Environmental Product Declaration

THRACE Woven Geotextiles

In accordance with ISO 14025 and EN 15804 + A1

EPD Registration Number	Publication Date	Date of Validity	Program	Program operator	CPC
S-P-02482	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

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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@environdec.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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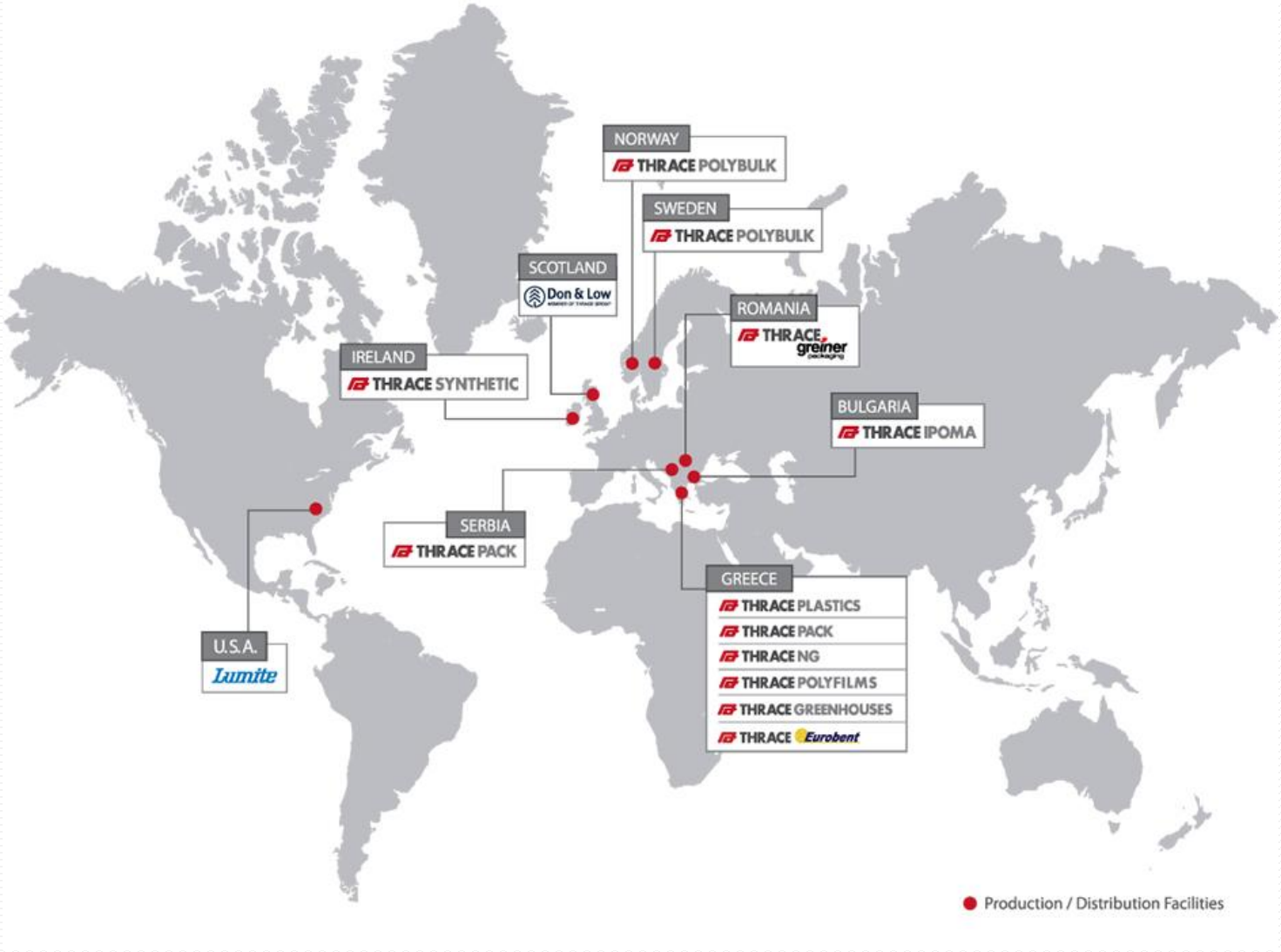
Thrace Group

- 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.

Woven Geotextiles

The Woven geotextiles product categories covered by the present EPD are **WG, WGPB & TPG, WMT & HF and WMM.**

The reference CPC code according to the UN CPC classification system is 369 “Other plastic products”.

Woven geotextiles are ideally for the following applications:

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

Woven Geotextiles

Product description

The studied products are UV-stable, high strength polypropylene slit-film tape Woven geotextiles used for many civil engineering and building applications. They 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. The construction of the geotextile makes them ideal for soil separation, stabilization, and reinforcement. They are resistant to commonly encountered soil chemicals, mildew, biological agents and insects and are non-biodegradable.

Woven geotextiles are offered for various applications such road, railway, and geobag applications. They act as separator to prevent the intermixing of the different soil layer types, as filter to allow the flow of fluids while preventing the passage of soil particles and as reinforcement for weak soils to increase the load bearing capacity.

Intended use

Woven geotextiles are offered for a wide range of civil engineering and building applications. They are specifically designed to offer filtration, reinforcement, and separation functions.

Technical data

Indicatively, the technical data of WG Standard will be presented.

Property	WG	HF	WMM	WMT	Unit
Tensile Strength (EN ISO 10319)	14-150	27-45	17-32	12-43	kN/m
Elongation MD/CD (EN ISO 10319)	14/10-25.5/25	11/17-22/22	28/25-75/75	20/9-25/16	%
Resistance to static puncture (EN ISO 12236)	1.8->18	1.05-4.8	2.1-3.9	2.0-4.3	kN
Characteristic Opening Size (EN ISO 12956)	150-300	0.26-0.28	1.2	600->650	µm
Water flow rate (EN ISO 11058)	5-144	35-166	100-400	40-180	l/ (m^2· s)
Thickness (2kPa)	0.3-2.4	0.4-0.55	0.5-0.85	0.55-1.2	mm
Mass/ Unit area (EN ISO 9864)	75-1200	80-300	120-250	130-230	g/m^2

Property	TPG	Unit
Grab Tensile Strength (ASTM D4632)	180-800	lbf
Grab Elongation MD/CD (ASTM D4632)	8-25	%
Trapezoidal Tear (ASTM D4533)	75-250	lbf
CBR Puncture Strength (ASTM D6241)	550-2400	lbf
Aparent Opening Size (ASTM D4751	40-80	mm
Permittivity (ASTM D4491)	0.08-0.109	sec^{-1}
Water Flow Rate (ASTM D4491)	3.7-154.6	gpm/ft^2
Mass/Unit Area	4.1-14.7	oz/yd^2

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

Woven Geotextiles

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.

WG, WGPB & TPG

Contribution (% in weight) of materials to the declared unit – 1 kg of product	
Polypropylene	96
Colour Masterbatch (carbon black)	1
Filler Masterbatch (calcium carbonate)	3

WMT & HF

Contribution (% in weight) of materials to the declared unit – 1 kg of product	
Polypropylene	40.5
High Density Polyethylene	55
Filler Masterbatch (calcium carbonate)	1.2
UV Masterbatch	1.4
Colour Masterbatch (carbon black)	1.3
Processing Aid	0.6

WMM

Contribution (% in weight) of materials to the declared unit – 1 kg of product	
High Density Polyethylene	95
UV Masterbatch	2.5
Colour Masterbatch (carbon black)	1.5
Processing Aid	1

Woven Geotextiles

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

Model	Nominal density (g/m^2)	Declared range (g/m^2)
HF180	230	207-253
HF315	200	180-220
HF400	150	135-165
IWG21	105	94-116
TPG180T	120	108-132
TPG250C	160	144-176
TPG270	190	171-209
TPG315	205	184-226
TPG550	375	337-416
W60L	290	261-319
WG105HF	500	450-550
WG105-TPG700	500	450-550
WG120	560	504-616
WG14	75	67-83
WG150	800	720-880
WG150-135	695	625-765

Model	Nominal density (g/m^2)	Declared range (g/m^2)
WG25	125	112-138
WG30	145	130-160
WG30-TPG200	145	130-160
WG35TS	160	144-176
WG40HF	190	171-209
WG40L	200	180-220
WG40-TPG200	145, 190	130-209
WG40-TPG250	190	171-209
WG45	210	189-231
WG45L	210	189-231
WG50	235	211-259
WG55	255	229-281
WG60	280	252-308
WG65	310	279-341
WG70	355	319-391

Model	Nominal density (g/m^2)	Declared range (g/m^2)
WG80	400	360-440
WG80HF	370	333-407
WG85HF	400	360-440
WG85L	410	369-451
WG85-TPG600	400	360-440
WGBP090-WG16	90	81-99
WGBP100-WG19	100	90-110
WGDL-BASE	62	55-69
WGF16-T15	90	81-99
WGN2	105	94-116
WGPB090	90	81-99
WGPB120	120	108-132
WMM120	120	108-132
WMT130	130	117-143
MWT230	230	207-253
WP500	160	144-176

Woven Geotextiles

More available models of Woven geotextiles that are covered by this EPD are mentioned in the following tables.

Model	
TPG135	TPGF240LW
WG30-TPG200	EG1500
TPG200S	WG120L
TPG350	WG122
TPG350R1	WG135
TPG400	WGF16
TPG400S	WG19
TPG450	WG21
TPG475LW	WG150CCF
TPG4CHF	WG40
TPG4X6	WG45HF
TPG560ADC	WG55HF
TPG600	WG60L
TPG650	WG65L
WG105-TPG700	WG80L

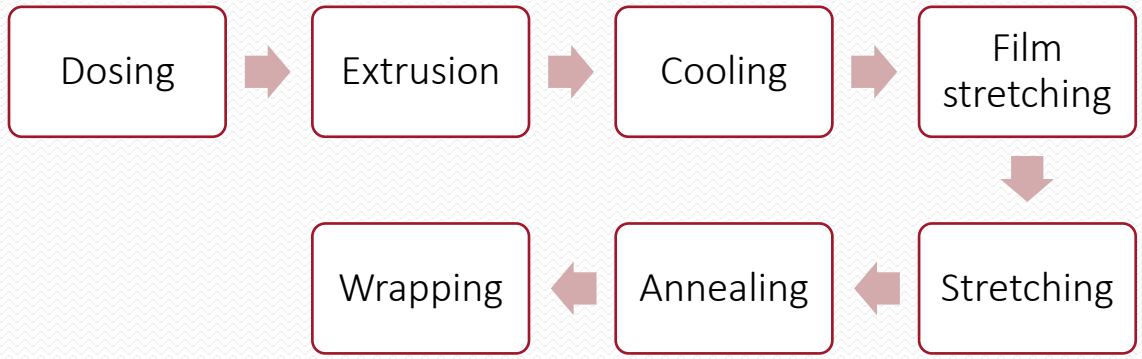
Model	
WG80-TPG450	WMT220 Ridge
WG85	WMT235 Drain
WG95	WMT28L
WGF16-T51	WMT32-28L
WGF25	WMM200
WGLF90	WMM210
WGPB100	WMM230 twill
WGPB100-WG19	WMM240
WGDL-BASE	WMM250
HF400 (no178)	WTM185
WMT110	TPG180T
WMT140	TPG200
WMT160	TPG250
WMT165	TPG270
WMT190 Ridge	TPG315

Model	
TPG350	WG30HF
TPG350-R1	WG35HF
TPG400	WG40HF
TPG475LW	WG45HF
TPG560ADC	WG50HF
TPG550	WG55HF
TPG4C-HF	WG60HF
TPG600	WG65HF
TPG650	WG80HF
TP4x6	WG85HF
TP4x6F	WG105HF
TPG700	WGPB090
TPG400EO	WGPB100
TPG404MM	WGPB120
WG14HF	WGF16

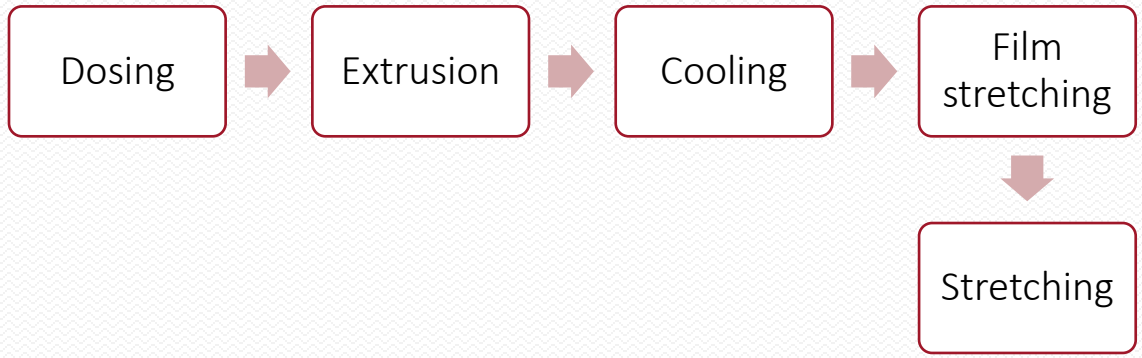
Model	
IWG21	WGLF90
WG N2	WG105
WG25	WG122
WG30	WG135
WG35TS	EG1500
WG40	WMM120 HF1300
WG60L	WMM200
WG65	EG3220
WG65L	EG3770
EG1500	EG4404
EG3220	HF180R
WG3770	WG150
WG70	HF200
WG80L	HF180
WG85	WMT230

Manufacturing Process

Slit tape production



Fiber production



This EPD describes the impacts of WG, WGPB & TPG, WMT & HF and WMM Woven geotextiles produced in Thrace's NG manufacturing site in Xanthi, Greece, using for each product category weighted average values. The results reported in this EPD, through the three selected reference products, are representative for the three product categories.

Reference service life

The reference service life does not have to be declared, because this LCA does not declare the entire Life Cycle. Therefore, it is a voluntary statement. According to the manufacturer the reference service lifetime of Woven geotextiles is about 100 years in soil temperatures <25 ^{o}C.

Life Cycle Assessment - LCA

Declared Unit

The declared unit is 1 kg of Woven geotextile 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 Woven geotextiles (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.

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 integrates 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.
- An uncertainty regarding the packaging process was raised due to the complexity of monitoring the stored packaging materials. Thus, an assumption made which described the packaging material used for the packaging of the manufactured product. PVC cores and Polyethylene film, in percentages 95% and 5% respectively, were assumed to be the main packaging materials used.
- UV Masterbatch was assumed to consist of polypropylene exclusively. Coloring Masterbatch (carbon black) was assumed to comprise of 55% polyethylene 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. The Woven geotextiles included in the EPD are accounted for the 50% of the total production (*of the reference year*).

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).

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 1kg of Woven geotextile.

