1.3
E'GRID 95R	50	1.3
E'GRID 125R	50	1.3
E'GRID 145R	50	1.3
E'GRID 170R	50	1.3

Note: Other roll sizes are available.

Weight of the product:

Product	Control unit weight (kg/m2)
E'GRID 50R	0.330(-0.040)
E'GRID 60R	0.360(-0.060)
E'GRID 70R	0.420(-0.070)
E'GRID 95R	0.550(-0.080)
E'GRID 125R	0.760(-0.100)
E'GRID 145R	0.950(-0.120)
E'GRID 170R	1.120(-0.140)

Base materials / Ancillary materials:

E'GRID® xxxR geogrids are manufactured from high-density polyethylene (HDPE). HDPE is a thermo-plastic polymer known for its high strength-to-density ratio. It belongs to the group of polyolefins and is partially crystalline and nonpolar. It is produced from the monomer ethylene. HDPE has little branching, giving it strong intermolecular forces and high tensile strength.

Raw material	Unit	Value
Polyethylene granules/pellets (HDPE)	%	94.5
Masterbatch granules/pellets	%	5.5

Note: The percentage value is based on the ratio of High density polyethylene to Masterbatch, which is 100:5.8.

2.2 APPLICATION (INTENDED USE OF THE PRODUCT)

E'GRID® xxxR geogrids are used for the reinforcement of soils in the construction of structures such as retaining walls, bridge abutments, steep slopes, slip repairs, cellular foundation, or basal mattresses.

2.3 REFERENCE SERVICE LIFE

RSL PRODUCT

The RSL of the soil reinforcement geogrid depends on the service life of the reinforced retaining wall, slope or bridge abutment structure. The RSL of the product is up to 120 years on the basis of durability assessment in accordance with EN 13249-13257, EN 13265 and EN 13431.

USED RSL (YR) IN THIS LCA CALCULATION:

120

RSL PARTS

No deviation regarding the RSL for one of the raw materials/components is applicable.

2.4 TECHNICAL DATA

The technical specifications for each specific product are listed below.

2 Product

Name	Unit	Value/Tolerance			
		E'GRID 50R	E'GRID 60R	E'GRID 70R	E'GRID 95R
Weight of product (TR 041 B.1)	g/m²	330	360	420	550
Tensile Strength-MD (EN ISO 10319)	kN/m	53.1/-3.1	63.9/-3.9	74.3/-4.3	100.4/-4.7
Elongation at Maximum Load-MD (EN ISO 10319)	%	11.0/±3.0	11.0/±3.0	11.0/±3.0	11.0/±3.0
Static Puncture (CBR test) (EN ISO 12236)	N/m	NPD*			
Dynamic Perforation Resistance (cone drop test) (EN ISO 13433)	mm	NPD			
Tensile creep (EN ISO 13431) Long term creep rupture strength at a design life of 120 years and 10°C in soil temperature	kN/m	25.1	30.1	35.1	48.0
Tensile creep (EN ISO 13431) Long term creep rupture strength at a design life of 120 years and 20°C in soil temperature	kN/m	22.4	26.9	31.4	43.0
Dangerous substances (National Regulations in force in EU Member States)	-	Less than required by national regulations in EU Member States			
Specific dimension of the finished rolls (width x length)	m	1.3 or 1.0 x 50			

Name	Unit	Value/Tolerance		
		E'GRID 125R	E'GRID 145R	E'GRID 170R
Weight of product (TR 041 B.1)	g/m²	760	950	1120
Tensile Strength-MD (EN ISO 10319)	kN/m	132.3/-5.1	153.0/-6.0	177.1/-7.1
Elongation at Maximum Load-MD (EN ISO 10319)	%	11.0/±3.0	11.0/±3.0	11.0/±3.0
Static Puncture (CBR test) (EN ISO 12236)	N/m	NPD*		
Dynamic Perforation Resistance (cone drop test) (EN ISO 13433)	mm	NPD		
Tensile creep (EN ISO 13431) Long term creep rupture strength at a design life of 120 years and 10°C in soil temperature	kN/m	63.8	73.7	85.2
Tensile creep (EN ISO 13431) Long term creep rupture strength at a design life of 120 years and 20°C in soil temperature	kN/m	57.1	66.0	76.3
Dangerous substances (National Regulations in force in EU Member States)	-	Less than required by national regulations in EU Member States		
Specific dimension of the finished rolls (width x length)	m	1.3 or 1.0 x 50		

*NPD: No performance determined

2 Product

2.5 SUBSTANCES OF VERY HIGH CONCERN

The product does not contain substances included in the “Candidate list of substances of very high concern for authorisation” (SVHC).

