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THRACE NG
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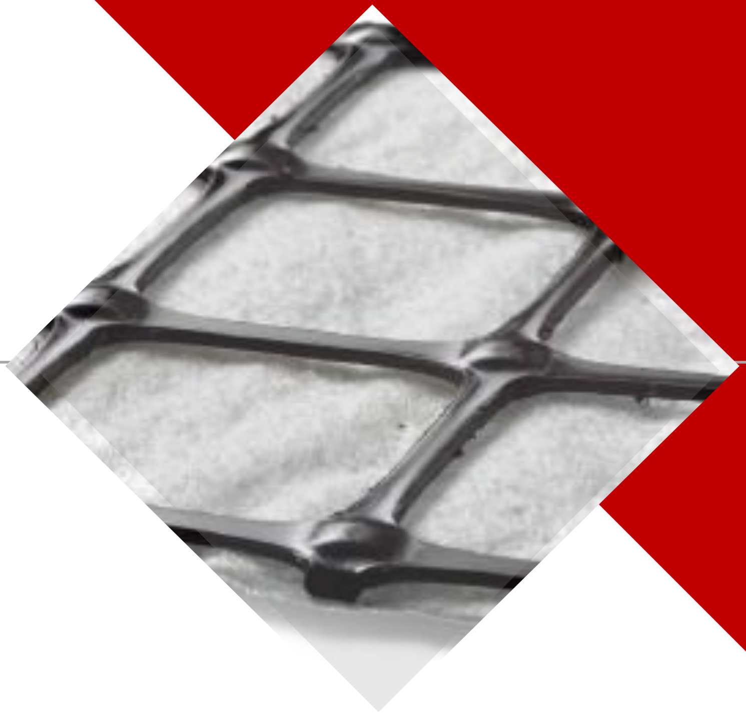
Environmental Product Declaration



THRACE Geogrids & Geocomposites

In accordance with ISO 14025 and EN 15804 + A1

EPD Registration Number	Publication Date	Date of Validity	Program	Program operator	CPC
S-P-02483	18/02/2021	17/02/2026	The International EPD® System www.environdec.com	EPD International AB	369 Other plastic products

Programme Information

Program	
The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm, Sweden www.environdec.com info@environdec.com	Program

Owner of the EPD	
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Product category rules (PCR):	PCR 2012:01 Construction products and construction services
PCR review was conducted by:	The Technical Committee of the International EPD System Contact via info@envrirondec.com
Independent third-party verification of the declaration and data, according to ISO 14025:	☐ EPD process certification ☒ EPD verification (external)
Accredited by:	European Inspection and Certification Company S.A. www.eurocert.gr
Technical support:	SustChem Consulting S.A. www.sustchem.gr

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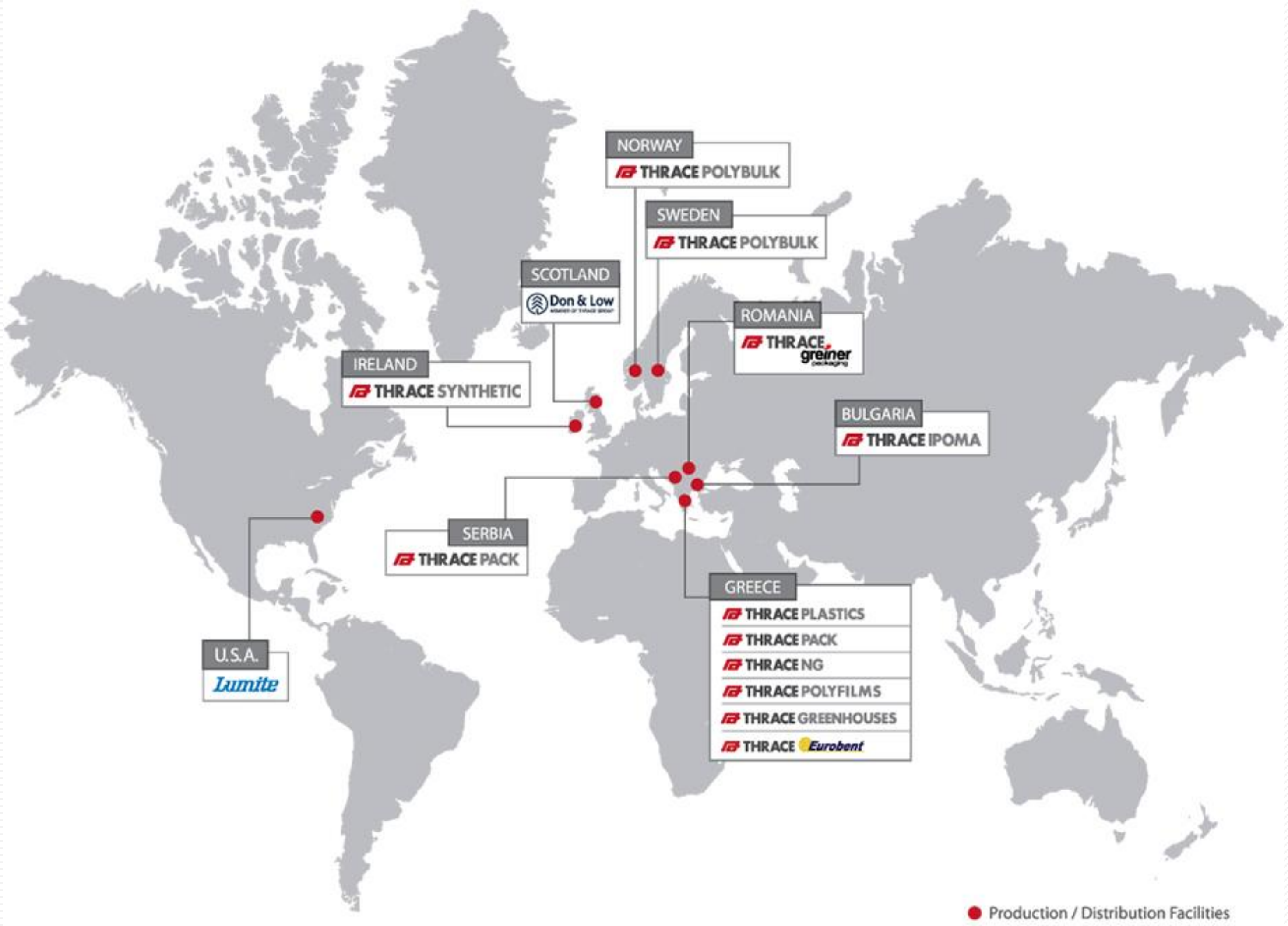
Thrace Group