WG, WGPB & TPG:

Environmental Impact Categories		Impact/ 1 kg of WG, WGPB & TPG Woven geotextile			
	Unit	A1	A2	A3	Total
Depletion of abiotic resources (elements)	kg Sb eq.	1.549E-06	7.357E-09	1.939E-07	**1.750E-06**
Depletion of abiotic resources (fossil)	MJ net calorific value	78.3057	1.2811	11.129	**90.7158**
Acidification Potential	kg SO_2 eq.	0.005309	5.025E-04	0.004644	**0.01046**
Eutrophication Potential	kg PO_4^{-3} eq.	5.562E-04	1.281E-04	2.048E-04	**8.891E-04**
Global Warming Potential (GWP100)	kg CO_2 eq.	2.3963	0.0936	1.1343	**3.6242**
Ozone Layer Depletion Potential	kg R-11 eq.	6.481E-11	1.562E-17	2.119E-14	**6.483E-11**
Photochemical Ozone Creation Potential	Kg C_2H_4 eq.	8.149E-04	-2.218E-04	2.552E-04	**8.484E-04**

Impact Category – Waste categories		Impact/ 1 kg of WG, WGPB & TPG Woven geotextile			
	Unit	A1	A2	A3	Total
Hazardous waste disposed	kg	1.6879E-08	7.1828E-08	3.3017E-09	**9.201E-08**
Non-hazardous waste disposed	kg	0.02127	0.000104	0.004256	**0.02563**
Radioactive waste disposed	kg	0.00128	1.7443E-06	0.000147	**0.00143**

Life Cycle Assessment - LCA

WG, WGPB & TPG:

Impact Category – Use of resources		Impact/ 1 kg of WG, WGPB & TPG Woven geotextile			
	Unit	A1	A2	A3	Total
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	3.4125	0.0626	4.1572	**7.6323**
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	3.4125	0.0626	4.1572	**7.6323**
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	38.216	1.0787	11.512	**50.8067**
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	43.7391	0	0	**43.7391**
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	81.9551	1.0787	11.512	**94.5458**
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	0.0161	0.000126	0.00817	**0.0244**

Life Cycle Assessment - LCA

WMT & HF:

Environmental Impact Categories		Impact/ 1 kg of WMT & HF Woven geotextile			
	Unit	A1	A2	A3	Total
Depletion of abiotic resources (elements)	kg Sb eq.	1.244E-06	8.778E-09	1.939E-07	**1.447E-06**
Depletion of abiotic resources (fossil)	MJ net calorific value	74.2814	1.5289	11.129	**86.9392**
Acidification Potential	kg SO_2 eq.	0.006497	6.012E-04	0.004644	**0.01174**
Eutrophication Potential	kg PO_4^{-3} eq.	5.262E-04	1.532E-04	2.048E-04	**8.843E-04**
Global Warming Potential (GWP100)	kg CO_2 eq.	2.2603	0.1118	1.1343	**3.5064**
Ozone Layer Depletion Potential	kg R-11 eq.	6.268E-08	1.863E-17	2.119E-14	**6.268E-08**
Photochemical Ozone Creation Potential	Kg C_2H_4 eq.	0.00107	-2.657E-04	2.552E-04	**0.00106**

Impact Category – Waste categories		Impact/ 1 kg of WMT & HF Woven geotextile			
	Unit	A1	A2	A3	Total
Hazardous waste disposed	kg	7.273E-09	8.569E-08	3.301E-09	**9.627E-08**
Non-hazardous waste disposed	kg	0.00908	1.247E-04	0.004256	**0.01347**
Radioactive waste disposed	kg	5.468E-04	2.081E-06	1.477E-04	**6.966E-04**

Life Cycle Assessment - LCA

WMT & HF:

Impact Category – Use of resources	Unit	A1	A2	A3	Impact/ 1 kg of WMT & HF Woven geotextile Total
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	1.9513	0.0888	4.1572	**6.1973**
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	1.9513	0.0888	4.1572	**6.1973**
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	58.5802	1.5315	11.512	**71.6237**
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	19.26	0	0	**19.26**
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	77.8402	1.5315	11.512	**90.8837**
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	0.0204	0.00015	0.00817	**0.0288**

Life Cycle Assessment - LCA

WMM:

Environmental Impact Categories		Impact/ 1 kg of WMM Woven geotextile			
	Unit	A1	A2	A3	Total
Depletion of abiotic resources (elements)	kg Sb eq.	1.021E-06	1.6837E-08	1.939E-07	**1.232E-06**
Depletion of abiotic resources (fossil)	MJ net calorific value	71.3273	2.9319	11.129	**85.3882**
Acidification Potential	kg SO_2 eq.	0.007367	0.001154	0.004644	**0.01316**
Eutrophication Potential	kg PO_4^{-3} eq.	5.042E-04	2.940E-04	2.048E-04	**0.001003**
Global Warming Potential (GWP100)	kg CO_2 eq.	2.1604	0.2041	1.1343	**3.4989**
Ozone Layer Depletion Potential	kg R-11 eq.	1.086E-07	3.573E-17	2.119E-14	**1.086E-07**
Photochemical Ozone Creation Potential	Kg C_2H_4 eq.	0.001258	-4.993E-04	2.552E-04	**0.001014**

Impact Category – Waste categories		Impact/ 1 kg of WMM Woven geotextile			
	Unit	A1	A2	A3	Total
Hazardous waste disposed	kg	2.2844E-10	1.6438E-07	3.3017E-09	**1.679E-07**
Non-hazardous waste disposed	kg	1.477E-04	2.392E-04	0.004256	**0.004644**
Radioactive waste disposed	kg	8.78E-06	3.992E-06	1.477E-04	**0.000161**

Life Cycle Assessment - LCA

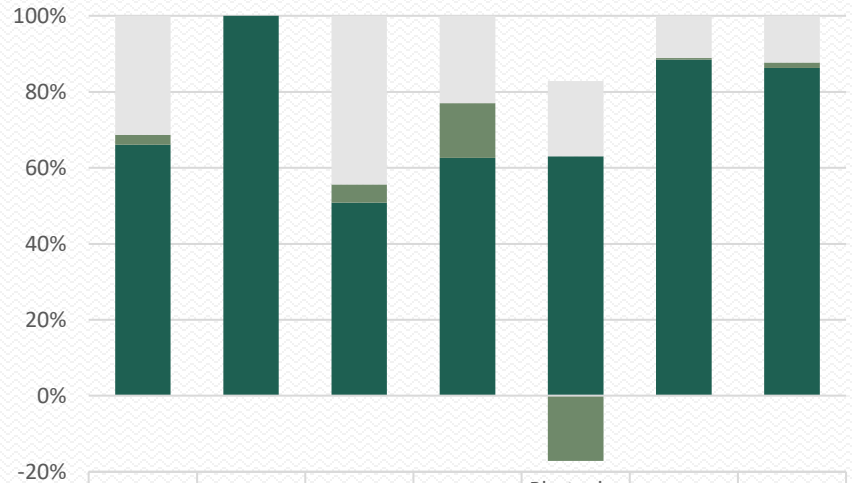
WMM:

Impact Category – Use of resources	Unit	Impact/ 1 kg of WMM Woven geotextile			
		A1	A2	A3	Total
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	0.8795	0.1707	4.1572	**5.2074**
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	0.8795	0.1707	4.1572	**5.2074**
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	73.5125	2.9425	11.512	**87.967**
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	1.307	0	0	**1.307**
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	74.8195	2.9425	11.512	**89.274**
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	0.0236	0.000289	0.008176	**0.0321**

Interpretation

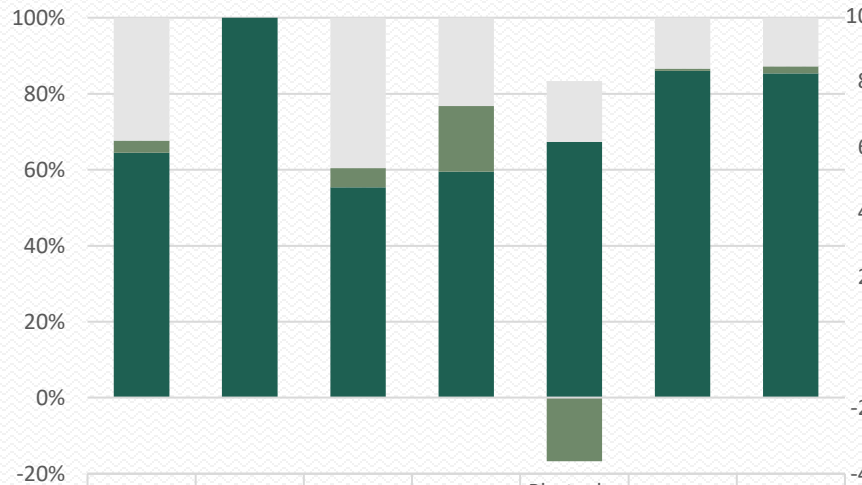
The following figures present the influence of the stages A1, A2, and A3 on the total environmental impact and it can be clearly seen that the analyzed impact categories are mainly influenced by the raw material supply (A1) and the manufacturing stage (A3). It should be noted that many of the impact categories do not differ more than ±10% between the three product sub-categories of Woven geotextiles. However, the results of the environmental impacts of each product category are presented separately.

Environmental Impacts (WG, WGPB & TPG)



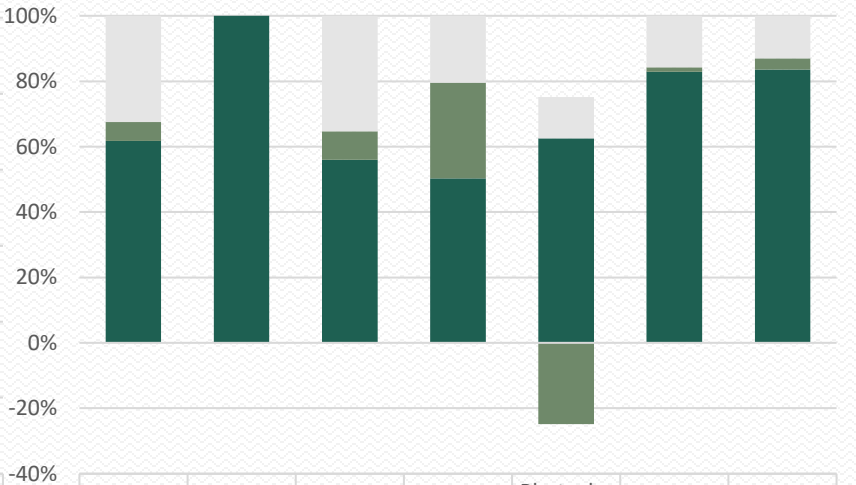
	Global Warming Potential	Ozone Depletion Potential	Acidification Potential	Eutrophication Potential	Photochemical Ozone Creation Potential	Depletion of Abiotic resources (element)	Depletion of Abiotic resources (fossil)
A3	31,3	0	44,4	23	19,8	11,1	12,3
A2	2,6	0	4,8	14,4	-17,2	0,4	1,4
A1	66,1	100	50,8	62,6	63,1	88,5	86,3

Environmental Impacts (WMT & HF)



	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	32,4	0	39,5	23,2	16	13,4	12,8
A2	3,2	0	5,1	17,3	-16,7	0,6	1,8
A1	64,5	100	55,3	59,5	67,3	86	85,4

Environmental Impacts (WMM)



	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	32,4	0	35,3	20,4	12,7	15,7	13
A2	5,8	0	8,8	29,3	-24,8	1,4	3,4
A1	61,7	100	56	50,3	62,5	82,9	83,5

Interpretation

Specifically, the impact categories ADPe and ADPf are largely dominated by the raw material supply stage (A1), whereas impact category ODP is entirely influenced by the raw material supply stage (A1).

The GWP of 1 kg of Woven geotextile is dominated by around 61-66% 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 the contribution with a share of 31-32% of the total impact.

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.

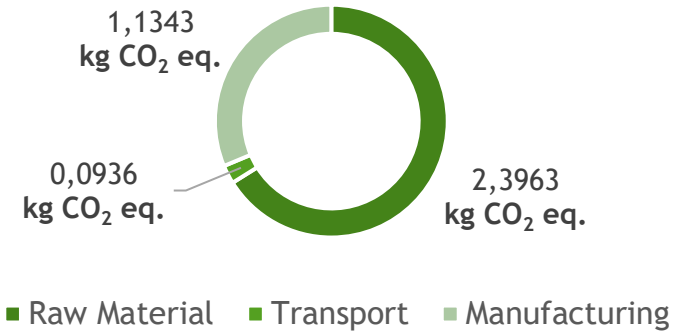
Contributions from the raw materials extraction and production stage (A1) and the manufacturing stage (A3) are the most important considering the formation of Acidification Potential (AP). Regarding WG, WGPB & TPG, WMT & HF and WMM Woven geotextile product categories, raw material supply is responsible for the contribution of 50-56% of the total impact, whereas a similar pattern is followed by the manufacturing process which contributes to a percentage of 35-44% of the total impact. Transportation stage – A2 is only accountable for a minimal contribution, where transportation processes slightly contribute to the total impact within a range of 4-8%.

A relevant pattern is followed regarding the formation of Eutrophication Potential (EP). However, the transportation stage (A2) holds a significant share of the total impact. Stage A2 is responsible for the contribution of 17% of the total impact for WMT & HF and 29% for WMM product categories. Still, the impact is largely dominated by the raw material supply stage (A1).