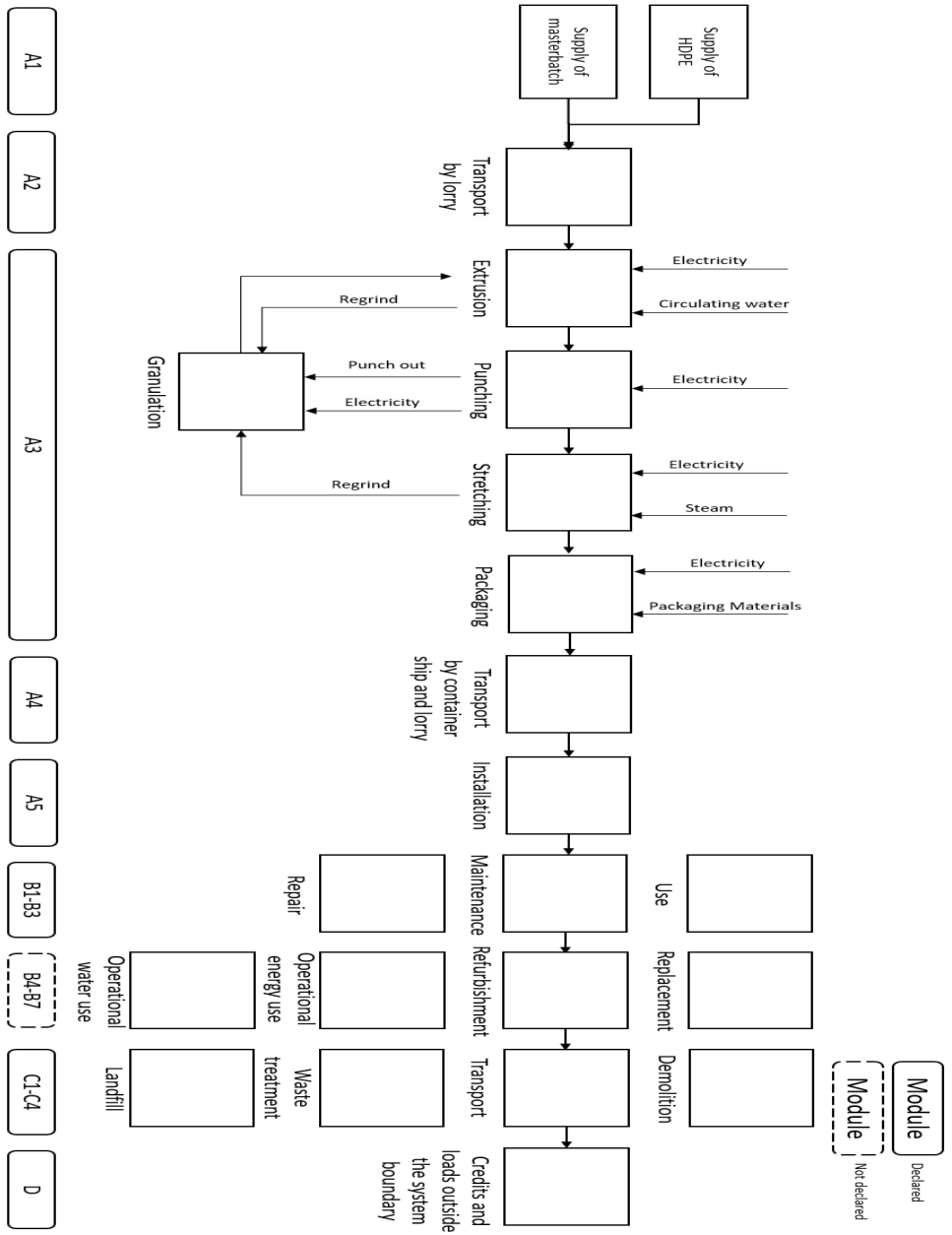
2.6 DESCRIPTION PRODUCTION PROCESS

The manufacturing is located at BOSTD Geosynthetics Qingdao Ltd., No. 8, Ronghai 1st Road, Qingda Industrial Zone, Chengyang District, Qingdao, Shandong, China.

The geogrids are made from HDPE granulate. In the first step granulate is melted and then extruded. The extruded sheet passes the punching process. Depending on the specific product the punches differ in size. The punched sheet is then stretched. The result is the specific uniaxial structure of each geogrid. The products are rolled and then packaged. The products are banded with PP banding tape and packing strap.