- Converting 110K tons PP/PE per year
- Sales network in 80 countries
- 58% production in Greece
- 16 member companies
- 2,100 employees
- Operations in 10 countries
- 1,800 customers worldwide
- 28 production technologies
- 17% sales in Greece



Thrace NG

Thrace Nonwovens & Geosynthetics S.A. was established in 2010, assuming all the Technical Fabrics activities of Thrace Plastics, which was originally founded in 1979. Today Thrace NG is producing PP technical fabrics and yarns/fibres.

Our vision is to be the most valuable partner for our customers and suppliers and to consistently increase shareholders' value while ensuring a prosperous future for all individuals working in THRACE GROUP.

Thrace Nonwovens & Geosynthetics S.A. is certified to ISO 9001, ISO 14001, ISO 45001 and ISO 50001

Expertise

At Thrace NG we strive for excellence and that shapes every aspect of our procedures, our processes and our people. Thrace NG`s strategy is to sustain growth through long term client relations, by the implementation of the latest manufacturing technologies and innovation.

Products

Polypropylene woven flat and circular fabrics, needle-punched and spunbond nonwoven fabrics, geogrids and geocomposites, staple fibres, multifilament yarns and tapes, HDPE tape and monofilament nets, polypropylene ropes, webbings, monofilament yarns, vapour control layers, roofing membranes and specialty textile materials.

Areas of Application

Geosynthetics, agri & horticulture, building construction, industrial fabrics, packaging, furniture & bedding, filtration, disposables, medical, workwear.

Markets

Thrace NG exports all over the world, in more than 80 countries.

WHAT MAKES US DIFFERENT

At Thrace NG we recognize that personalized customer service can make the difference between success and failure when it comes down to selecting the proper product for the corresponding application. Thrace NG`s dedicated staff follows a one-to-one relationship approach with our clients in order to understand their needs and provide them with effective solutions.