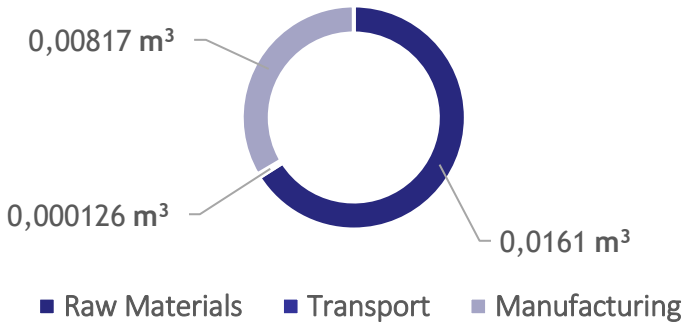
Woven Geotextiles

WG, WGPB & TPG

Global Warming Potential
kg CO_2 eq. per kg of product

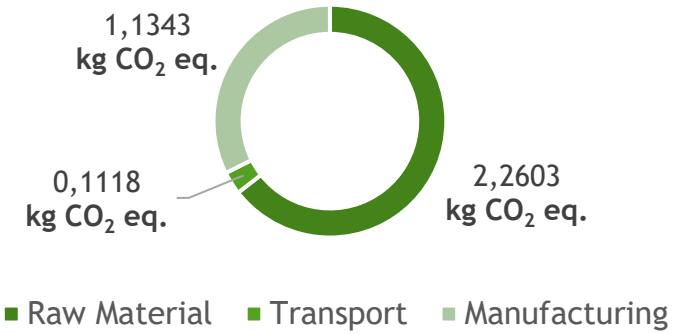


Use of Water
m^3 per kg of product

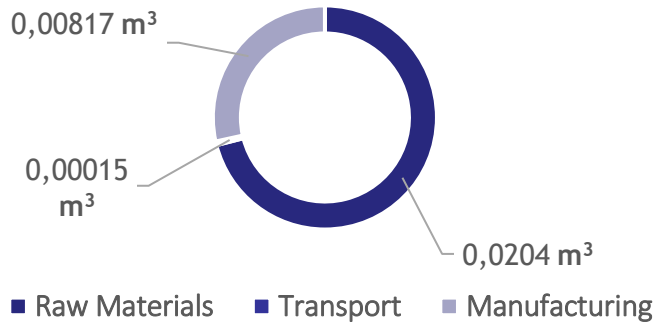


WMT & HF

Global Warming Potential
kg CO_2 eq. per kg of product

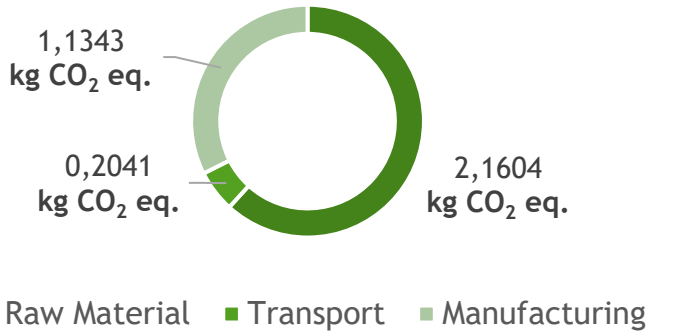


Use of Water
m^3 per kg of product

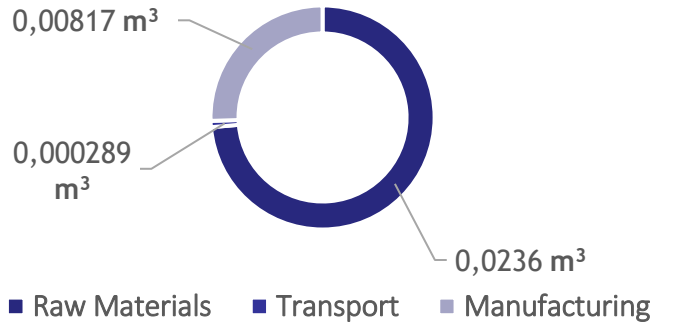


WMM

Global Warming Potential
kg CO_2 eq. per kg of product



Use of Water
m^3 per kg of product



References

EN 15804:2012+A1:2013 “Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products”

International EPD® System, General Program Instructions for the International EPD System, version 3.1

International EPD® System, PCR 2012:01 “Construction products and construction services, version 2.33”

International Organization for Standardization (ISO), Environmental labels and declarations – Type III environmental declarations – Principles and procedures. ISO 14025:2006

International Organization for Standardization (ISO), Environmental management – Life Cycle assessment – Principles and framework. ISO 14040:2006

International Organization for Standardization (ISO), Environmental management – Life Cycle assessment – Requirements and guidelines. ISO 14040:2006

Environmental Product Declaration

THRACE Needle-Punched Nonwoven Geotextiles

In accordance with ISO 14025 and EN 15804 + A1

EPD Registration Number	Publication Date	Date of Validity	Program	Program operator	CPC
S-P-02479	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

Owner of the EPD

Thrace Nonwovens & Geosynthetics S.A.

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Site: Magiko Xanthi, GR-671 00 Xanthi, Greece

T: +30 2541 045712

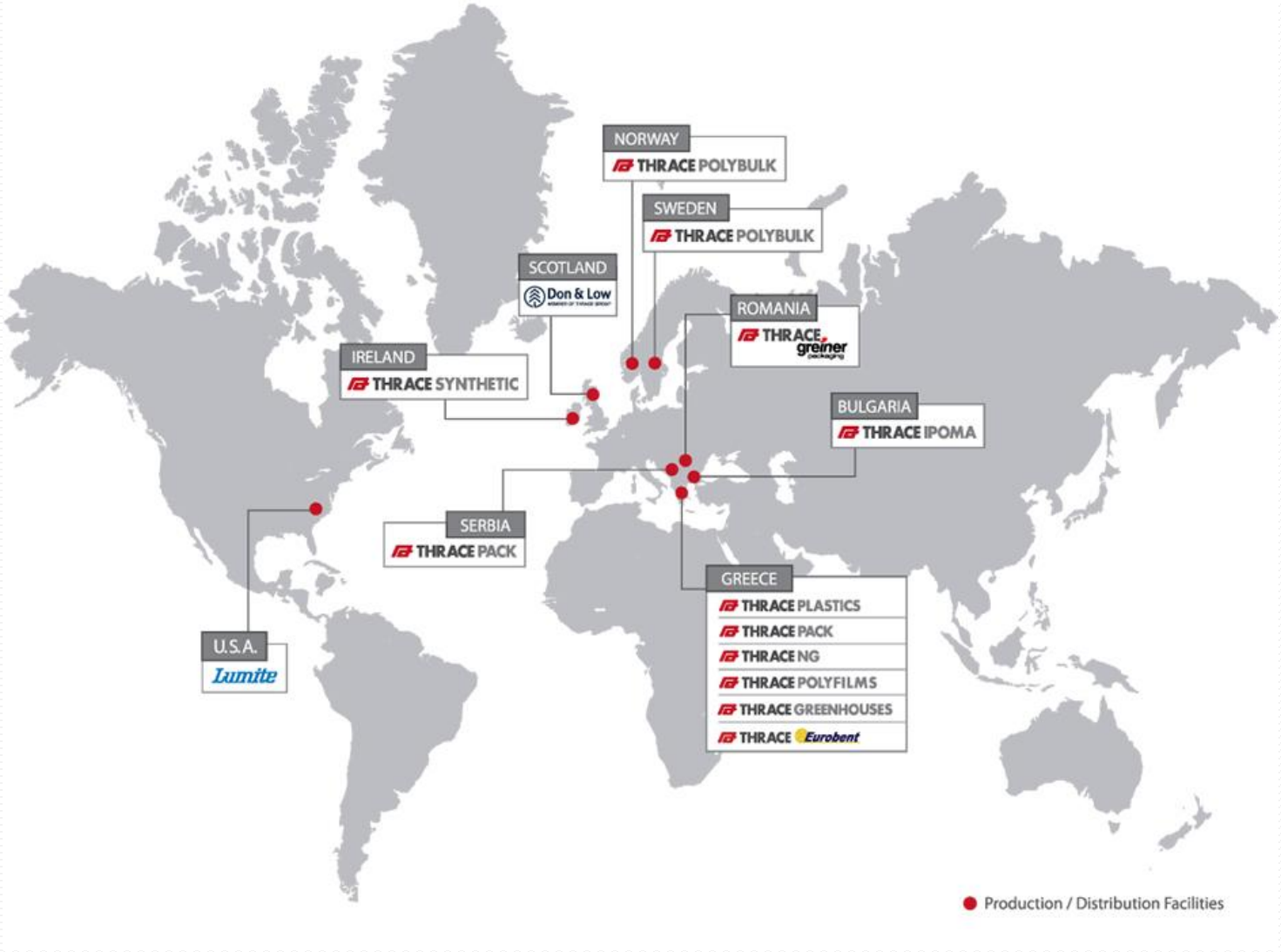
qualitycontrol@thraceplastics.gr

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

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

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.

Nonwoven Geotextiles

The Nonwoven geotextiles products covered by the present EPD are divided in two main product categories:
The first one includes **NW Standard**, **SNW Superior** & **PNW Protection** products, while the other includes **CNW Medium**, **G_EX**, **Black versions**, **Anthacite** and **Grey** Nonwoven geotextiles.

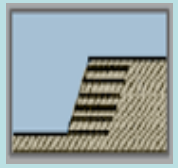
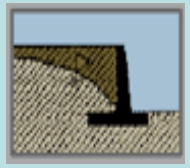
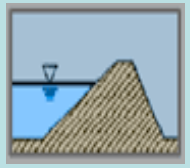
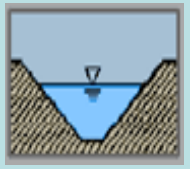
The reference CPC code according to the UN CPC classification system is 369 “Other plastic products”.

Nonwoven geotextiles are ideal for the following applications:

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

NW, SNW Superior, PNW Protection, C_NW, G_EX, Black, Anthacite and Grey Nonwoven geotextiles products are UV stabilized polypropylene needle punched non-woven geotextile and 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.

The construction of the geotextile makes them ideal for the following applications.

								
EN 13249	EN 13250	EN 13251	EN 13252	EN 13253	EN 13254	EN 13255	EN 13257	**EN 13265**
F	F	F	F	F	F	F	F	**F**
R	R	R	D	R	R	R	R	**R**
F+S	F+S	F+S	F+S	F+S	F+S	F+S	F+S	**F+R**
R+S	R+S	R+S	F+D	R+S	R+S	R+S	R+S	
F+R	F+R	F+R	F+S+D	F+R	F+R	F+R	F+R	
F+R+S	**F+R+S**	**F+R+S**		**F+R+S**	**F+R+S**	**F+R+S**	**F+R+S**	

F = Filtration, R = Reinforcement, S = Separation, D = Drainage, P = Protection

Nonwoven Geotextiles

Product description

The studied products are UV stabilized polypropylene needle punched nonwoven geotextiles. Nonwoven geotextiles are resistant to commonly encountered soil chemicals, mildew and insects and is non-biodegradable. Also, nonwoven geotextiles are highly resistant to acid and alkaline environments. 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.

The products covered in the EPD represent the 81.66% of the total Nonwoven geotextiles production (*of the reference year*).

Intended use

Nonwoven geotextiles are used in many civil engineering and building applications. They are specifically designed to offer filtration, separation, and erosion control functions.

Nonwoven geotextiles are offered for various applications such road, railway, and drainage applications. They act as a separator to prevent the intermixing of the different soil layer types, and as a filter to allow the flow of fluids while preventing the passage of soil particles.

EPD®

THRACE NG

Technical data

Indicatively, the technical data of a Nonwoven geotextile will be presented.

Property	NW	S_NW	P_NW	C_NW	Unit
Tensile Strength (EN ISO 10319)	6-84	6-30	5-150	4.5-140	kN/m
Elongation MD/CD (EN ISO 10319)	36/42-80/80	36/4265/65	40/40-75/75	39/39-70/70	%
Resistance to static puncture (EN ISO 12236)	0.86-14	1.05-4.8	1.5-25	0.588-19	kN
Water flow rate (EN ISO 11058)	35-144	45-144	7-180	20-137	l/ (m^2· s)
Mass/ Unit area (EN ISO 9864)	80-1200	80-300	100-2000	90-2000	g/m^2
Dynamic Perforation resistance (EN ISO 13433)	0-48	10-48	0-38	0-40	mm
Characteristic Opening Size (O_{90})	60-128	60-128	50-130	50-130	µm

Property	Test Procedure	G_EX	Unit
Grab Tensile Strength	ASTM D4632	90-380	lbs
Grab Elongation	ASTM D4632	50	%
Trapezoid Tear	ASTM D4533	40-145	lbs
CBR Puncture	ASTM D6241	265-1050	lbs
UV Stability (500 hrs)	ASTM D4355	70	%
Weight	ASTM D5261	3.5-16	oz/yd^2
Permittivity	ASTM D4491	0.7-2.0	sec^{-1}
Water Flow Rate	ASTM D4491	50-150	gpm/ft^2
A.O.S.	ASTM D4751	70-100	U.S. Sieve

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

Nonwoven Geotextiles

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.
The products covered in the EPD represent the 81.66% of the total Nonwoven geotextiles production.

NW, SNW Superior & PNW Protection

Contribution (% in weight) of materials to the declared unit – 1 kg of Nonwoven geotextile	
Polypropylene	98.77
Spin Finish Oil	0.80
UV stabilizer	0.43

CNW, G_EX, Black, Anthacite & Grey

Contribution (% in weight) of materials to the declared unit – 1 kg of Nonwoven geotextile	
Polypropylene	97.7 – 98.67
Colour Masterbatch (carbon black)	0.1 – 1.5
Spin Finish Oil	0.8
UV Masterbatch	0 – 0.43

Nonwoven Geotextiles

The names and densities of the products described in the EPD are defined in the following tables:

Model	Nominal density (g/m^2)	Declared range (g/m^2)
1000CNW	1000	900-1100
100NW	83, 85, 90, 100	74-110
1100NW	1100	990-1210
110NW	110	99-121
120NW	120, 130	108-143
130NW	130	117-143
140NW	120, 127, 130, 140	108-154
170NW	170	153-187
200CNW	200	180-220
200NW	185, 190, 200	166-220
240NWA	240	216-264
270NW	240, 260, 270	216-297
285CNW	270	243-297
300CNW	285, 300	256-330
300NW	295, 300	265-330
325NWA	325	292-358
400NW	330, 400	297-440
500CNW	470	423-517
85NW	85	76-94
850CNW	850	765-935
90CNW	90	81-99

Model	Nominal density (g/m^2)	Declared range (g/m^2)
AS280	170, 180	153-198
AU140NW	140	123-154
AU160NW	160	144-176
CL150NW	150	135-165
CL170NW	170	153-187
CL200NW	190, 200	171-220
CL250NW	250	225-275
G120EX	104	93-115
G125EX	113, 119	101-131
G130EX	129	116-142
G150EX	194	174-214
G160EX	237	213-261
G180EX	271	243-299
G250EX	356	320-392
G275EX	407	366-448
S8NW-C	105	94-116
ME1000NW	1000	900-1100
ME350NW	350, 355	315-391
MES8NW	108	97-119
P150NW	150	135-165
P400NW	400	360-440
P450NW	450	405-495
P500NW	470, 500	423-550
P600NW	570, 600	513-660

Model	Nominal density (g/m^2)	Declared range (g/m^2)
PPN100	100	90-110
PPN155	163	146-180
PPN200	210	189-231
S10NW	120	108-132
S12NW	140	126-154
S13NW	150	135-165
S14NW	155, 160	139-176
S15NW	170	153-187
S16NW	180	162-198
S18NW	200	180-220
S20NW	220, 225, 250	198-275
S22NW	270	243-297
S25NW	285, 300	256-330
S30NW	380	342-418
S6NW	80	72-88
S8NW	100	90-110
S9NW	150, 110	94-121
S8NW-C	105	95-116
NT2	70	63-77
NT3	88	79-97
NT4	128	115-141
NT5	178	160-196
NT6	220	205-245

Nonwoven Geotextiles

More available models covered by this EPD are mentioned in the following tables:

Model	
80NW	315NW-GRK5
90NW	100NWA
190NW	105NWA
220NW-C	125NWA
330NW-C	155NWA
520NW	180NWA
600NW	200NWA
650NW	215NWA
750NW	250NWA
800NW	285NWA
1000NW	400NWA
1200NW	500NWA
160NW-GRK3	600NWA
200NW-GRK3	700NWA
265NW-GRK4	800NWA