2.7 CONSTRUCTION DESCRIPTION

When installing soil reinforcement geogrid, it is simply unrolled by hand. Apart from rolling out, no further installation measures are necessary, which would otherwise be required during road construction. A reject or unused portion of 3% of the geogrid is assumed during the installation process.



3 Calculation rules

3.1 DECLARED UNIT

kilogram

According to the PCR, square meter (m^2) is specified as the declared unit for geogrids. However, in this EPD, 1 kg is used as the declared unit due to the significant variation in mass per square meter among different product variants, driven by differences in mesh size and material composition. Using m^2 as the declared unit could therefore lead to misleading comparisons across products. By utilizing 1 kg as the declared unit, the EPD enables a more functionally consistent and fairer comparison between product variants. For transparency and alignment with the PCR, a conversion to kg per m^2 is provided.

Reference unit: kilogram (kg)

3.2 CONVERSION FACTORS

Description	Value	Unit
Reference unit	1	kg
Conversion factor to 1 kg	1.000000	kg

3.3 SCOPE OF DECLARATION AND SYSTEM BOUNDARIES

This is a Cradle to gate with options, modules C1-C4 and module D EPD. The life cycle stages included are as shown below:

(X = module included, ND = module not declared)

A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	ND	ND	ND	ND	X	X	X	X	X

The modules of the EN 15804 contain the following:

Module A1 = Raw material supply	Module B5 = Refurbishment
Module A2 = Transport	Module B6 = Operational energy use
Module A3 = Manufacturing	Module B7 = Operational water use
Module A4 = Transport	Module C1 = De-construction / Demolition
Module A5 = Construction - Installation process	Module C2 = Transport
Module B1 = Use	Module C3 = Waste Processing
Module B2 = Maintenance	Module C4 = Disposal
Module B3 = Repair	Module D = Benefits and loads beyond the product system boundaries
Module B4 = Replacement	

3.4 REPRESENTATIVENESS

This EPD is representative for E'GRID® xxxR geogrid - High performance geogrid used for soil reinforcement solutions, a product of BOSTD Geosynthetics Qingdao Ltd..

3.5 CUT-OFF CRITERIA

Product stage (A1-A3)

All input flows (e.g. raw materials, transportation, energy use, packaging, etc.) and output flows (e.g. production waste) are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

3 Calculation rules

Construction process stage (A4-A5)

All input flows (e.g. transportation to the construction site, additional raw material use for construction, installation energy (use)of energy use for assembly , etc.) and output flows (e.g. construction waste, packaging waste, etc.) are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

Use stage (B1-B3)

All (known) input flows (e.g. raw materials, transportation, energy use, packaging, etc.) and output flows (e.g. emissions to soil, air and water, construction waste, packaging waste, end-of-life waste, etc.) related to the building fabric are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

End of life stage (C1-C4)

All input flows (e.g. energy use for demolition or disassembly, transport to waste processing, etc.) and output flows (e.g. end-of-life waste processing of the product, etc.) are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

Benefits and loads beyond the system boundary (Module D)

All benefits and loads beyond the system boundary resulting from reusable products, recyclable materials and/or useful energy carriers leaving the product system are considered in this LCA.

The following processes are excluded:

- Manufacturing of equipment used in production, buildings or any other capital asset
- Energy and water consumption associated with company management and sales
- Transportation of personnel to the plant
- The transportation of personnel within the plant
- Research and development activities
- Long-term emissions

3.6 ALLOCATION

There are totally 14 production lines, including 5 geogrid lines, 2 geonet lines, 2 geocell extruded lines, 4 geocell welding lines and 1 BOPP line. Energy consumption is determined individually for each production line, each of which is equipped with an indepedent electricity meter. Electricity use is reported in terms of kWh per kilogram of product manufactured.

Steam consumption is calculated using a monthly steam consumption coefficient (A), expressed in tonnes of steam per tonne of product (t/t). This coefficient is derived by dividing the total steam consumed during the month by the total weight of steam-using products manufactured during the same period. For the products included in the EPD, steam consumption is estimated by multiplying each product's weight by the coefficient A.

No allocation is performed with regard to the use of secondary materials or fuels, co-products, plant-specific production processes or multi-input systems.

The polluter pays principle applies as the general allocation principle. Double counting is avoided.

3.7 DATA COLLECTION & REFERENCE PERIOD

All process-specific data are collected for the reference year 2024 (01.01.2024 - 31.12.2024).

3.8 ESTIMATES AND ASSUMPTIONS

For all raw materials used (raw materials, operating materials, packaging), the transportation distance is recorded. A payload factor of 50% is used for all truck transports (suppliers, disposal transports and internal transports), which corresponds to a full delivery and empty return journey.