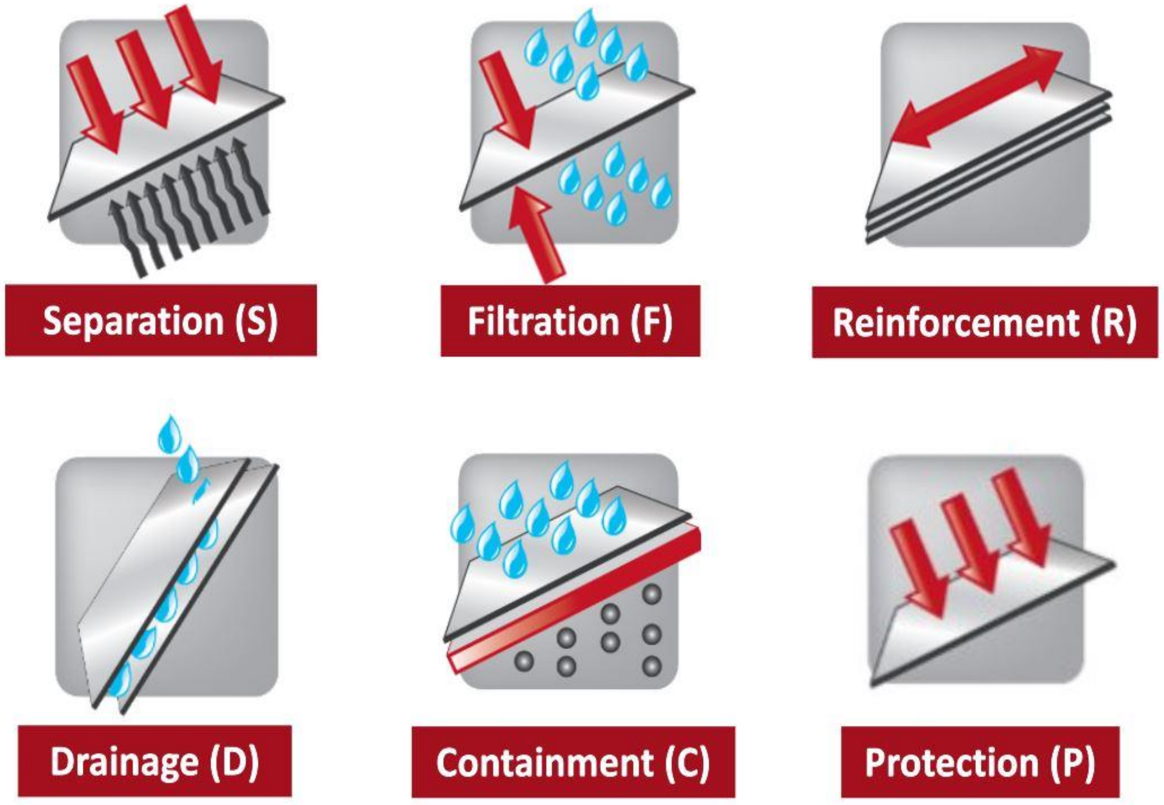
Geogrids & Geocomposites

The products covered by the present EPD are divided in two main product categories. The first one includes **Geogrid** products, while the other includes **Geocomposites**. Basically, Geocomposites comprise of a geogrid bonded to a Geotextile.
The reference CPC code according to the UN CPC classification system is 369 "Other plastic products".
Geogrids and Geocomposites are ideally for the following applications:

Intended use	Technical Specification	Geogrids Function	Geocomposites Function		
Roads and other trafficked areas	EN 13249	Reinforcement	Filtration	Separation	Reinforcement
Railways	EN 13250	Reinforcement	Filtration	Separation	Reinforcement
Earthworks, foundations and retaining structures	EN 13251	Reinforcement	Filtration	Separation	Reinforcement
Drainage control	EN 13252	Reinforcement	Filtration	Separation	Reinforcement
Erosion control	EN 13253	Reinforcement	Filtration	Separation	Reinforcement
Reservoir and dams	EN 13254	Reinforcement	Filtration	Separation	Reinforcement
Canals	EN 13255	Reinforcement	Filtration	Separation	Reinforcement
Solid waste disposal	EN 13257	Reinforcement	Filtration	Separation	Reinforcement
Liquid waste disposal	EN 13265	Reinforcement	Filtration	Separation	Reinforcement

Geosynthetics Functions

Geogrids are polypropylene extruded biaxial geogrid, and the construction of the biaxial geogrid makes it ideal for the following applications with its main function being “Reinforcement”.
Geocomposites, consisting of a polypropylene extruded biaxial geogrid thermally bonded to a UV stabilized polypropylene needle-punched Nonwoven geotextile. The construction of the geocomposite makes it ideal for stabilization, separation and filtration in road construction, landfill applications and in many uses in the field of civil engineering.
Both of them are manufactured at one of Thrace Nonwovens & Geosynthetics S.A. facilities that have achieved ISO 9001 certification for its systematic approach to quality, as well as ISO 14001 for its safe environmental practices.



Geogrids & Geocomposites

Product description

The studied products are biaxial geogrids manufactured from polypropylene (PP) sheets using the extrusion method of punching a pattern of holes, followed by stretching in both directions under controlled temperature, in order to reach the material's tensile characteristics. The geogrid composites are produced by heat bonding the geogrids with any type of Thrace Group Nonwoven Geotextiles. Geogrids are resistant to commonly encountered soil chemicals, mildew and insects and are non-biodegradable. The products are manufactured at one of Thrace's Nonwovens & Geosynthetics S.A. facilities that have achieved ISO 9001 certification for its systematic approach to quality, as well as ISO 14001 for its safe environmental practices.

Intended use

Thrace Group Geogrids and Geocomposites can be used both to decrease the fill material thickness and to increase the bearing capacity of the underlying soil material. The apertures of the biaxial geogrids aid in aggregate interlock thus allowing for effective reinforcement and soil confinement. Geogrids can also be used to construct mattresses to be placed on soft soils.

Geogrids & Geocomposites are offered for various applications such road, railway, paving, landfill, and erosion control applications.

Technical data

Indicatively, the technical data of a Geogrid will be presented.

Property	Value	Unit
Tensile strength (EN ISO 10319)	15-40	kN/m
Grid Opening Size MD/CD (Measured)	25/33-66/66	mm
Overall Flexural Stiffness (ASTM D1388)	400.000 - >5.000.0000	mg·cm
Torsional Stiffness (ASTM D7864)	0.145-0.65	m·N/deg
Weathering Resistance/Resistance to oxidation/Resistance to Liquids	100/100	% retained strength

For further information, details and/ or explanation, please contact the relevant department qualitycontrol@thraceplastics.gr

Geogrids & Geocomposites

Base materials

The composition of the reference products is reported in the following tables. The content of SVHC does not exceed 0.1% of the total weight.