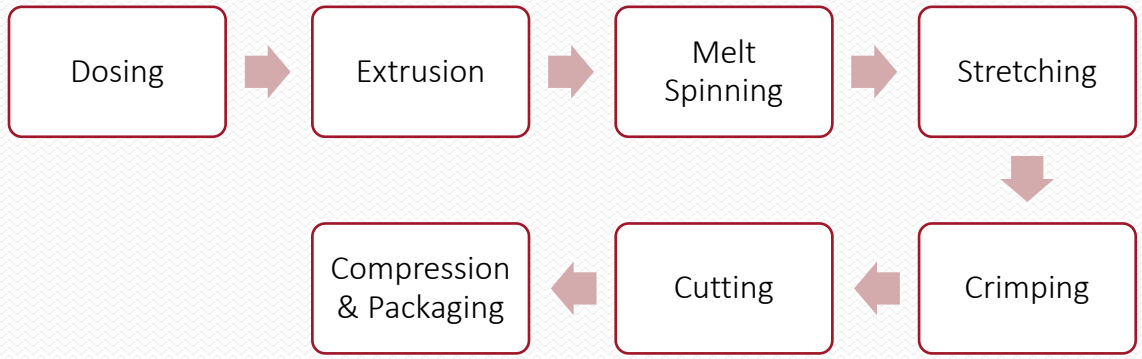
Model	
P100NW	CL100NW
P200NW	CL130NW
P250NW	CL140NW
P300NW	CL160NW
P350NW	CL180NW
P430NW-PR	CL220NW
P700NW	CL240NW
P800NW	CL300NW
P900NW	100CNW
P1000NW	120CNW
P1100NW	150CNW
P1200NW	160CNW
P1300NW	170CNW
P1600NW	250CNW
P2000NW	350CNW

Model	
400CNW	ME300NW
450CNW	ME400NW
600CNW	G140EX
650CNW	G145EX
700CNW	G225EX
800CNW	G245EX
900CNW	G350EX
1100CNW	NT6
1200CNW	100NW black
2000CNW	120NW black
MES10NW	140NW black
MES14NW	200NW black
MES20NW	270NW black
ME140NW	S8NW black
ME200NW	S12NW black

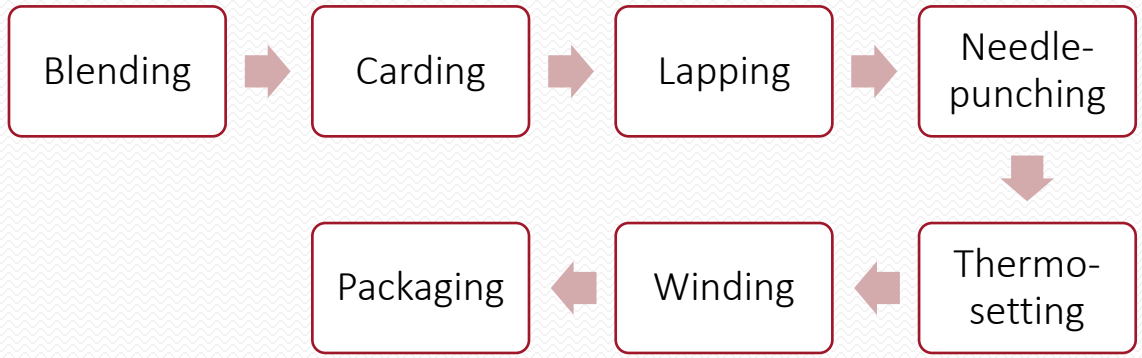
Model
S14NW black
S16NW black
S18NW black
P150NW black
90NW Anthr.
100NW Anthr.
PPN100 Grey
PPN155 Grey
PPN200 Grey
350NW
500NW
P550NW

Manufacturing Process

Staple Fibers production



Fabric Production



This EPD describes the impacts of NW, SNW Superior & PNW Protection, and CNW, G_EX, Black, Anthacite & Grey Nonwoven geotextiles produced in Thrace's NG manufacturing site in Xanthi, Greece, using for each product category weighted average values. The results reported in this EPD, through the two selected reference products, are representative for the two product categories.

Reference service life

The reference service life does not have to be declared, because this LCA does not declare the entire Life Cycle. Therefore, it is a voluntary statement. According to the manufacturer the reference service lifetime of Nonwoven geotextiles is about 100 years in soil temperatures <25 ^{o}C.

Life Cycle Assessment - LCA

Declared Unit

The declared unit is 1 kg of Nonwoven geotextile 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 Nonwoven geotextiles (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.

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 2019 to 2020 were used as reference.
- An uncertainty regarding the packaging process was raised due to the complexity of monitoring the stored packaging materials. Thus, an assumption made which described the packaging material used for the packaging of the manufactured product. PVC cores and Polyethylene film, in percentages 95% and 5% respectively, were assumed to be the main packaging materials used.
- UV Masterbatch was assumed to consist of polypropylene exclusively. 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.
- 9% of the total raw material flows that entered the product system were excluded from the study, as they were used as inputs in another product system. Therefore, raw material data used for the calculation of the potential impact categories are allocated according to the 91% of the total input flows.
- 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. The Nonwoven geotextiles included in the EPD are accounted for the 81.66% of the total production.

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).

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 of Nonwoven geotextile.

NW Standard, SNW Superior & PNW Protection:

Environmental Impact Categories		Impact/ 1 kg of NW Standard, SNW Superior & PNW Protection Nonwoven geotextile			
	Unit	A1	A2	A3	Total
Depletion of abiotic resources (elements)	kg Sb eq.	1.369E-06	6.2763E-09	1.69E-07	**1.544E-06**
Depletion of abiotic resources (fossil)	MJ net calorific value	79.3056	1.0931	10.7054	**91.1041**
Acidification Potential	kg SO_2 eq.	0.00523	0.0004288	0.00392	**0.00958**
Eutrophication Potential	kg PO_4^{-3} eq.	5.531E-04	1.093E-04	1.769E-04	**8.39E-04**
Global Warming Potential (GWP100)	kg CO_2 eq.	2.401	0.07981	1.0335	**3.5140**
Ozone Layer Depletion Potential	kg R-11 eq.	1.313E-14	1.3321E-17	1.775E-14	**3.090E-14**
Photochemical Ozone Creation Potential	Kg C_2H_4 eq.	8.182E-04	-1.889E-04	2.202E-04	**8.494E-04**

Impact Category – Waste categories		Impact/ 1 kg of NW Standard, SNW Superior & PNW Protection Nonwoven geotextile			
	Unit	A1	A2	A3	Total
Hazardous waste disposed	kg	1.726E-08	6.127E-08	3.292E-09	**8.182E-08**
Non-hazardous waste disposed	kg	0.02179	8.917E-05	0.003763	**0.0256**
Radioactive waste disposed	kg	0.001313	1.488E-06	0.0001238	**0.001438**

Life Cycle Assessment - LCA

NW Standard, SNW Superior & PNW Protection:

Impact Category – Use of resources	Unit	Impact/ 1 kg of NW Standard, SNW Superior & PNW Protection Nonwoven geotextile			
		A1	A2	A3	Total
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	3.4587	0.0636	3.5015	**7.0239**
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	3.4587	0.0636	3.5015	**7.0239**
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	38.2442	1.097	11.0223	**50.3637**
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	44.7057	0	0	**44.7057**
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	82.9499	1.097	11.0223	**95.0694**
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	0.01536	1.076E-04	0.006847	**0.0223**

Life Cycle Assessment - LCA

CNW Medium, G_EX, Black versions, Anthacite & Grey Nonwoven geotextile

Environmental Impact Categories		Impact/ 1 kg of CNW Medium, G_EX, Black versions, Anthacite & Grey Nonwoven geotextile			
	Unit	A1	A2	A3	Total
Depletion of abiotic resources (elements)	kg Sb eq.	1.367E-06	6.474E-09	1.69E-07	**1.542E-06**
Depletion of abiotic resources (fossil)	MJ net calorific value	79.219	1.1279	10.7054	**91.0525**
Acidification Potential	kg SO_2 eq.	0.005238	0.0004404	0.00392	**0.00960**
Eutrophication Potential	kg PO_4^{-3} eq.	5.528E-04	1.122E-04	1.769E-04	**8.42E-04**
Global Warming Potential (GWP100)	kg CO_2 eq.	2.4001	0.08193	1.0335	**3.5155**
Ozone Layer Depletion Potential	kg R-11 eq.	1.309E-14	1.375E-17	1.775E-14	**3.086E-14**
Photochemical Ozone Creation Potential	Kg C_2H_4 eq.	8.179E-04	-1.931E-04	2.202E-04	**8.451E-04**

Impact Category – Waste categories		Impact/ 1 kg of CNW Medium, G_EX, Black versions, Anthacite & Grey Nonwoven geotextile			
	Unit	A1	A2	A3	Total
Hazardous waste disposed	kg	1.717E-08	6.3207E-08	3.292E-09	**8.367E-08**
Non-hazardous waste disposed	kg	0.02166	9.198E-05	0.003763	**0.02552**
Radioactive waste disposed	kg	0.001305	1.535E-06	0.000123	**0.00143**

Life Cycle Assessment - LCA

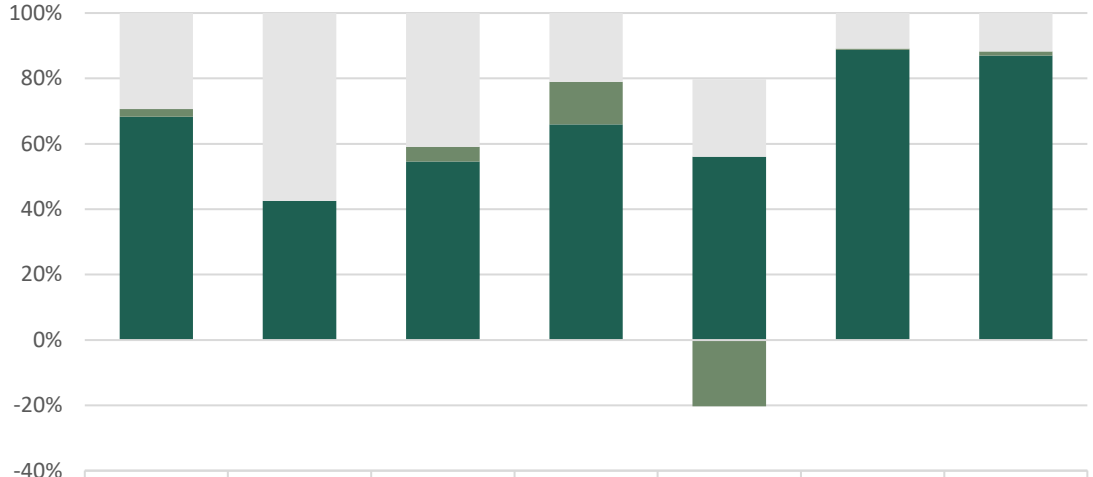
CNW Medium, G_EX, Black versions, Anthacite & Grey Nonwoven geotextile

Impact Category – Use of resources	Unit	Impact/ 1 kg of CNW Medium, G_EX, Black versions, Anthacite & Grey Nonwoven geotextile			
		A1	A2	A3	Total
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value	3.4449	0.06563	3.4816	**6.9922**
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	3.4449	0.06563	3.4816	**6.9922**
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	38.4606	1.1319	11.0223	**50.6149**
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	44.3927	0	0	**44.3927**
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value	82.8533	1.1319	11.0223	**95.0076**
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	0.01545	1.109E-04	0.006847	**0.0224**

Interpretation

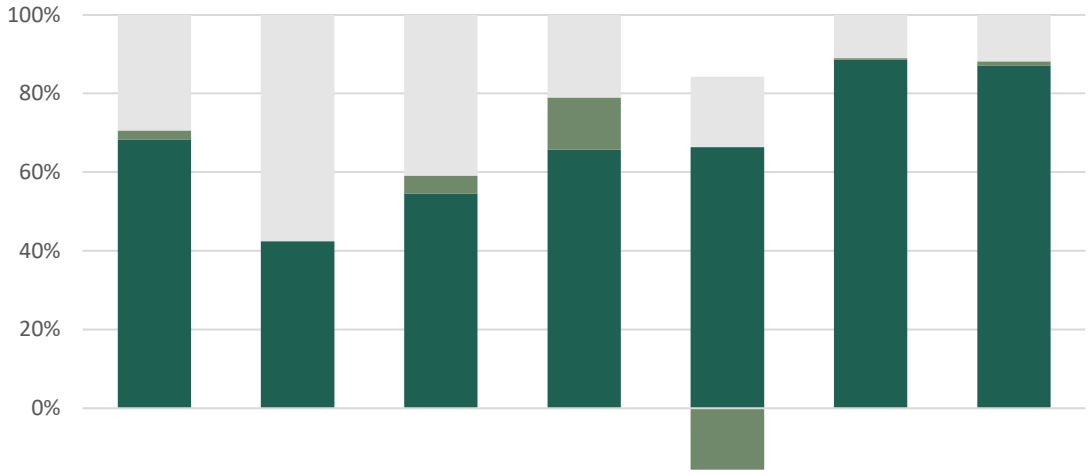
The following figures present the influence of the stages A1, A2, and A3 on the total environmental impact and it can be clearly seen that the analyzed impact categories are mainly influenced by the raw material supply (A1) and the manufacturing stage (A3). It should be noted that many of the impact categories do not differ more than ±10% between the two product sub-categories of Nonwoven geotextiles. However, the results of the environmental impacts are presented separately.