Excluded are the manufacturing of capital equipment, construction undertakings, and infrastructure development, along with the maintenance and operation of capital equipment. Additionally, activities related to personnel, as well as energy and water consumption associated with company management and sales, are also excluded.

For module A4 (Transportation from the production gate to the construction site), it is estimated that the international transport includes 19000 km by ship and 1000 km by lorry (85% payload).

For module C1 (Demolition), the process and amount of the generic dataset 'Polyester weefsel' (EN: polyester fabric) from chapter 22.46 Grondwapening en grondscheiding (EN:

3 Calculation rules

22.46 Soil reinforcement and soil separation) of the programme DuboCalc (Database version NMD 1.10) is used. In this generic dataset, 0.0013 hrs work of the process “Hydraulic excavator (average)” per m² of geotextile are assumed for demolition, which refers to 0.0019 hrs work per kg of geotextile.

For the End-of-life stage, the NMD szenario PE/PP soil reinforcement (geotextile and geogrid) is chosen. According to this scenario, 25% of the geogrid remains in the subground, while 70% is incinerated and 5% is recycled.

The scenarios included are currently in use and are representative for one of the most likely scenario alternatives.

3.9 DATA QUALITY

The data are based on the annual average. Generic datasets from the ecoinvent database V3.9.1 are used for the secondary data, which refers to reference year 2022. This database is regularly maintained and meets the requirements of EN 15804+A2 (background data not older than 10 years). All consistent datasets contained in the ecoinvent database are documented and can be viewed in the online ecoinvent documentation. In the operating data survey all relevant process-specific data could be collected. The quality of the data can be thus considered as good.

The primary data are collected and provided by **BOSTD Geosynthetics Qingdao LTD.** and the datasets selected in the LCA for raw materials refer to refer to **Rest-of-the-World** as the geographical reference, repesenting the average global production.

Aspect	Data quality assessment
Time-related coverage	The primary data represent the current situation of the date of study (2024) or as close as possible (<5 years). The secondary data are updated within last 10 years.
Geographical coverage	Most of the datasets selected for the LCA refer to Rest-of-the-World as the geographical reference, repesenting the average global production.
Technology coverage	The data are representative of the technology used in production processes.
Completeness	Specific data are benchmarked with literature data. Simple validation checks (e.g., mass or energy balances) are performed.
Representativeness	The data fulfill the defined time-related, geographical, and technological scope.
Precision	The data used are as representative as possible. The data are derived from credible sources, and references are provided.
Reproducibility	Information about the method and data (reference source) are provided.
Sources of the data	The data are derived from credible sources, and references are provided.

3.10 POWER MIX

In this EPD, the national power mix of China is considered in the calculation of the environmental impacts, refering to the local based approach. No CO2 cerificates are considered. The GWP-total of the electricity is calculated as 0.97 kg CO2 eqv./kWh.

4 Scenarios and additional technical information

4.1 TRANSPORT TO CONSTRUCTION SITE (A4)

For the transport from production place to assembly/user, the following scenario is assumed for module A4 of this EPD.

	Value and unit
Vehicle type used for transport	International transport (19000 km by ship and 1000 km by lorry (85% payload))
Fuel type and consumption of vehicle	
Distance	19000 km by ship and 1000 km by lorry (85% payload)
Capacity utilisation (including empty returns)	
Bulk density of transported products	
Volume capacity utilisation factor	

4.2 ASSEMBLY (A5)

The following information describes the scenarios for flows entering the system and flows leaving the system at module A5.

FLOWS ENTERING THE SYSTEM

There are no significant environment impacts as a result of materials or energy used in the construction stage (A5).

FLOWS LEAVING THE SYSTEM

The following output flows leaving the system at module A5 are assumed.

Description	Value	Unit
Output materials as result of loss during construction	3	%
Output materials as result of waste processing of materials used for installation/assembly at the building site	0.000	kg
Output materials as result of waste processing of used packaging	0.001	kg

4.3 USE STAGE (B1)

No significant environment impact in the use stage modules, because there is no (significant) emission to air, soil or water.

4.4 MAINTENANCE (B2)

For maintenance no input or output flows are modelled.

4 Scenarios and additional technical information

4.5 REPAIR (B3)

Repairs are not applicable within the functional unit and to achieve the reference service life.

4.6 DE-CONSTRUCTION, DEMOLITION (C1)

The following information describes the scenario for demolition at end of life.