Geogrids

Contribution (% in weight) of materials to the declared unit – 1 kg of geogrid	
Polypropylene	95
Colour Masterbatch (carbon black)	5

Geocomposites are produced by heat bonding the geogrids with any type of Thrace Group Nonwoven geotextiles. More information about the available Nonwoven Geotextiles can be found at the **THRACE Needle-Punched Nonwoven Geotextiles** Environmental Product Declaration.

Geocomposite

Contribution (% in weight) of materials to the declared unit – 1 kg of average geocomposite	
Geogrid	70.5
Nonwoven geotextile	29.5

Geogrids & Geocomposites

The densities of the products described in the EPD are defined in the following tables.

Model	Nominal density (g/m²)	Declared range (g/m²)	NW Style used
TG1515	190	171-209	-
TG2020L	255	229-281	-
TG2020S	255	229-281	-
TG3030L	350	315-385	-
TG3030S	350	315-385	-
TG4040L	490	441-539	-
TG4040S	490	441-539	-
TG4040XL	560	504-616	-
TGC-15-170	360	324-396	170NW, 120NW
TGC-20L-S13	400	360-440	S13NW
TGC-20S-120	420	378-462	120NW
TGC-20S-170	420	378-462	170NW

Model	Nominal density (g/m²)	Declared range (g/m²)	NW Style used
TGC-30L-200	540	486-594	200NW
TGC-30S-140	490	441-539	140NW
TGC-30S-200	540	486-594	200NW
TGC-30S-S13	510	459-561	S13NW
TGC-30S-170	530	477-583	170NW
TGC-30S-S8	450	405-495	S8NW
TGC-33L-S22	670	603-737	S22NW
TGC-40L-120	630	567-693	140NW
TGC-40S-S13	640	576-704	S13NW
TGC-40S-S8	590	531-649	S8NW

Geogrids & Geocomposites

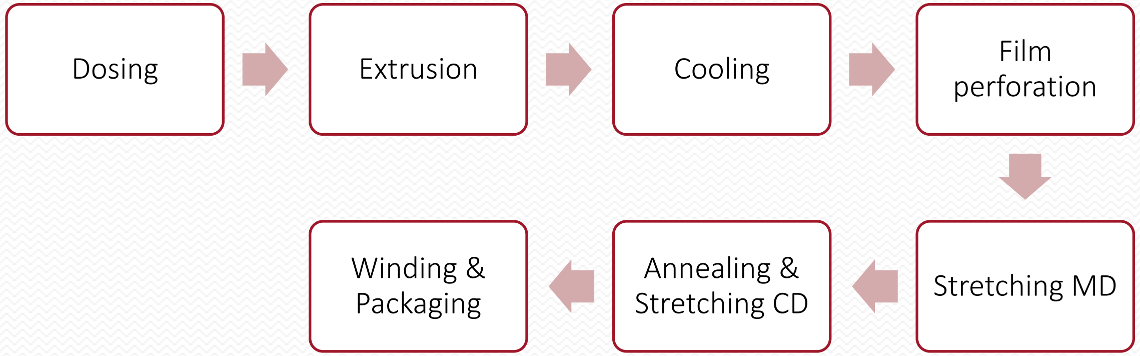
More available models of Geogrids & Geocomposites that are covered by this EPD are mentioned in the following tables.

Model	
TG1515S	TG3333L
TGC-20L-120	TG4545S
TGC-20L-150	TG4545L
TGC-20L-170	TGC-15-S8
TGC-30S-170	TGC-15-S10
TGC-30S-150	TGC-15-200
TGC-30S-S20	TGC-15-500
TGC-30S-100	TGC-15-S22
TGC-40L-140	TGC-15-S25
TGC-40S-150	TGC-15-S30
TGC-40S-100	TGC-20L-AR140
TG1	TGC-20L-S10
TG2	TGC-20L-S12
TG2525	TGC-20L-S20
TG3333S	TGC-20S-AR140

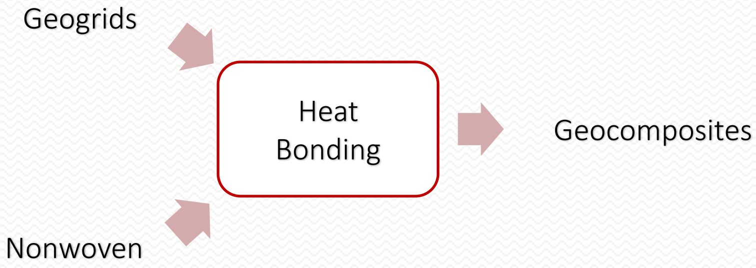
Model	
TGC-20S-170	TGC-30S-S12
TGC-20S-S8	TGC-30S-S30
TGC-20S-S10	TGC-33S-S16
TGC-20S-S12	TGC-33S-S22
TGC-20S-S13	TGC-33L-S8
TGC-20S-S14	TGC-33L-S10
TGC-20S-S18	TGC-40S-170
TGC-20S-S20	TGC-40L-140
TGC-20S-S22	TGC-40L-170
TGC-20S-S25	TGC-40S-S10
TGC-20S-S30	TGC-40S-S25
TGC-30L-S8	TGC-40L-S8
TGC-30L-S10	TGC-45S-S14
TGC-30L-S18	TGC-45S-S16
TGC-30S-S10	TGC-45S-S20