Environmental Impacts
(NW, SNW Superior & PNW Protection)



	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	29,4	57,5	40,9	21,1	17,9	10,9	11,8
A2	2,3	0	4,5	13	-15,4	0,4	1,2
A1	68,3	42,5	54,6	65,9	42,5	88,6	87

Environmental Impacts
(CNW, G_EX, Black, Anthacite & Grey)



	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	29,4	57,5	40,9	21	17,9	11	11,8
A2	2,3	0,04	4,6	13,3	-15,7	0,4	1,2
A1	68,3	42,4	54,6	65,7	66,4	88,6	87

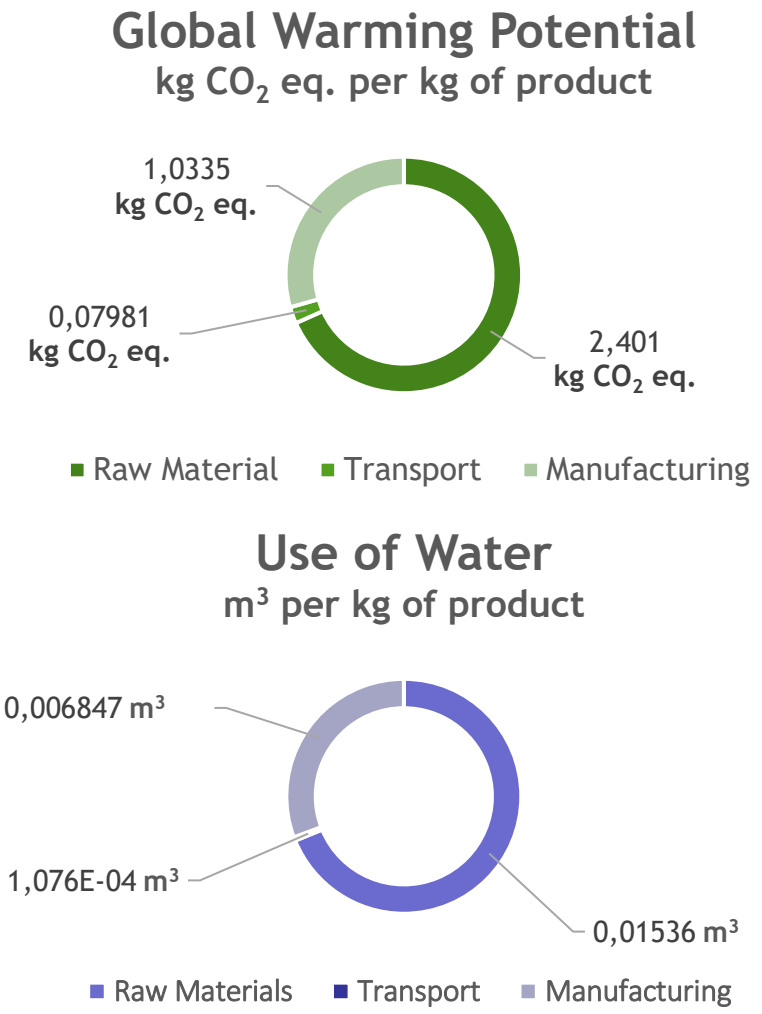
Interpretation

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

The GWP of 1 kg of Nonwoven geotextile is dominated by 68% 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 29.4% of the total impact.

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.

NW , SNW Superior & PNW Protection Nonwoven geotextiles

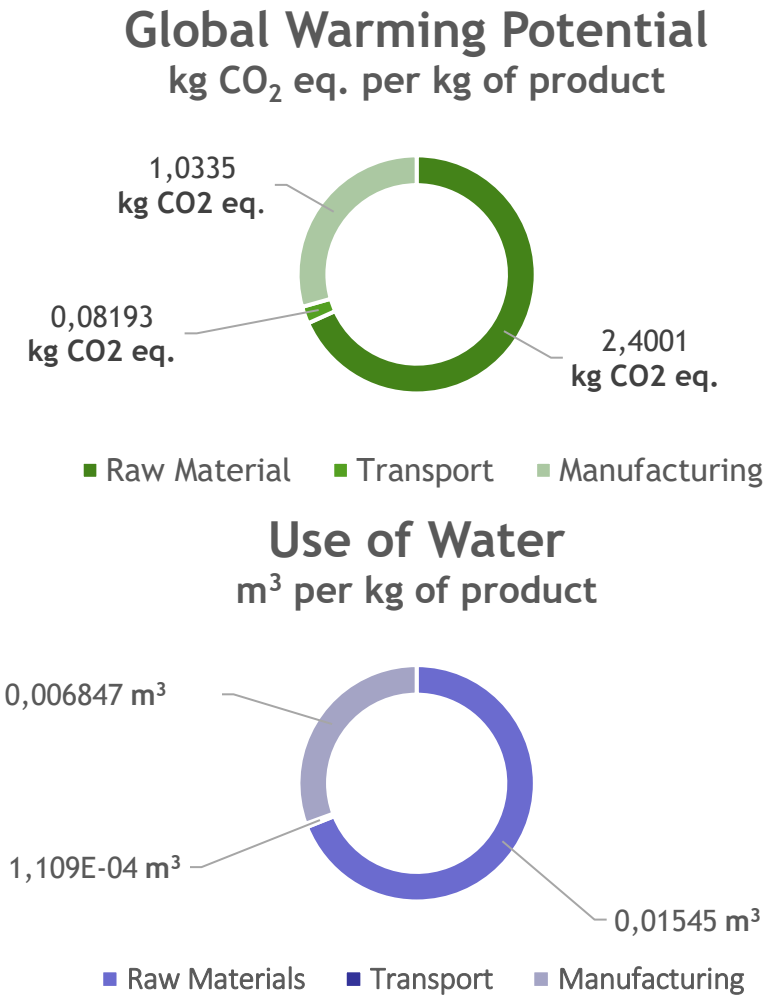


Interpretation

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 categories of the Nonwoven products, raw material supply is responsible for the contribution of 54.6% of the total impact, whereas a similar pattern is followed by the manufacturing processes which contribute to a percentage of 40.9% of the total impact. Transportation stage – A2 is only accountable for 4.5% of the total impact.

A relevant pattern is followed regarding the formation of Eutrophication Potential (EP). However, the transportation stage (A2) holds a larger share of the total impact in comparison to previous cases. Stage A2 is responsible for the contribution of 13% of the total impact, whereas raw material supply (A1) is dominant with a share of 66%.

CNW , G_EX, Black, Anthacite & Grey Nonwoven geotextiles



References

EN 15804:2012+A1:2013 “Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products”

International EPD® System, General Program Instructions for the International EPD System, version 3.1

International EPD® System, PCR 2012:01 “Construction products and construction services, version 2.33”

International Organization for Standardization (ISO), Environmental labels and declarations – Type III environmental declarations – Principles and procedures. ISO 14025:2006

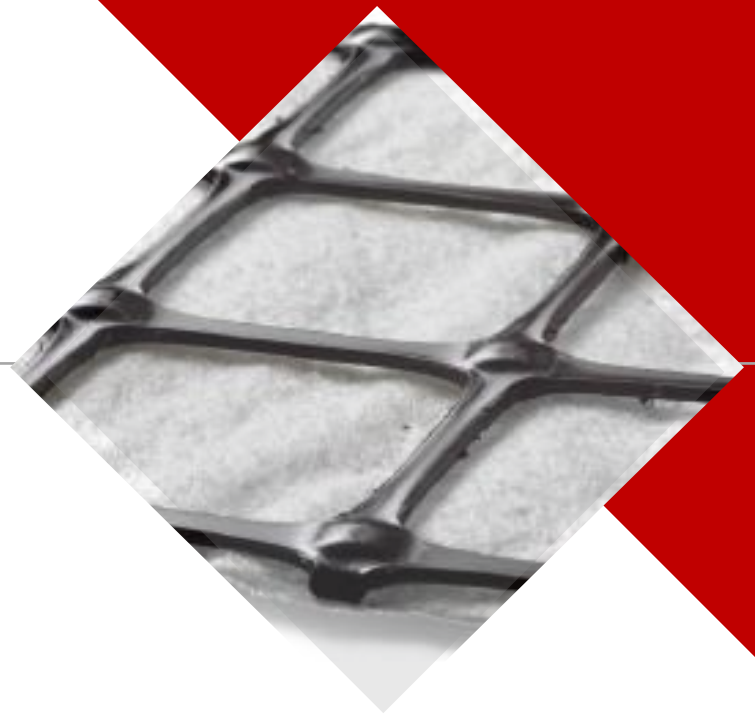
International Organization for Standardization (ISO), Environmental management – Life Cycle assessment – Principles and framework. ISO 14040:2006

International Organization for Standardization (ISO), Environmental management – Life Cycle assessment – Requirements and guidelines. ISO 14040:2006

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

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Box 210 60
SE-100 31 Stockholm, Sweden

www.environdec.com
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Owner of the EPD

Thrace Nonwovens & Geosynthetics S.A.

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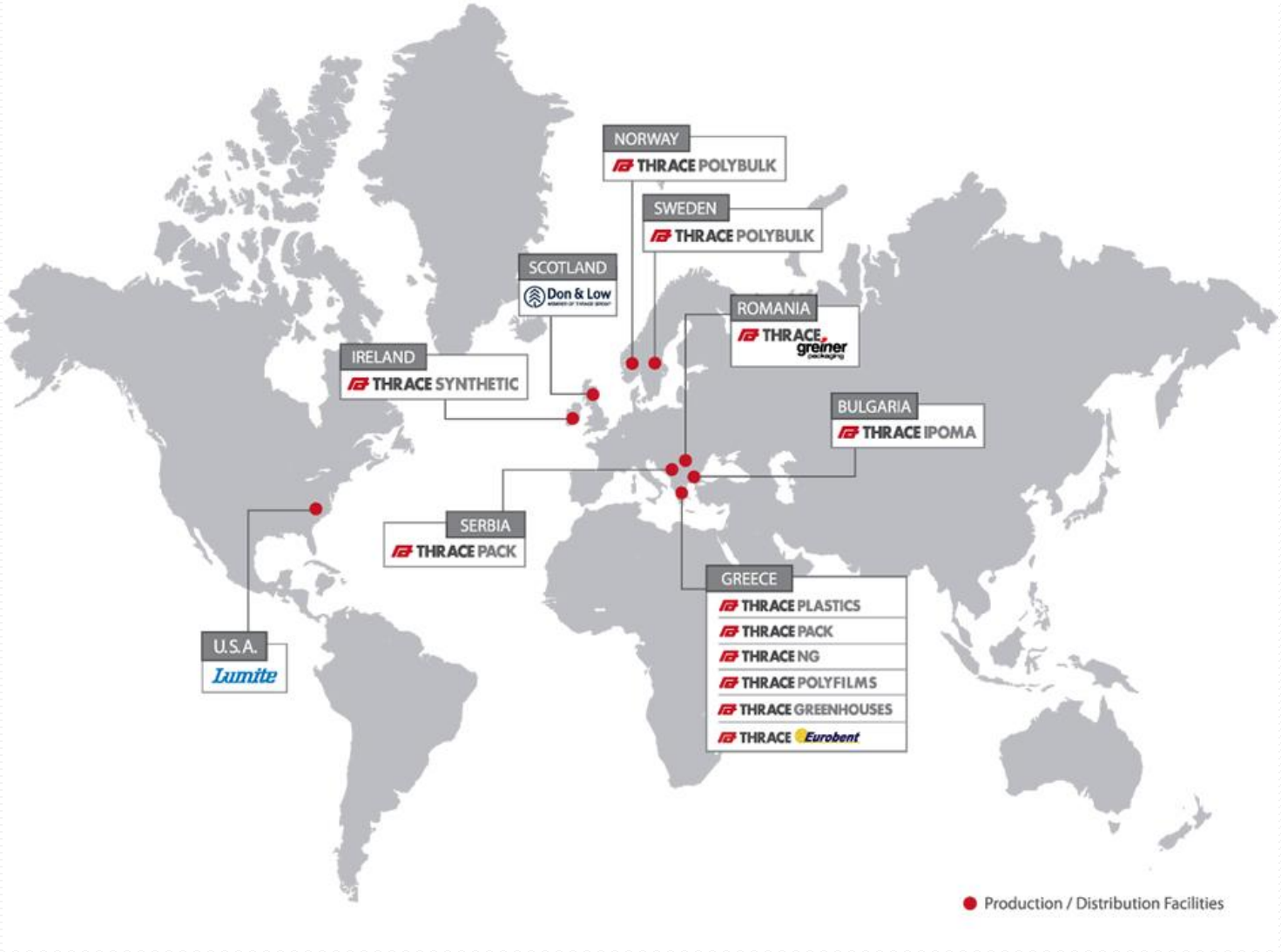
qualitycontrol@thraceplastics.gr

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

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

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:

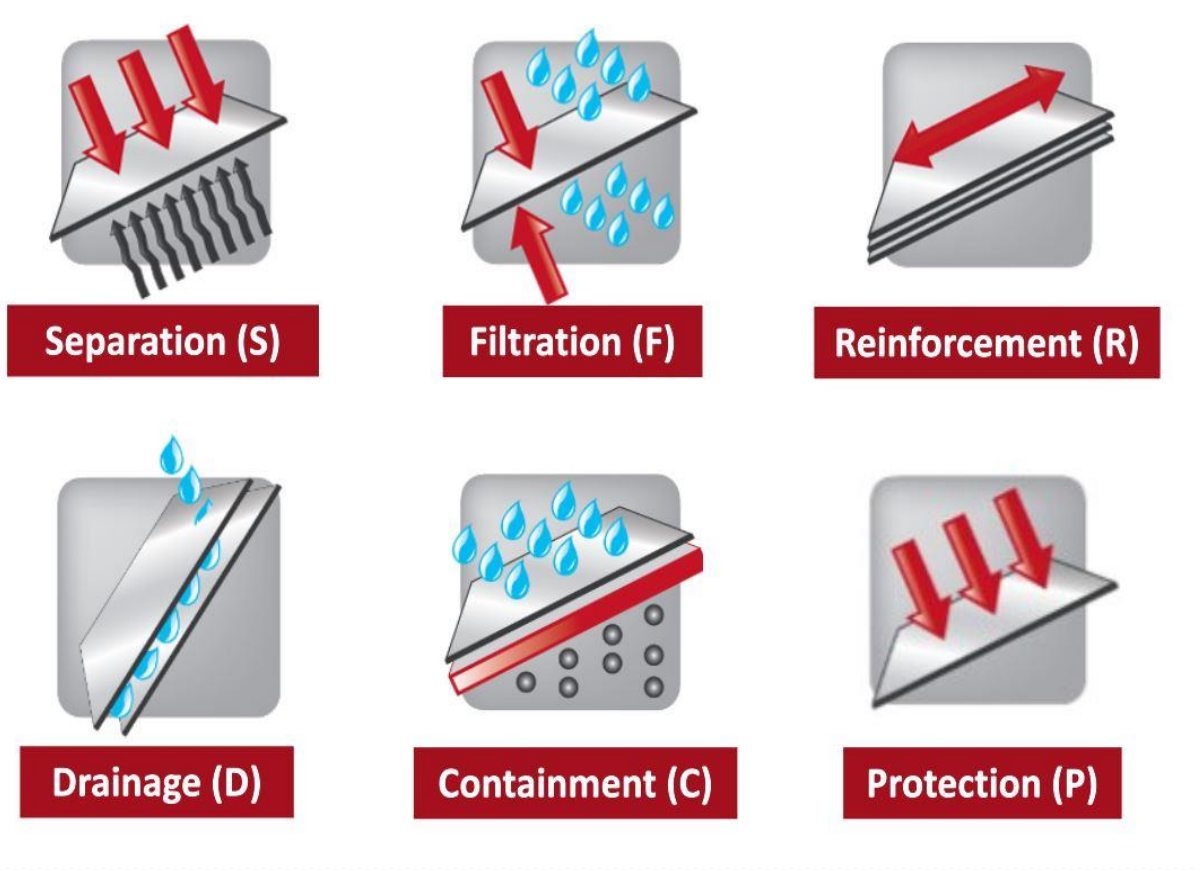
Intended use	Technical Specification	Geogrids Function	Geocomposites Function		
Roads and other trafficked areas	EN 13249	Reinforcement	Filtration	Separation	Reinforcement
Railways	EN 13250	Reinforcement	Filtration	Separation	Reinforcement
Earthworks, foundations and retaining structures	EN 13251	Reinforcement	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/m^2)	Declared range (g/m^2)	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/m^2)	Declared range (g/m^2)	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

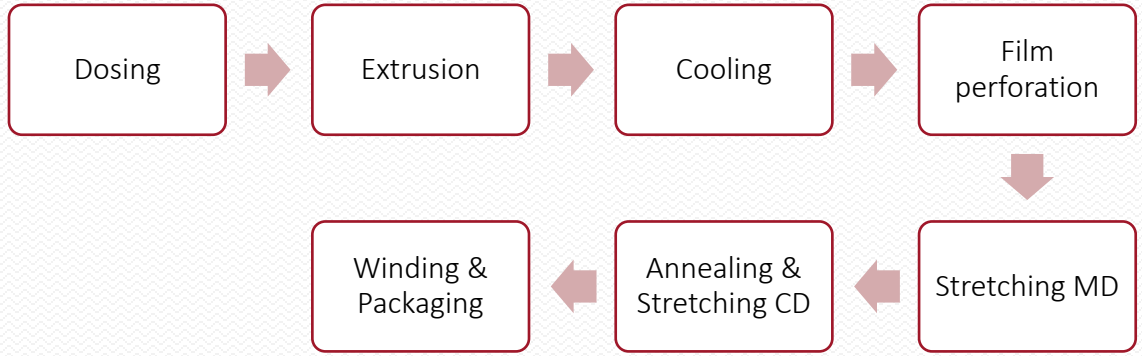
More available models of Geogrids & Geocomposites that are covered by this EPD are mentioned in the following tables.