Description	Amount	Unit
(ei3.9.1) Hydraulic excavator (average) [NMD generic]	0.002	hr

4.7 TRANSPORT END-OF-LIFE (C2)

The following distances and transport conveyance are assumed for transportation during end of life for the different types of waste processing.

Waste Scenario	Transport conveyance	Not removed (stays in work) [km]	Landfill [km]	Incineration [km]	Recycling [km]	Re-use [km]
(ei3.9.1) PE/PP soil reinforcement (geotextile and geogrid 54)	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0

The transport conveyance(s) used in the scenario(s) for transport during end of life has the following characteristics.

	Value and unit
Vehicle type used for transport	(ei3.9.1) Lorry (Truck), unspecified (default) | market group for (GLO)
Fuel type and consumption of vehicle	not available
Capacity utilisation (including empty returns)	50 % (loaded up and return empty)
Bulk density of transported products	inapplicable
Volume capacity utilisation factor	1

4 Scenarios and additional technical information

4.8 END OF LIFE (C3, C4)

The scenario(s) assumed for end of life of the product are given in the following tables.
First the assumed percentages per type of waste processing are displayed, followed by the assumed amounts.

Waste Scenario	Region	Not removed (stays in work) [%]	Landfill [%]	Incineration [%]	Recycling [%]	Re-use [%]
(ei3.9.1) PE/PP soil reinforcement (geotextile and geogrid 54)	NL	25	0	70	5	0

Waste Scenario	Not removed (stays in work) [kg]	Landfill [kg]	Incineration [kg]	Recycling [kg]	Re-use [kg]
(ei3.9.1) PE/PP soil reinforcement (geotextile and geogrid 54)	0.250	0.000	0.700	0.050	0.000
Total	**0.250**	**0.000**	**0.700**	**0.050**	**0.000**

4.9 BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY (D)

The presented Benefits and loads beyond the system boundary in this EPD are based on the following calculated Net output flows in kilograms and Energy recovery displayed in MJ Lower Heating Value.

Waste Scenario	Net output flow [kg]	Energy recovery [MJ]
(ei3.9.1) PE/PP soil reinforcement (geotextile and geogrid 54)	0.050	16.082
Total	**0.050**	**16.082**

5 Results

For the impact assessment long-term emissions (>100 years) are not considered. The results of the impact assessment are only relative statements that do not make any statements about end-points of the impact categories, exceedance of threshold values, safety margins or risks. The following tables show the results of the indicators of the impact assessment, of the use of resources as well as of waste and other output flows.

5.1 ENVIRONMENTAL IMPACT INDICATORS PER KILOGRAM

CORE ENVIRONMENTAL IMPACT INDICATORS EN 15804+A2

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	2.33E+0	4.51E-2	1.25E+0	3.63E+0	3.02E-1	1.79E-1	0.00E+0	0.00E+0	0.00E+0	1.08E-1	1.60E-2	1.88E+0	3.19E-2	-8.17E-1
GWP-f	kg CO_2 eq.	2.32E+0	4.50E-2	1.25E+0	3.62E+0	3.02E-1	1.78E-1	0.00E+0	0.00E+0	0.00E+0	1.08E-1	1.60E-2	1.88E+0	3.19E-2	-8.17E-1
GWP-b	kg CO_2 eq.	3.52E-3	1.07E-5	-2.65E-4	3.27E-3	1.43E-4	1.11E-4	0.00E+0	0.00E+0	0.00E+0	1.50E-5	5.20E-6	2.58E-4	1.76E-5	-2.17E-4
GWP-luluc	kg CO_2 eq.	1.14E-3	7.46E-5	4.04E-4	1.62E-3	4.26E-4	6.89E-5	0.00E+0	0.00E+0	0.00E+0	1.21E-5	5.69E-5	1.84E-4	2.27E-6	-8.04E-5
ODP	kg CFC 11 eq.	1.47E-8	7.19E-10	7.71E-9	2.32E-8	4.40E-8	3.63E-9	0.00E+0	0.00E+0	0.00E+0	1.72E-9	2.84E-10	5.09E-8	6.92E-11	-3.87E-8
AP	mol H+ eq.	9.59E-3	9.84E-4	5.93E-3	1.65E-2	5.91E-3	7.01E-4	0.00E+0	0.00E+0	0.00E+0	1.00E-3	7.64E-5	8.08E-4	2.15E-5	-8.21E-4
EP-fw	kg P eq.	4.58E-5	2.63E-7	2.39E-5	7.00E-5	4.50E-6	2.41E-6	0.00E+0	0.00E+0	0.00E+0	3.90E-7	1.59E-7	5.43E-6	4.53E-8	-2.73E-6
EP-m	kg N eq.	1.79E-3	2.54E-4	1.09E-3	3.14E-3	1.24E-3	1.40E-4	0.00E+0	0.00E+0	0.00E+0	4.63E-4	2.90E-5	2.29E-4	1.41E-5	-2.40E-4
EP-T	mol N eq.	1.98E-2	2.81E-3	1.20E-2	3.46E-2	1.38E-2	1.54E-3	0.00E+0	0.00E+0	0.00E+0	5.04E-3	3.10E-4	2.55E-3	8.46E-5	-2.64E-3
POCP	kg NMVOC eq.	8.74E-3	7.78E-4	3.62E-3	1.31E-2	3.77E-3	5.35E-4	0.00E+0	0.00E+0	0.00E+0	1.49E-3	1.06E-4	7.38E-4	3.65E-5	-1.42E-3
ADP-mm	kg Sb-eq.	9.18E-6	7.44E-8	3.28E-6	1.25E-5	3.22E-7	4.16E-7	0.00E+0	0.00E+0	0.00E+0	3.77E-8	5.00E-8	8.92E-7	6.24E-9	-6.18E-7
ADP-f	MJ	7.40E+1	5.81E-1	1.34E+1	8.80E+1	4.35E+0	2.83E+0	0.00E+0	0.00E+0	0.00E+0	1.41E+0	2.29E-1	1.45E+0	6.42E-2	-1.48E+1
WDP	m3 world eq.	4.02E-1	1.96E-3	1.06E-1	5.10E-1	2.65E-2	1.90E-2	0.00E+0	0.00E+0	0.00E+0	3.04E-3	1.25E-3	8.67E-2	2.70E-3	-1.37E-1