Manufacturing Process

Geogrids



Geocomposites



This EPD describes the impacts of Geogrids & Geocomposites produced in Thrace's NG manufacturing site in Xanthi, Greece, using for each product category weighted average values. The results reported in this EPD and therefore the LCA study conducted, refer to the Geogrid manufacturing. Since Geocomposites comprise of a geogrid and a Nonwoven geotextile, the aggregate environmental impact is defined by the combination of 70.51% of the environmental impacts of the geogrid and, 29.49% of the environmental impacts of the Nonwoven Geotextile, respectively.

Reference service life

The reference service life does not have to be declared, because this LCA does not declare the entire Life Cycle. Therefore, the following is a voluntary statement. According to the manufacturer the reference service lifetime of Geogrids and Geocomposites is about 100 years in soil temperatures <25°C.

Life Cycle Assessment - LCA

Declared Unit

The declared unit is 1 kg of Geogrid with densities in a wide range as described in Product Information chapter.

System boundary

This EPD only covers the Cradle-to-gate (stages A1-A3) as represented in the following table, because the rest of the Life Cycle stages are very dependent on the development of particular scenarios.

Product Stage			Construction Process Stage		Use Stage							End of Life Stage				Resource Recovery Stage
Raw material	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction, demolition	Transport	Waste processing	Disposal	Reuse, recycling, or energy recovery potentials
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	MND	MND	MND	MND	MND

MND: Module Not Declared

Therefore, the stages included in the study are:

- **Raw Materials supply (A1).** Production of raw materials used in the manufacturing of the products.
- **Transportation of raw materials to the site (A2).**
- **Manufacturing of Geogrids (A3).** The electricity used in the manufacturing processes is from the Greek national grid. The reference year of the study is from May 2019 to April 2020. The energy used to bond the geogrid with the nonwoven geotextile in order to form the geocomposite is negligible.

Raw material (A1) → Transportation (A2) → Manufacturing (A3)

Life Cycle Assessment - LCA

Cut-off criteria

All flows whose influence is higher than 1% of the total mass, energy or environmental impact are included in the Life Cycle Assessment. It is assumed, that the total neglected input flows are much less than 1% of energy and mass. All associated processes specific data are determined and modelled by the use of generic data provided by the integrated GaBi databases. Disposal or reuse of production wastes were not taken into account.

Assumptions, Allocation, and Estimates

- Regarding the exclusion of product life cycle stages and processes, the use, end-of-life, and reuse stage have not been accounted for. Also, the capital goods (construction of the manufacturing site) are not included in the LCA study.
- Producer specific data used for calculations refer to the inventory of one full year and more specifically data from May 2019 to April 2020 were used as reference.
- The packaging material is negligible. It is considered that the share of the packaging material is <0.1% (w/w) of the total product.
- Coloring Masterbatch (carbon black) was assumed to comprise of 55% polypropylene and 45% carbon black.
- A default mean of road transportation (Truck Euro 5 – 2.7t payload – 7.5t gross weight) has been assumed. Weighted average of the distance covered, and times needed were taken into account. Regarding the ship transportation, an "Average ship, 3,500t payload capacity" was assumed due to lack of actual data.
- Regarding the energy consumption and the raw material consumption in the manufacturing process, an allocation based on the mass of the finished products from the site has been applied. Energy required for the bonding of the nonwoven geotextile and geogrid is negligible. Therefore, the LCA study refers to the manufacture of 1 kg of Geogrid.

Background data and data quality

For all processes primary data was collected and provided by Thrace Nonwovens & Geosynthetics S.A. The primary data refers to May 2019 to April 2020 as reference period. For the data, which are not influenced by the manufacturer, generic data is used. The GaBi-database was used for the generic data. This database is updated regularly.

The LCA software GaBi ts version 9.1.0.53 was used for inventory and impact assessment calculations based on data entry of the developed model. A compilation of Ecoinvent v.3.5 and Professional databases was used.

Comparability

- EPDs within the same product category but from different program may not be comparable.
- EPDs of construction products may not be comparable if they do not comply with EN 15084.
- This EPD and the PCR CPC 54 "Construction products and construction services" are available on the website of The International EPD® System (www.environdec.com).

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THRACE NG

Life Cycle Assessment - LCA

Parameters describing the environmental impacts

The following tables present the environmental impact potentials for different parameters, for the material flows as well as for the waste and other outputs. The results refer to 1 kg Geogrid.