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

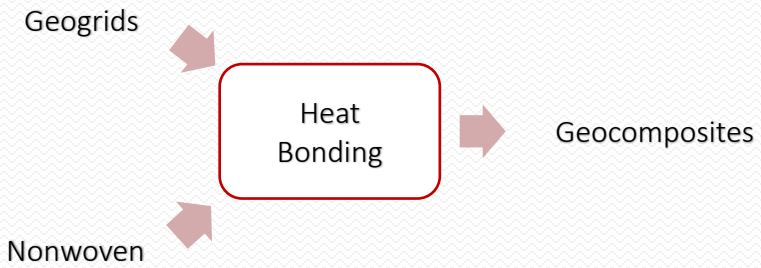
Model	
TGC-20S-170	TGC-30S-S12
TGC-20S-S8	TGC-30S-S30
TGC-20S-S10	TGC-33S-S16
TGC-20S-S12	TGC-33S-S22
TGC-20S-S13	TGC-33L-S8
TGC-20S-S14	TGC-33L-S10
TGC-20S-S18	TGC-40S-170
TGC-20S-S20	TGC-40L-140
TGC-20S-S22	TGC-40L-170
TGC-20S-S25	TGC-40S-S10
TGC-20S-S30	TGC-40S-S25
TGC-30L-S8	TGC-40L-S8
TGC-30L-S10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

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).

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**

Life Cycle Assessment - LCA

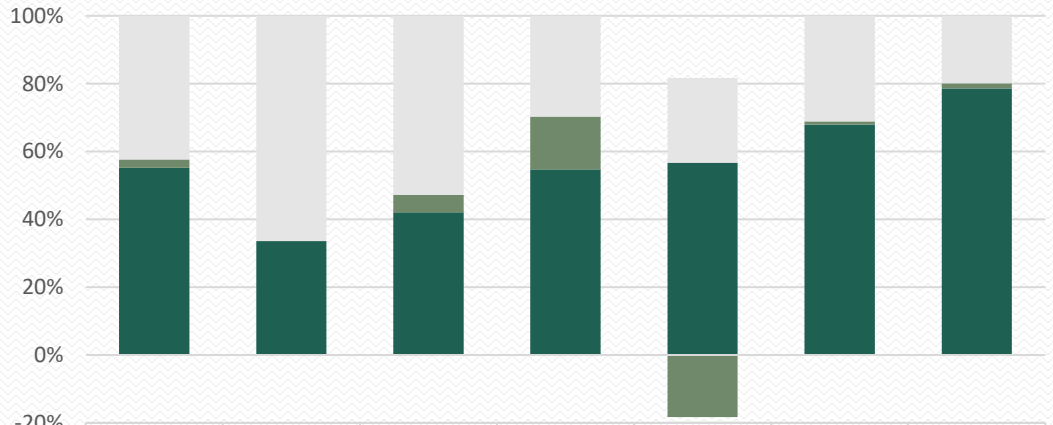
Geocomposites:

Impact Category – Use of resources	Unit	Impact/ 1 kg of Geocomposite			
		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

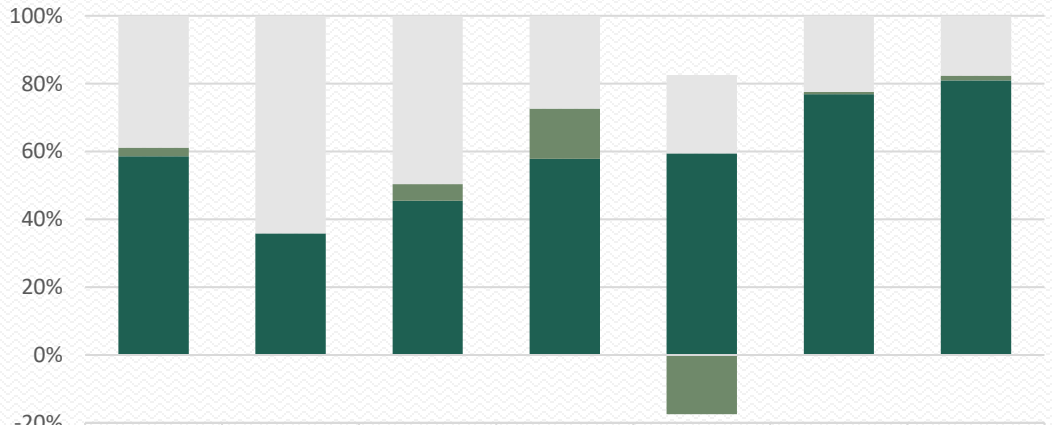
The following figures present the influence of the stages A1, A2, and A3 on the total environmental impact and it can be clearly seen that the analyzed impact categories are mainly influenced by the raw material supply (A1) and the manufacturing stage (A3). The results of the environmental impacts of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

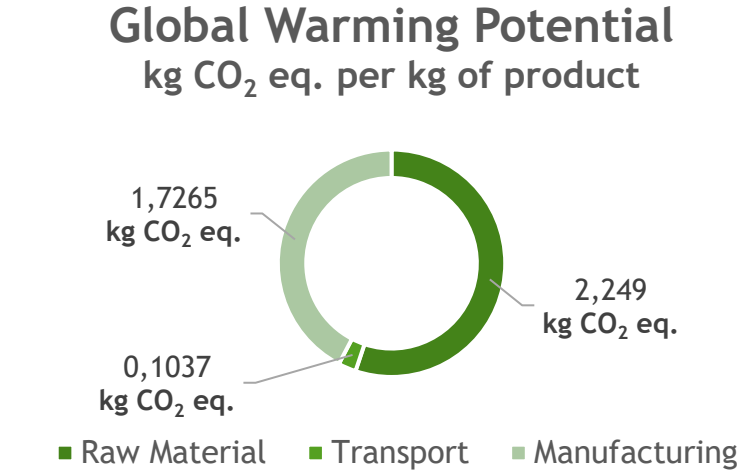
Interpretation

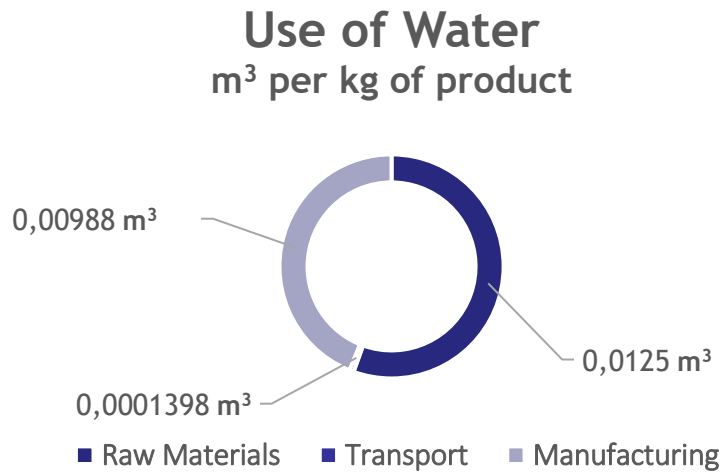
Specifically, the impact categories ADPelement and ADPfossil are largely dominated by the raw material supply stage, whereas impact category ODP is largely influenced by the manufacturing stage.

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



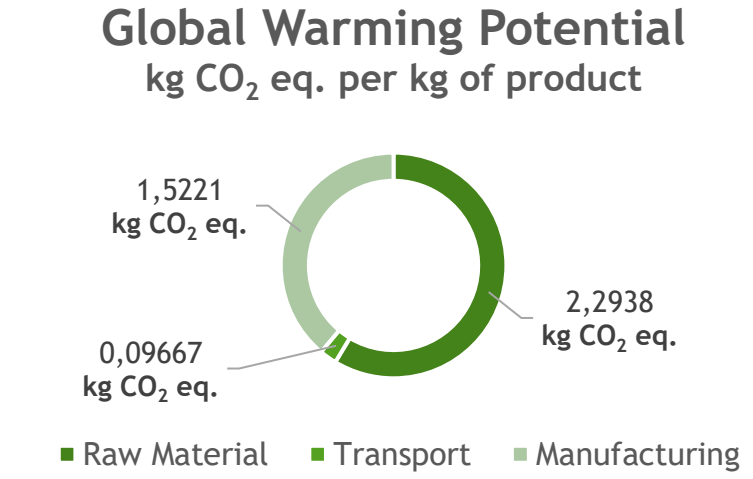


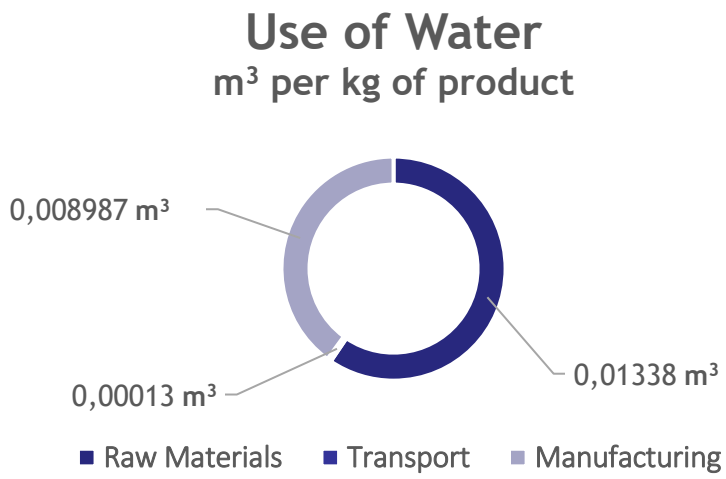
Interpretation

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





References

EN 15804:2012+A1:2013 “Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products”

International EPD® System, General Program Instructions for the International EPD System, version 3.1

International EPD® System, PCR 2012:01 “Construction products and construction services, version 2.33”

International Organization for Standardization (ISO), Environmental labels and declarations – Type III environmental declarations – Principles and procedures. ISO 14025:2006

International Organization for Standardization (ISO), Environmental management – Life Cycle assessment – Principles and framework. ISO 14040:2006

International Organization for Standardization (ISO), Environmental management – Life Cycle assessment – Requirements and guidelines. ISO 14040:2006

EPD®
THE INTERNATIONAL EPD® SYSTEM

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THRACE NG
MEMBER OF THRACE GROUP

ENVIRONMENTAL PRODUCT DECLARATION

PP Multifilament Yarns and **Fibers for Concrete** of Thrace Nonwovens & Geosynthetics S.A.

In accordance with ISO 14025 and EN 15804+A1

Programme	The International EPD® System, www.environdec.com
Programme operator	EPD International AB
EPD registration number	S-P-05536
Publication date	2022-02-01
Valid until	2027-01-31

- COMPANY INFORMATION -

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/fibers. The plant of Thrace Nonwovens & Geosynthetics S.A. is located at Magiko Xanthi, 67100, Greece, in an Industrial Zone, nearby urban areas. The exact geographical coordinates of the plant are 41.05794666622788, 24.896821261376395.

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, staple fibers, multifilament yarns and tapes, HDPE tape and monofilament nets, polypropylene ropes, webbings, monofilament yarns, vapor 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 recognise that personalised 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.

-PRODUCT DESCRIPTION-

The composition of the products is presented in Table below.

Material	By weight (%)
Polypropylene	60-100
Additives	0-20
UV Stabilizer	0-10
Color	0-10

No substance in the "Candidate List of Substances of Very High Concern (SVHC) for authorization" exceeds 0.1% by weight in the final products.

Picture 1: Multifilament yarns

Multifilament Yarns are the ideal starting material for weaving, braiding and twisting. Their technical characteristics offer excellent resistance to acids and alkalis. They all offer superior technical parameters, with high tenacity, chemical resistance and flexibility. The multifilament yarns fulfil the requirements of the EU Construction Products Regulation **305/2011** and are regularly used for the production of geotextiles and related products. Other applications include production of filtration fabrics, slings, braided ropes, webbings, sewing, nets, belts, etc.

Picture 2: Fibers for concrete

Fibers for concrete are high-performance high-tenacity polypropylene **Class 1a microfibers** used for crack control of concrete, which fulfil the requirements of the EU Construction Products Regulation **305/2011** and amendments, and the specifications of the European Standard **EN 14889-2**. They are highly resistant to chemicals, especially in highly alkaline environments, such as concrete, mortar and grout, and have a round cross section. They are specially engineered and manufactured for use in concrete, mortar or grout, at a minimum recommended dosage rate of 0.9kg per cubic meter of concrete. The main applications of the fibers is in floor slabs, driveways, precast units, building restoration, pools etc.

-TECHNICAL CHARACTERISTICS-

PP MULTIFILAMENT NATURAL YARNS

Property	Standard	Unit	Nominal Value									Tolerance
Linear Density	ISO 2060	Denier	300	400	600	840	1000	1200	1500	2000	3000-5000	±5%
Elongation	ASTM D2256	%	24	30	22	22	22	22	22	22	22	±25%
Tenacity	ASTM D2256	gr/den	4.3	6	7	7	7	7	7	7	6.5	minimum
Shrinkage	Testrite 3min @ 120°C	%	1-3	1-3	4-6	3-5	3-5	2-4	2-4	2-4	2-4	
UV resistance[5]	ASTM G154	%	30	30	30	30	30	30	30	30	30	minimum
Bobbin dimensions		Intermingled or Parallel - Bobbin length 300mm (300Den-150mm), internal diameter 75mm - weight up to 8 kg										
		Twisted (400den and up) - Bobbin length 282mm, internal diameter 73mm - weight up to 5 kg										
Twisting		Intermingled, Parallel or Twisted 40-250 tpm, S or Z are available upon request.										