GWP-total=Global Warming Potential total (GWP-total) | **GWP-f**=Global Warming Potential fossil fuels (GWP-fossil) | **GWP-b**=Global Warming Potential biogenic (GWP-biogenic) | **GWP-luluc**=Global Warming Potential land use and land use change (GWP-luluc) | **ODP**=Depletion potential of the stratosperic ozon layer (ODP) | **AP**=Acidification potential, Accumulated Exceedance (AP) | **EP-fw**=Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater) | **EP-m**=Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine) | **EP-T**=Eutrophication potential, Accumulated Exceedance (EP-terrestrial) | **POCP**=Formation potential of tropospheric ozone (POCP) | **ADP-mm**=Abiotic depletion potential for non fossil resources (ADP mm) | **ADP-f**=Abiotic depletion for fossil resources potential (ADP fossil) | **WDP**=Water (user) deprication potential, deprivation-weighted water consumption (WDP)

5 Results

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS EN 15804+A2

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D
PM	disease incidence	1.00E-7	2.31E-9	7.83E-8	1.81E-7	1.53E-8	6.19E-9	0.00E+0	0.00E+0	0.00E+0	2.79E-8	1.58E-9	7.49E-9	4.53E-10	-5.96E-9
IR	kBq U235 eq.	2.41E-2	1.58E-4	1.24E-2	3.67E-2	1.44E-2	1.68E-3	0.00E+0	0.00E+0	0.00E+0	2.89E-4	8.92E-5	4.67E-3	3.54E-5	-3.15E-3
ETP-fw	CTUe	6.86E+0	3.37E-1	3.69E+0	1.09E+1	1.75E+0	1.07E+0	0.00E+0	0.00E+0	0.00E+0	6.75E-1	1.69E-1	2.16E+1	4.80E-2	-4.22E-1
HTP-c	CTUh	5.92E-10	2.08E-11	3.00E-10	9.13E-10	1.16E-10	4.22E-11	0.00E+0	0.00E+0	0.00E+0	3.30E-11	8.45E-12	3.50E-10	1.76E-12	-1.08E-10
HTP-nc	CTUh	1.45E-8	2.73E-10	1.17E-8	2.65E-8	1.95E-9	9.74E-10	0.00E+0	0.00E+0	0.00E+0	2.30E-10	1.84E-10	3.61E-9	6.90E-11	-1.25E-9
SQP	Pt	3.22E+0	1.89E-1	2.10E+0	5.51E+0	1.47E+0	2.35E-1	0.00E+0	0.00E+0	0.00E+0	9.52E-2	1.80E-1	4.90E-1	1.45E-1	-2.12E-1

PM=Potential incidence of disease due to PM emissions (PM) | **IR**=Potential Human exposure efficiency relative to U235 (IRP) | **ETP-fw**=Potential Comparative Toxic Unit for ecosystems (ETP-fw) | **HTP-c**=Potential Comparative Toxic Unit for humans (HTP-c) | **HTP-nc**=Potential Comparative Toxic Unit for humans (HTP-nc) | **SQP**=Potential soil quality idex (SQP)

CLASSIFICATION OF DISCLAIMERS TO THE DECLARATION OF CORE AND ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

ILCD classification	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, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching 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

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ILCD classification	Indicator	Disclaimer
	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.