Geogrids:

Environmental Impact Categories		Impact/ 1 kg of Geogrid			
	Unit	A1	A2	A3	Total
Depletion of abiotic resources (elements)	kg Sb eq.	5.737E-07	8.155E-09	2.625E-07	**8.444E-07**
Depletion of abiotic resources (fossil)	MJ net calorific value	76.303	1.4202	19.362	**97.0852**
Acidification Potential	kg SO_2 eq.	0.004591	5.572E-04	0.005753	**0.01090**
Eutrophication Potential	kg $PO4^{-3}$ eq.	4.973E-04	1.420E-04	2.705E-04	**9.099E-04**
Global Warming Potential (GWP100)	kg CO_2 eq.	2.249	0.1037	1.7265	**4.0793**
Ozone Layer Depletion Potential	kg R-11 eq.	1.297E-14	1.731E-17	2.561E-14	**3.860E-14**
Photochemical Ozone Creation Potential	kg C_2H_4 eq.	7.616E-04	-2.456E-04	3.361E-04	**8.521E-04**

Impact Category – Waste categories		Impact/ 1 kg of Geogrid			
	Unit	A1	A2	A3	Total
Hazardous waste disposed	kg	1.6753E-08	7.962E-08	6.239E-09	**1.026E-07**
Non-hazardous waste disposed	kg	0.02113	1.159E-04	0.00599	**0.02724**
Radioactive waste disposed	kg	0.00127	1.933E-06	0.0002539	**0.00153**

Life Cycle Assessment - LCA

Geogrids:

Impact Category – Use of resources	Unit	Impact/ 1 kg of Geogrid			
		A1	A2	A3	Total
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	3.3148	0.0827	5.0245	8.4220
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	0	0	0	0
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	3.3148	0.0827	5.0245	8.4220
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	37.594	1.4253	19.814	58.8333
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	41.99	0	0	41.99
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	79.584	1.4253	19.814	100.8233
Use of secondary material	kg	0	0	0	0
Use of renewable secondary fuels	MJ, net calorific value	0	0	0	0
Use of non-renewable secondary fuels	MJ, net calorific value	0	0	0	0
Use of net fresh water	m^3	0.0125	1.398E-04	0.00988	0.0226

Life Cycle Assessment - LCA

Parameters describing the environmental impacts

The following tables present the environmental impact potentials for different parameters, for the material flows as well as for the waste and other outputs. The results refer to 1 kg Geocomposite.

Geocomposites:

Environmental Impact Categories		Impact/ 1 kg of Geocomposite			
	Unit	A1	A2	A3	Total
Depletion of abiotic resources (elements)	kg Sb eq.	8.082E-07	7.601E-09	2.35E-07	**1.051E-06**
Depletion of abiotic resources (fossil)	MJ net calorific value	77.1885	1.3237	16.8092	**95.3214**
Acidification Potential	kg SO_2 eq.	0.004779	5.193E-04	0.005213	**0.01051**
Eutrophication Potential	kg PO_4^{-3} eq.	5.138E-04	1.324E-04	2.429E-04	**8.891E-04**
Global Warming Potential (GWP100)	kg CO_2 eq.	2.2938	0.09667	1.5221	**3.9126**
Ozone Layer Depletion Potential	kg R-11 eq.	1.301E-14	1.613E-17	2.33E-14	**3.633E-14**
Photochemical Ozone Creation Potential	kg C_2H_4 eq.	7.783E-04	-2.288E-04	3.019E-04	**8.513E-04**

Impact Category – Waste categories		Impact/ 1 kg of Geocomposite			
	Unit	A1	A2	A3	Total
Hazardous waste disposed	kg	1.6903E-08	7.4205E-08	5.3699E-09	**9.648E-08**
Non-hazardous waste disposed	kg	0.02132	0.000108	0.005334	**0.02677**
Radioactive waste disposed	kg	0.00128	1.802E-06	0.0002155	**0.001501**

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THRACE NG

Life Cycle Assessment - LCA

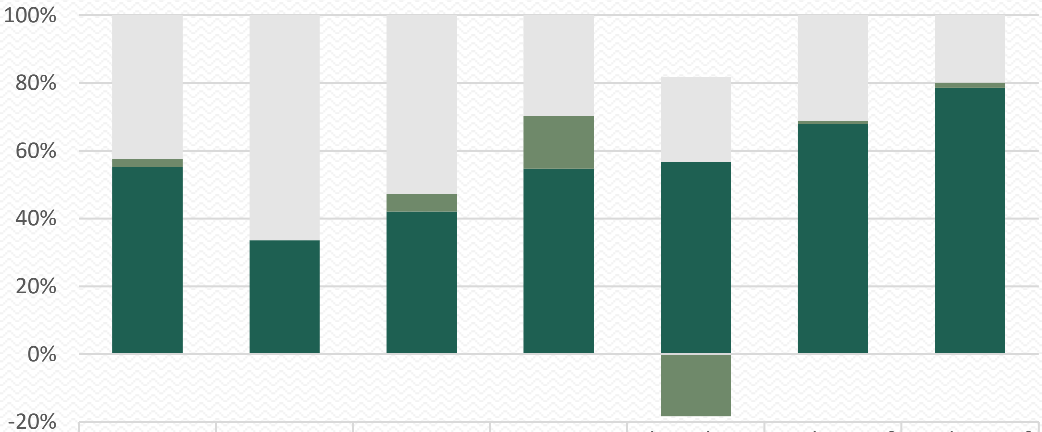
Geocomposites:

Impact Category – Use of resources		Impact/ 1 kg of Geocomposite			
	Unit	A1	A2	A3	Total
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	3.3572	0.0771	4.5754	**8.0097**
Use of renewable primary energy resources used as raw materials	MJ, net calorific value	0	0	0	**0**
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	3.3572	0.0771	4.5754	**8.0097**
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	37.7857	1.3285	17.2213	**56.3356**
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	42.7909	0	0	**42.7909**
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	80.5766	1.3285	17.2213	**99.1265**
Use of secondary material	kg	-	-	-	**-**
Use of renewable secondary fuels	MJ, net calorific value	-	-	-	**-**
Use of non-renewable secondary fuels	MJ, net calorific value	-	-	-	**-**
Use of net fresh water	m^3	0.01338	0.00013	0.008987	**0.0225**

Interpretation

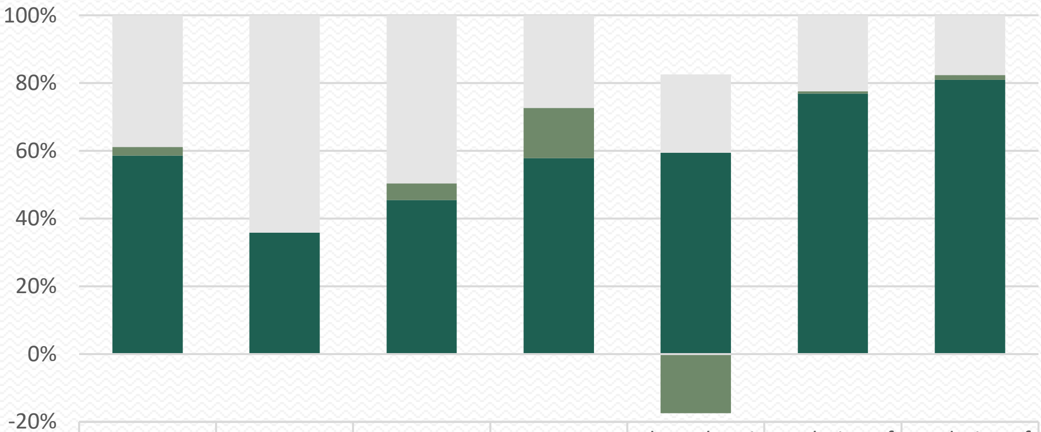
The following figures present the influence of the stages A1, A2, and A3 on the total environmental impact and it can be clearly seen that the analyzed impact categories are mainly influenced by the raw material supply (A1) and the manufacturing stage (A3). The results of the environmental impacts of the respective product categories are presented separately.

Environmental Impacts (Geogrids)



	Global Warming Potential	Ozone Depletion Potential	Acidification Potential	Eutrophication Potential	Photochemical Ozone Creation Potential	Depletion of Abiotic resources (element)	Depletion of Abiotic resources (fossil)
A3	42,3	66,4	52,8	29,7	25	31,1	19,9
A2	2,5	0	5,1	15,6	-18,3	1	1,5
A1	55,1	33,6	42,1	54,7	56,7	67,9	78,6

Environmental Impacts (Geocomposites)



	Global Warming Potential	Ozone Depletion Potential	Acidification Potential	Eutrophication Potential	Photochemical Ozone Creation Potential	Depletion of Abiotic resources (element)	Depletion of Abiotic resources (fossil)
A3	38,9	64,1	49,6	27,3	23,1	22,4	17,6
A2	2,5	0	4,9	14,9	-17,5	0,7	1,4
A1	58,6	35,8	45,5	57,8	59,5	76,9	81