PP MULTIFILAMENT COLORED YARNS

Property	Standard	Unit	Nominal Value									Tolerance
Linear Density	ISO 2060	Denier	300	400	600	840	1000	1200	1500	2000	3000	±5%
Tensile elongation @peak	ASTM D2256	%	25	25	22	22	22	22	22	22	22	±25%
Tenacity @peak	ASTM D2256	gr/den	4	5	5	6	6	6	6	6	6	minimum
Shrinkage	Testrite 3min @ 120°C	%	1-3	1-3	4-6	3-5	3-5	2-4	2-4	2-4	2-4	
UV resistance[5]	ISO 21898	%	50	50	50	50	50	50	50	50	50	minimum
Bobbin dimensions		Intermingled or Parallel - Bobbin length 300mm (300Den-150mm), internal diameter 75mm - weight up to 8 kg										
		Twisted (400den and up) - Bobbin length 282mm, internal diameter 73mm - weight up to 5 kg										
Twisting		Intermingled, Parallel or Twisted 40-250 tpm, S or Z are available upon request.										

-TECHNICAL CHARACTERISTICS-

PP FIBERS FOR CONCRETE

Properties	Method	Units	Nominal Value
PHYSICAL PROPERTIES			
Length*	Optically	mm	3-54mm (±10%) upon request
Diameter	Optically	µm	~32 (±10%)
Specific Gravity	Bibliography	g/cm^3	0.905
Melting point	ISO 11357-3	°C	~165
MECHANICAL PROPERTIES			
Linear Density	EN 13392	dtex	7.5 (±10%)
Tenacity	EN ISO 2062	cN/dtex	6.2 (-13%)
		MPa	560 (-13%)
Tensile elongation	EN 14899-2	%	22 (±4)
Young's modulus**	EN 14899-2	GPa	6.2
Effect on consistence of concrete (900gr fibers/m^3 of concrete)***	EN 12350-3, EN 12350-4	VEBE time 10s	1.26-1.28s
Consistency of the reference concrete***	EN 12350-3, EN 12350-4	VEBE time 7s	1.25s
FIBER CHARACTERISTICS			
Composition type	100% PP		
Cross section area	round		
UV stabilization	~150kLy		
Chemical resistance	Excellent resistance to acids and alkali		

* Available lengths: in multiples of 3, up to 54mm
**Calculated at 1% strain
***values validated for fiber lengths of 6 and 12 mm

Fiber Length	mm	3	6	12	18	21	30	51	54
Estimated Number of fibers per kg	millions	444	222	111	74	63	44	26	25

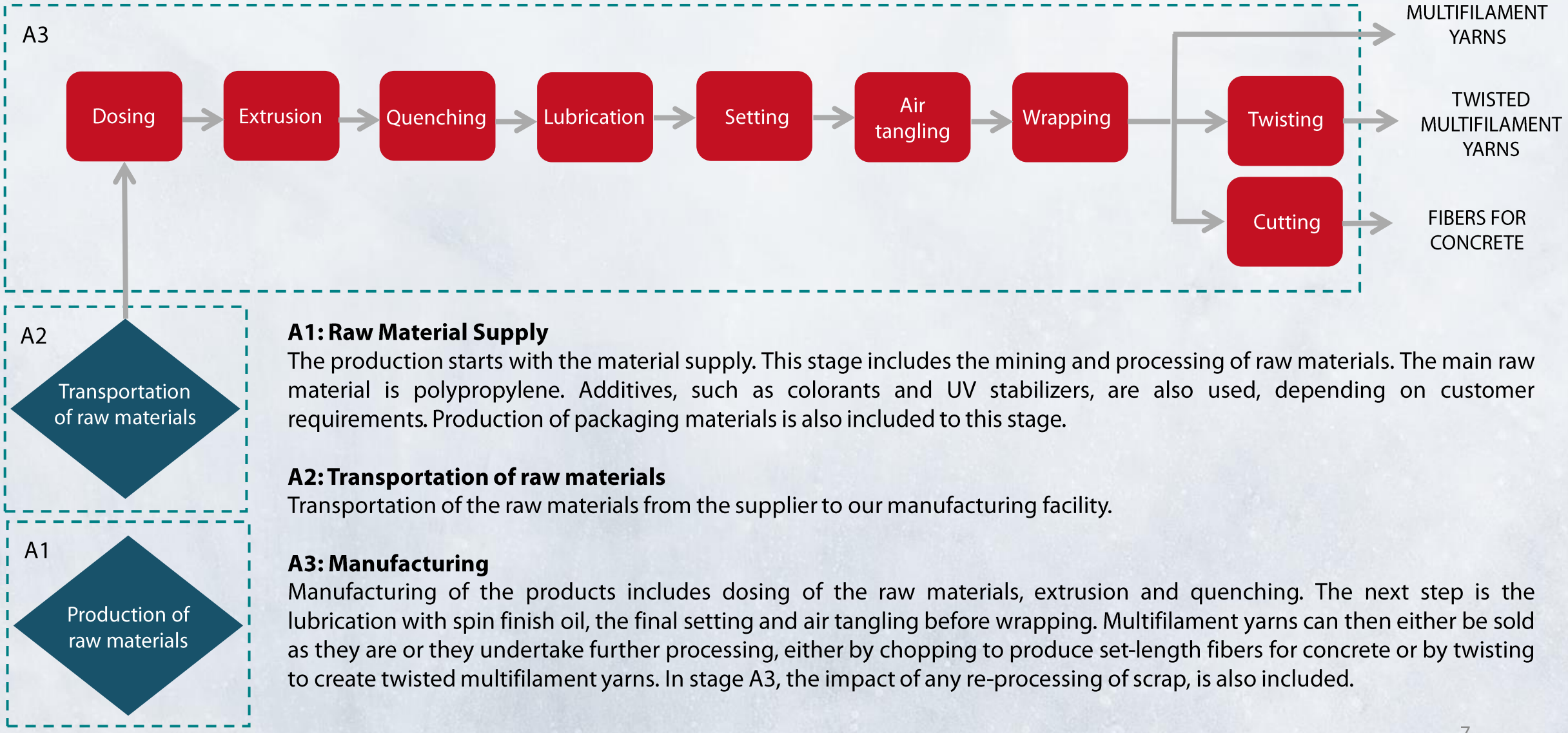
- SYSTEM BOUNDARIES -

The scope of the study is set to be ***Cradle-to-gate***. The system's boundaries are described in more detail below:

Product stage			**Construction stage**		**Use stage**							**End-of-life stage**				**Resource recovery stage**
Raw Materials Supply	**Transport**	**Manufacturing**	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction and demolition	Transport	Waste processing for reuse, recovery and/or recycling	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	MND	MND	MND	MND	MND

Modules of EPD, X=Included and MND=Module not Declared

- SYSTEM BOUNDARIES -



A1: Raw Material Supply
The production starts with the material supply. This stage includes the mining and processing of raw materials. The main raw material is polypropylene. Additives, such as colorants and UV stabilizers, are also used, depending on customer requirements. Production of packaging materials is also included to this stage.

A2: Transportation of raw materials
Transportation of the raw materials from the supplier to our manufacturing facility.

A3: Manufacturing
Manufacturing of the products includes dosing of the raw materials, extrusion and quenching. The next step is the lubrication with spin finish oil, the final setting and air tangling before wrapping. Multifilament yarns can then either be sold as they are or they undertake further processing, either by chopping to produce set-length fibers for concrete or by twisting to create twisted multifilament yarns. In stage A3, the impact of any re-processing of scrap, is also included.

- LCA INFORMATION -

DECLARED UNIT
The declared unit is 1 kg of product.

GOAL AND SCOPE
This EPD evaluates the impacts of 1 kg of polypropylene multifilament yarns and fiber for concrete from Cradle-to-Gate, produce by Thrace NG, at Magiko Plant.

GEOGRAPHICAL SCOPE
Worldwide

SOFTWARE AND DATABASE
Microsoft Excel is used to perform the LCA. Background data is sourced from Ecoinvent 3.7.1 Cut-off lci via software OpenLCA 1.10.3.

DATA QUALITY
ISO 14044 was applied in terms of data collection and quality requirements. The impact of the production of raw materials recovered from Ecoinvent database v.3.7.1. The data concerning the modules A2 (Transportation) and A3 (Product manufacturing) were provided by Thrace NG and concerns 1/9/2019-29/2/2020. These data were the quantities of all input and output materials extracted from the company's ERP system, the energy consumed, the waste management and the distances and means of transport for each input stream. Regarding electricity mix, the latest (2020) national residual electricity mix as published in DAPEEP SA was utilized.

ASSUMPTIONS
- For A2 the road and sea transportation a lorry 7,5-16 metric ton, EURO5 and bulk carrier for dry goods were used respectively.
- The color masterbatch is assumed to be 40% carbon black and 60% polypropylene.
- The UV Stabilizer is assumed to be 100% of polypropylene.

CUT-OFF RULES
The cut-off rule for insufficient data that are less than 1% of the total input mass and less than 5% of energy usage and mass per module was applied.

TIME REPRESENTIVENESS
All primary data used in this study is from 1/9/2019-29/2/2020 due to absence of measurement system for an entire year because of relocation of the plant. However, the production is not seasonal and as a result, this absence of data does not affect the results.

ALLOCATIONS
Wherever possible allocation was avoided by dividing the unit process to be allocated into two or more sub-processes and collecting the input and output data related to these sub-processes. When needed allocation based on physical properties and specifically on mass were used. The electricity of each machine for manufacturing and for other utilities, such as lighting, was allocated by mass of the produced products. Packaging materials and scrap were allocated by mass of the final products.

- ENVIRONMENTAL PERFORMANCE INDICATORS -

PP MULTIFILAMENT NATURAL (UNCOLORED) YARN

ENVIRONMENTAL IMPACTS	Unit	A1	A2	A3	A1-A3
Global Warming Potential	kg CO_2 eq	2,02E+00	5,54E-02	7,92E-01	2,87E+00
Ozone Depletion Potential	kg CFC-11 eq	4,59E-08	9,78E-09	4,43E-08	1,00E-07
Acidification Potential	Kg SO_2 eq	6,26E-03	1,91E-04	3,73E-03	1,02E-02
Eutrophication Potential	kg $PO4^{-3}$ eq	1,68E-03	4,05E-05	3,57E-03	5,29E-03
Photochemical Ozone Creation Potential	kg C_2H_4 eq	4,19E-04	7,07E-06	1,56E-04	5,81E-04
Depletion of abiotic resources potential (Elements)*	kg Sb eq	1,49E-05	2,65E-07	1,57E-06	1,67E-05
Depletion of abiotic resources potential (Fossil)*	MJ	7,02E+01	8,13E-01	9,47E+00	8,05E+01

WASTE CATEGORIES	Unit	A1	A2	A3	A1-A3
Hazardous waste disposed	kg	1,25E-05	2,23E-06	6,04E-06	2,08E-05
Non-hazardous waste disposed	kg	1,80E-01	3,30E-02	4,59E-02	2,58E-01
Radioactive waste disposed	kg	4,90E-05	5,66E-06	8,49E-05	1,40E-04

*The results of these environmental impact indicators shall be used with care as the uncertainties of these results are high or as there is limited experienced with the indicator.

- ENVIRONMENTAL PERFORMANCE INDICATORS -

PP MULTIFILAMENT NATURAL (UNCOLORED) YARN

RESOURCE USE	Unit	A1	A2	A3	A1-A3
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	2,97E+00	1,35E-02	2,03E+00	5,01E+00
Use of renewable primary energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renewable primary energy resources	MJ	2,97E+00	1,35E-02	2,03E+00	5,01E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	7,43E+01	8,35E-01	1,48E+01	9,00E+01
Use of non-renewable primary energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-renewable primary energy resources	MJ	7,43E+01	8,35E-01	1,48E+01	9,00E+01
Use of secondary materials	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of non-renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m^3	2,36E-02	1,02E-04	1,05E-02	3,42E-02

- ENVIRONMENTAL PERFORMANCE INDICATORS -

PP MULTIFILAMENT COLORED YARN

ENVIRONMENTAL IMPACTS	Unit	A1	A2	A3	A1-A3
Global Warming Potential	kg CO_2 eq	2,02E+00	5,72E-02	7,92E-01	2,87E+00
Ozone Depletion Potential	kg CFC-11 eq	5,42E-08	1,01E-08	4,43E-08	1,09E-07
Acidification Potential	Kg SO_2 eq	6,29E-03	1,98E-04	3,73E-03	1,02E-02
Eutrophication Potential	kg $PO4^{-3}$ eq	1,68E-03	4,20E-05	3,57E-03	5,29E-03
Photochemical Ozone Creation Potential	kg C_2H_4 eq	4,19E-04	7,33E-06	1,56E-04	5,82E-04
Depletion of abiotic resources potential (Elements)*	kg Sb eq	1,49E-05	2,74E-07	1,57E-06	1,67E-05
Depletion of abiotic resources potential (Fossil)*	MJ	7,03E+01	8,40E-01	9,47E+00	8,06E+01

WASTE CATEGORIES	Unit	A1	A2	A3	A1-A3
Hazardous waste disposed	kg	1,26E-05	2,30E-06	6,04E-06	2,10E-05
Non-hazardous waste disposed	kg	1,80E-01	3,41E-02	4,59E-02	2,59E-01
Radioactive waste disposed	kg	5,34E-05	5,85E-06	8,49E-05	1,44E-04

*The results of these environmental impact indicators shall be used with care as the uncertainties of these results are high or as there is limited experienced with the indicator.