5.2 INDICATORS DESCRIBING RESOURCE USE AND ENVIRONMENTAL INFORMATION BASED ON LIFE CYCLE INVENTORY (LCI)

PARAMETERS DESCRIBING RESOURCE USE

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D
PERE	MJ	1.03E+0	5.55E-3	9.68E-1	2.00E+0	8.87E-2	6.79E-2	0.00E+0	0.00E+0	0.00E+0	8.04E-3	3.23E-3	1.59E-1	1.19E-3	-1.04E-1
PERM	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	MJ	1.03E+0	5.55E-3	9.68E-1	2.00E+0	8.87E-2	6.79E-2	0.00E+0	0.00E+0	0.00E+0	8.04E-3	3.23E-3	1.59E-1	1.19E-3	-1.04E-1
PENRE	MJ	5.11E+1	5.81E-1	1.34E+1	6.50E+1	4.35E+0	2.14E+0	0.00E+0	0.00E+0	0.00E+0	1.41E+0	2.29E-1	1.45E+0	6.42E-2	-1.26E+1
PENRM	MJ	2.30E+1	0.00E+0	4.77E-2	2.30E+1	0.00E+0	6.91E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-2.19E+0
PENRT	MJ	7.40E+1	5.81E-1	1.34E+1	8.80E+1	4.35E+0	2.83E+0	0.00E+0	0.00E+0	0.00E+0	1.41E+0	2.29E-1	1.45E+0	6.42E-2	-1.48E+1
SM	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	m^3	7.58E-3	7.97E-5	2.67E-3	1.03E-2	9.36E-4	4.23E-4	0.00E+0	0.00E+0	0.00E+0	1.11E-4	5.52E-5	2.58E-3	6.59E-5	-1.95E-3

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**=Net use of fresh water

5 Results

OTHER ENVIRONMENTAL INFORMATION DESCRIBING WASTE CATEGORIES

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D
HWD	Kg	3.97E-5	3.17E-6	2.14E-4	2.57E-4	9.81E-6	8.21E-6	0.00E+0	0.00E+0	0.00E+0	9.51E-6	1.46E-6	5.12E-6	3.17E-7	-4.87E-5
NHWD	Kg	1.63E-1	1.45E-2	7.40E-2	2.51E-1	8.76E-2	4.16E-2	0.00E+0	0.00E+0	0.00E+0	2.02E-3	1.51E-2	7.37E-1	2.51E-1	-1.58E-2
RWD	Kg	1.62E-5	8.80E-8	9.12E-6	2.54E-5	2.05E-5	1.48E-6	0.00E+0	0.00E+0	0.00E+0	1.55E-7	5.23E-8	3.29E-6	2.16E-8	-2.41E-6

HWD=Hazardous waste disposed | **NHWD**=Non-hazardous waste disposed | **RWD**=Radioactive waste disposed

ENVIRONMENTAL INFORMATION DESCRIBING OUTPUT FLOWS

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D
CRU	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.56E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.00E-2	0.00E+0	0.00E+0
MER	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	MJ	0.00E+0	0.00E+0	1.98E-3	1.98E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.15E+0
EEE	MJ	0.00E+0	0.00E+0	1.15E-3	1.15E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.99E+0

CRU=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EET**=Exported Energy, Thermic | **EEE**=Exported Energy, Electric