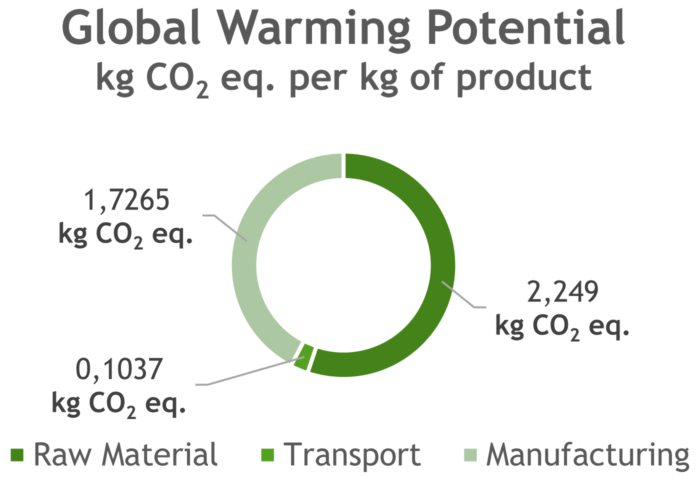
Interpretation

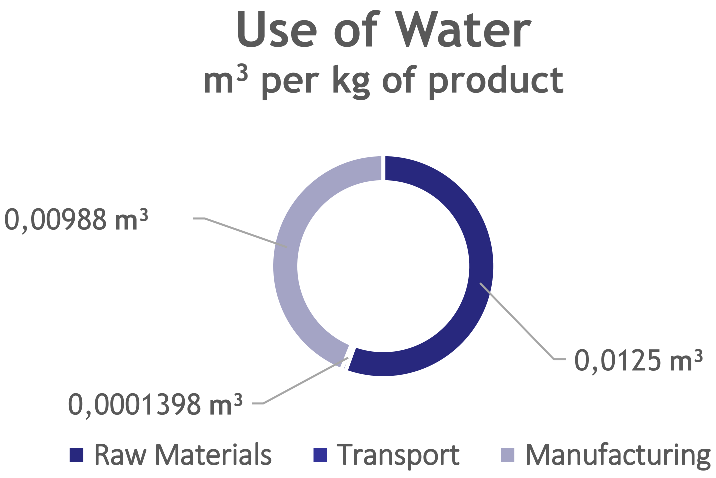
Specifically, the impact categories ADPelement and ADPfossil are largely dominated by the raw material supply stage, whereas impact category ODP is largely influenced by the manufacturing stage.

The GWP of 1 kg of Geogrid is dominated by 55.1% by the information module A1 – Raw material supply. Module A2 – Transportation contributes slightly to the impact category, whereas the manufacturing stage (A3) is responsible for the rest of contribution with a share of 42.3% of the total impact. A similar outcome is faced with the GWP of 1 kg of Geocomposite. Raw material supply stage (A1) is dominant with a share of 58.6% of the total impact, whereas manufacturing stage (A3) contributes at 38.9%.

The provision of base materials is also mostly accountable for the formation potential of tropospheric ozone photochemical oxidants, whereby it shall be noticed that the negative values of POCP are attributable to the fact that the nitrogen monoxides during any truck transportation were calculated with a negative characterization factor.

Geogrids



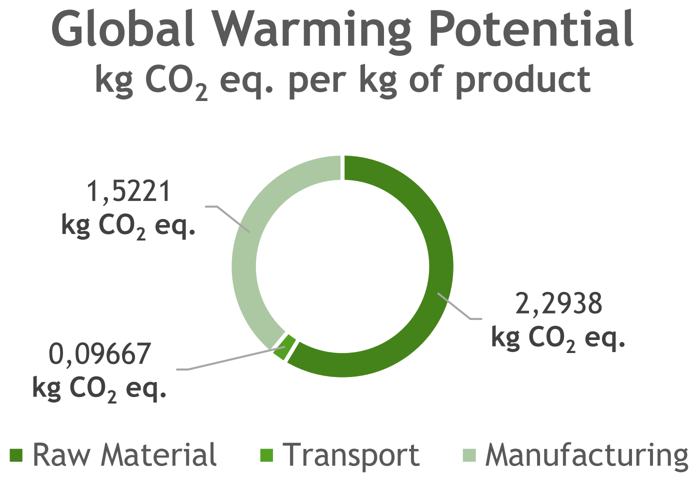


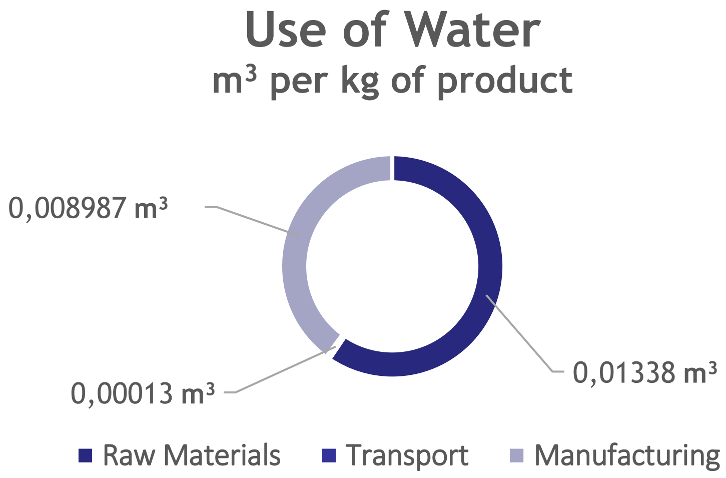
Interpretation

Contributions from the raw materials extraction and production stage (A1) and the manufacturing stage (A3) are the most important considering the formation of Acidification Potential (AP). Regarding both product categories, raw material supply is responsible for the contribution of 42-45% of the total impact, whereas a similar pattern is followed by the manufacturing process which contributes to a percentage of 49-52% of the total impact. Transportation stage – A2 is also accountable for the 5% of the total impact.

A slightly different pattern is followed regarding the formation of Eutrophication Potential (EP). Transportation stage (A2) is more dominant in comparison to the previous cases. Stage A2 is responsible for the contribution of 15% of the total impact, whereas raw material supply (A1) accounts for the 54-57% of the total impact.

Geocomposites





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