5 Results

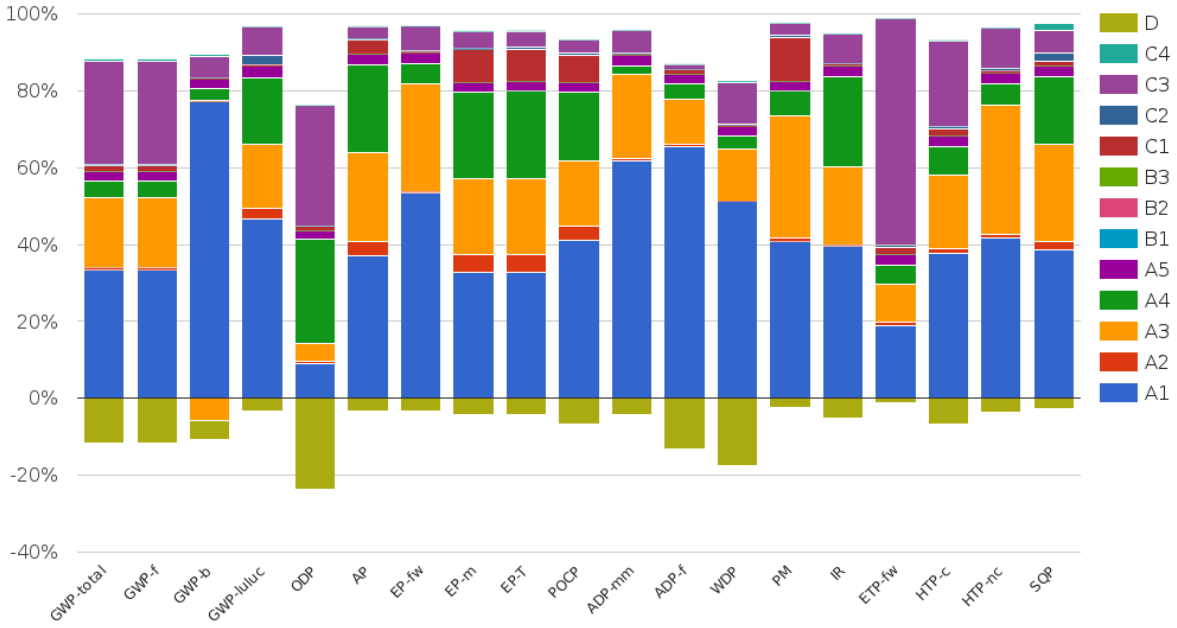
5.3 INFORMATION ON BIOGENIC CARBON CONTENT PER KILOGRAM

BIOGENIC CARBON CONTENT

The following Information describes the biogenic carbon content in (the main parts of) the product at the factory gate per kilogram:

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

6 Interpretation of results



As an Average-EPD, the environmental impacts of the declared products differ by less than 10%. In most of the impact categories, the environmental impact of E'GRID® xxxR geogrid is predominantly determined by the extraction and processing of raw materials (Module A1). Within the impact category of global warming potential (GWP-total), Module A1 represents the largest contribution at 35.5%, followed by waste treatment at end-of-life (Module C3) with 28.6% and manufacturing processes (Module A3) with 22.8%. Among the raw materials, high-density polyethylene granules are the primary contributor to environmental impacts, accounting for 94.5% of the results of GWP-total.

7 References

ISO 14040
ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

ISO 14044
ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14044:2006

ISO 14025
ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804+A2
EN 15804:2012+A2:2019/AC:2021, Sustainability of Buildings - Environmental Product Declarations - Framework Development Rules by Product Category

Kiwa-EE GPI R.2.0
Kiwa-Ecobility Experts, General Programme Instructions “Product Level”, SOP EE 1203_R. 2.0 (27.02.2025)

PCR A
Kiwa-Ecobility Experts, General Programme Instructions “Product Level” – Annex B1 Environmental Information Programme according to EN 15804 / ISO 21930, SOP EE 1203_R. 2.0 (27.02.2025)

PCR B
Kiwa-Ecobility Experts (Kiwa-EE) - Product Category Rules for Geosynthetic Products (2023-07-21)

TR 041
TR 041, Non-reinforcing hexagonal geogrid for the stabilization of unbound granular layers by way of interlock with the aggregate, European Organisation for Technical Assessment (2017)

EN ISO 10319
EN ISO 10319:2015-09, Geosynthetics - Wide-width tensile test (ISO 10319:2015)

EN ISO 12236
EN ISO 12236:2006-11, Geosynthetics - Static puncture test (CBR test) (ISO 12236:2006)

EN ISO 13433
EN ISO 13433:2006-10, Geosynthetics - Dynamic perforation test (cone drop test) (ISO 13433:2006)

EN ISO 13431
EN ISO 13431:2024-11, Geotextiles and geotextile-related products - Determination of tensile creep and creep rupture behaviour (ISO 13431:2024)

7 References

Ecoinvent
Ecoinvent database version 3.9.1, ecoinvent Association (https://ecoinvent.org/) (2022)

R<THINK characterization method
ecoinvent 3.9.1: EN 15804+A1 indicators (CML-IA Baseline v3.09), EN 15804+A2 indicators (EF 3.1)

8 Contact information

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Kiwa-Ecobility Experts is established member of the ECO PLATFORM