- ENVIRONMENTAL PERFORMANCE INDICATORS -

PP MULTIFILAMENT COLORED YARN

RESOURCE USE	Unit	A1	A2	A3	A1-A3
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	2,96E+00	1,39E-02	2,03E+00	5,00E+00
Use of renewable primary energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renewable primary energy resources	MJ	2,96E+00	1,39E-02	2,03E+00	5,00E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	7,44E+01	8,63E-01	1,48E+01	9,00E+01
Use of non-renewable primary energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-renewable primary energy resources	MJ	7,44E+01	8,63E-01	1,48E+01	9,00E+01
Use of secondary materials	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of non-renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m^3	2,35E-02	1,06E-04	1,05E-02	3,40E-02

- ENVIRONMENTAL PERFORMANCE INDICATORS -

PP TWISTED MULTIFILAMENT NATURAL (UNCOLORED) YARN

ENVIRONMENTAL IMPACTS	Unit	A1	A2	A3	A1-A3
Global Warming Potential	kg CO_2 eq	2,02E+00	5,54E-02	8,75E-01	2,95E+00
Ozone Depletion Potential	kg CFC-11 eq	4,59E-08	9,78E-09	4,89E-08	1,05E-07
Acidification Potential	Kg SO_2 eq	6,26E-03	1,91E-04	4,11E-03	1,06E-02
Eutrophication Potential	kg $PO4^{-3}$ eq	1,68E-03	4,05E-05	3,94E-03	5,66E-03
Photochemical Ozone Creation Potential	kg C_2H_4 eq	4,19E-04	7,07E-06	1,72E-04	5,98E-04
Depletion of abiotic resources potential (Elements)*	kg Sb eq	1,49E-05	2,65E-07	1,73E-06	1,69E-05
Depletion of abiotic resources potential (Fossil)*	MJ	7,02E+01	8,13E-01	1,05E+01	8,15E+01

WASTE CATEGORIES	Unit	A1	A2	A3	A1-A3
Hazardous waste disposed	kg	1,25E-05	2,23E-06	6,67E-06	2,14E-05
Non-hazardous waste disposed	kg	1,80E-01	3,30E-02	5,06E-02	2,63E-01
Radioactive waste disposed	kg	4,90E-05	5,66E-06	9,38E-05	1,48E-04

*The results of these environmental impact indicators shall be used with care as the uncertainties of these results are high or as there is limited experienced with the indicator.

- ENVIRONMENTAL PERFORMANCE INDICATORS -

PP TWISTED MULTIFILAMENT NATURAL (UNCOLORED) YARN

RESOURCE USE	Unit	A1	A2	A3	A1-A3
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	2,97E+00	1,35E-02	2,24E+00	5,22E+00
Use of renewable primary energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renewable primary energy resources	MJ	2,97E+00	1,35E-02	2,24E+00	5,22E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	7,43E+01	8,35E-01	1,64E+01	9,15E+01
Use of non-renewable primary energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-renewable primary energy resources	MJ	7,43E+01	8,35E-01	1,64E+01	9,15E+01
Use of secondary materials	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of non-renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m^3	2,36E-02	1,02E-04	1,16E-02	3,53E-02

- ENVIRONMENTAL PERFORMANCE INDICATORS -

PP TWISTED MULTIFILAMENT COLORED YARN

ENVIRONMENTAL IMPACTS	Unit	A1	A2	A3	A1-A3
Global Warming Potential	kg CO_2 eq	2,02E+00	5,72E-02	8,75E-01	2,96E+00
Ozone Depletion Potential	kg CFC-11 eq	5,42E-08	1,01E-08	4,89E-08	1,13E-07
Acidification Potential	Kg SO_2 eq	6,29E-03	1,98E-04	4,11E-03	1,06E-02
Eutrophication Potential	kg $PO4^{-3}$ eq	1,68E-03	4,20E-05	3,94E-03	5,66E-03
Photochemical Ozone Creation Potential	kg C_2H_4 eq	4,19E-04	7,33E-06	1,72E-04	5,98E-04
Depletion of abiotic resources potential (Elements)*	kg Sb eq	1,49E-05	2,74E-07	1,73E-06	1,69E-05
Depletion of abiotic resources potential (Fossil)*	MJ	7,03E+01	8,40E-01	1,05E+01	8,16E+01

WASTE CATEGORIES	Unit	A1	A2	A3	A1-A3
Hazardous waste disposed	kg	1,26E-05	2,30E-06	6,67E-06	2,16E-05
Non-hazardous waste disposed	kg	1,80E-01	3,41E-02	5,06E-02	2,64E-01
Radioactive waste disposed	kg	5,34E-05	5,85E-06	9,38E-05	1,53E-04

*The results of these environmental impact indicators shall be used with care as the uncertainties of these results are high or as there is limited experienced with the indicator.

- ENVIRONMENTAL PERFORMANCE INDICATORS -

PP TWISTED MULTIFILAMENT COLORED YARN

RESOURCE USE	Unit	A1	A2	A3	A1-A3
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	2,96E+00	1,39E-02	2,24E+00	5,21E+00
Use of renewable primary energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renewable primary energy resources	MJ	2,96E+00	1,39E-02	2,24E+00	5,21E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	7,44E+01	8,63E-01	1,64E+01	9,16E+01
Use of non-renewable primary energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-renewable primary energy resources	MJ	7,44E+01	8,63E-01	1,64E+01	9,16E+01
Use of secondary materials	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of non-renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m^3	2,35E-02	1,06E-04	1,16E-02	3,51E-02

- ENVIRONMENTAL PERFORMANCE INDICATORS -

PP FIBERS FOR CONCRETE

ENVIRONMENTAL IMPACTS	Unit	A1	A2	A3	A1-A3
Global Warming Potential	kg CO_2 eq	2,02E+00	5,54E-02	8,04E-01	2,88E+00
Ozone Depletion Potential	kg CFC-11 eq	4,59E-08	9,78E-09	4,50E-08	1,01E-07
Acidification Potential	Kg SO_2 eq	6,26E-03	1,91E-04	3,78E-03	1,02E-02
Eutrophication Potential	kg $PO4^{-3}$ eq	1,68E-03	4,05E-05	3,62E-03	5,34E-03
Photochemical Ozone Creation Potential	kg C_2H_4 eq	4,19E-04	7,07E-06	1,58E-04	5,84E-04
Depletion of abiotic resources potential (Elements)*	kg Sb eq	1,49E-05	2,65E-07	1,59E-06	1,67E-05
Depletion of abiotic resources potential (Fossil)*	MJ	7,02E+01	8,13E-01	9,62E+00	8,07E+01

WASTE CATEGORIES	Unit	A1	A2	A3	A1-A3
Hazardous waste disposed	kg	1,25E-05	2,23E-06	6,14E-06	2,09E-05
Non-hazardous waste disposed	kg	1,80E-01	3,30E-02	4,66E-02	2,59E-01
Radioactive waste disposed	kg	4,90E-05	5,66E-06	8,62E-05	1,41E-04

*The results of these environmental impact indicators shall be used with care as the uncertainties of these results are high or as there is limited experienced with the indicator.

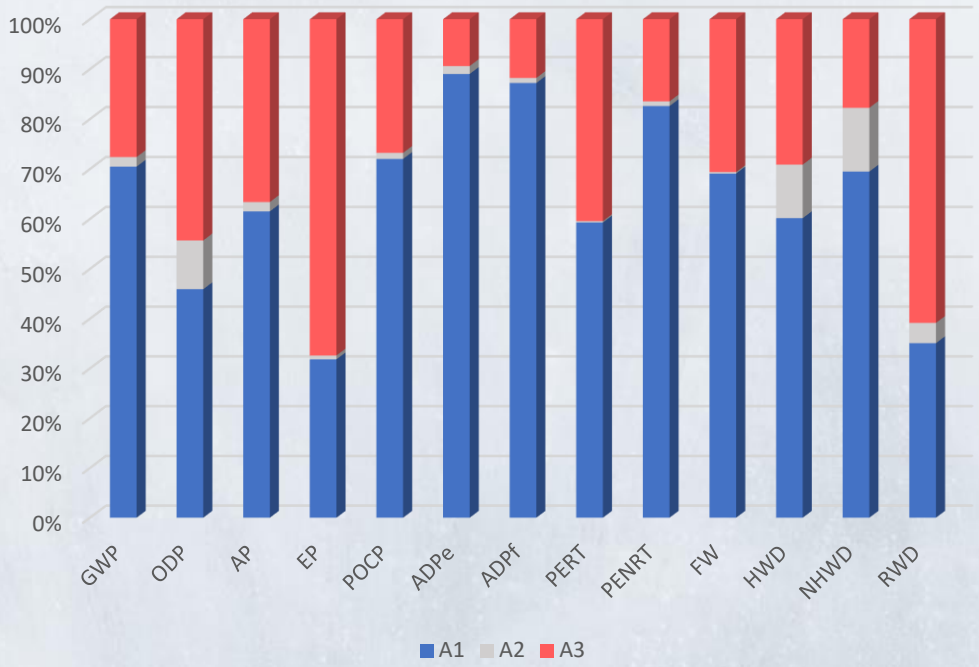
- ENVIRONMENTAL PERFORMANCE INDICATORS -

PP FIBERS FOR CONCRETE

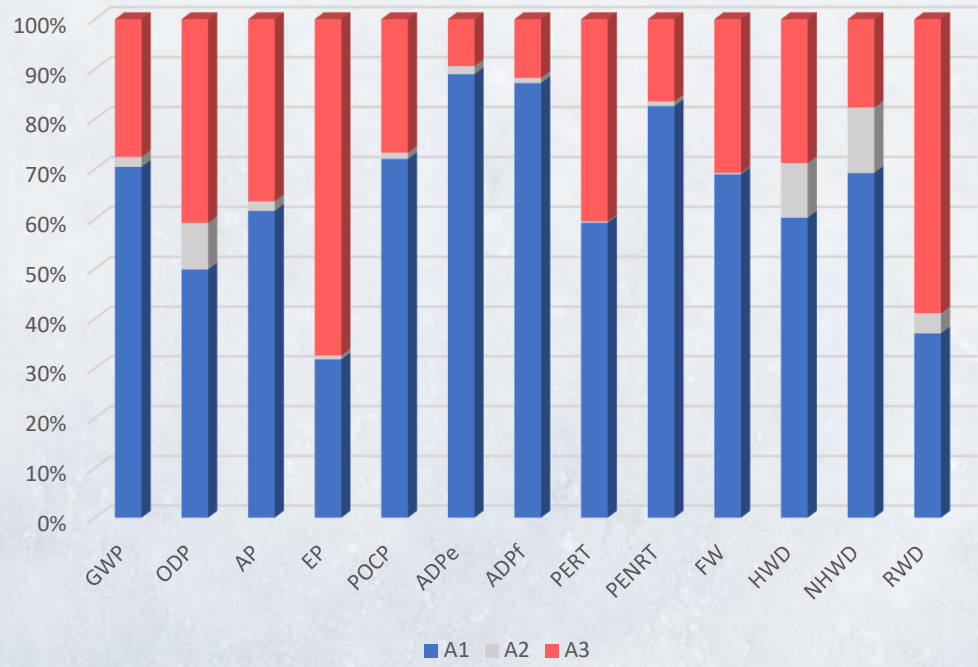
RESOURCE USE	Unit	A1	A2	A3	A1-A3
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	2,97E+00	1,35E-02	2,06E+00	5,04E+00
Use of renewable primary energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renewable primary energy resources	MJ	2,97E+00	1,35E-02	2,06E+00	5,04E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	7,43E+01	8,35E-01	1,50E+01	9,02E+01
Use of non-renewable primary energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-renewable primary energy resources	MJ	7,43E+01	8,35E-01	1,50E+01	9,02E+01
Use of secondary materials	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of non-renewable secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m^3	2,36E-02	1,02E-04	1,06E-02	3,44E-02

- INTERPRETATION -

PP MULTIFILAMENT TRANSPARENT YARN

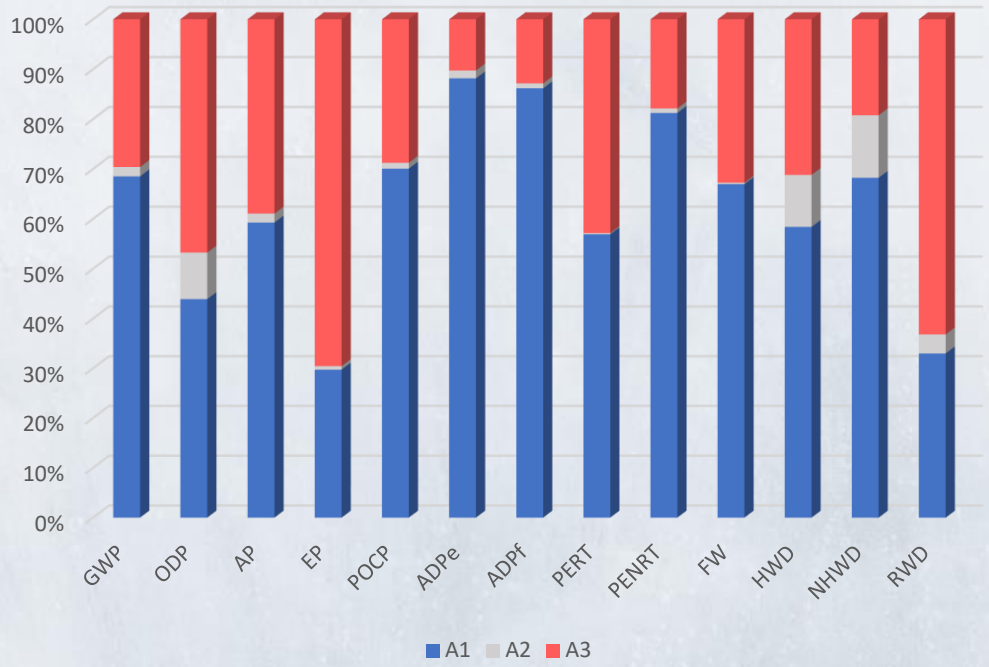


PP MULTIFILAMENT COLORED YARN

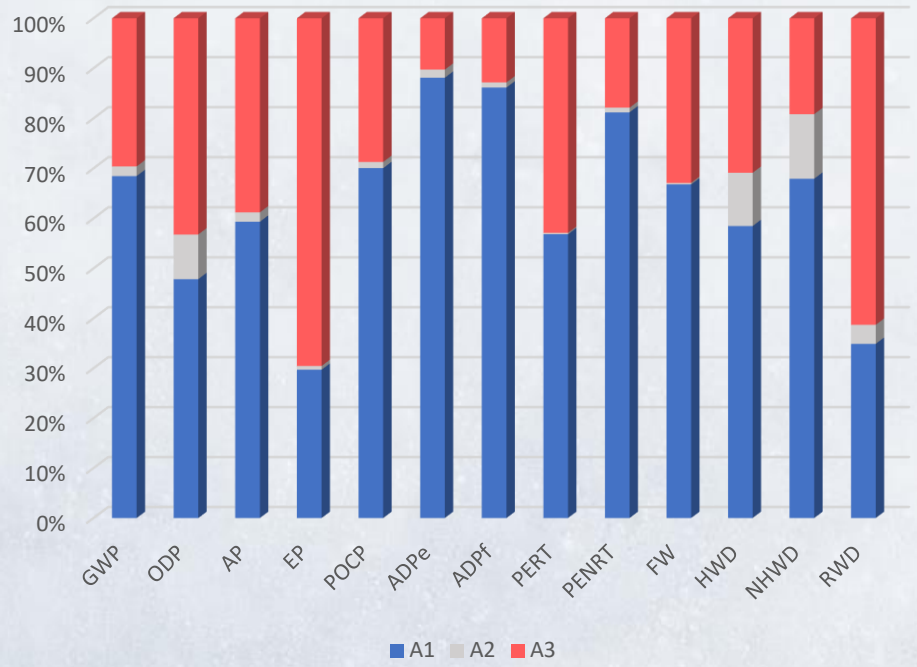


- INTERPRETATION -

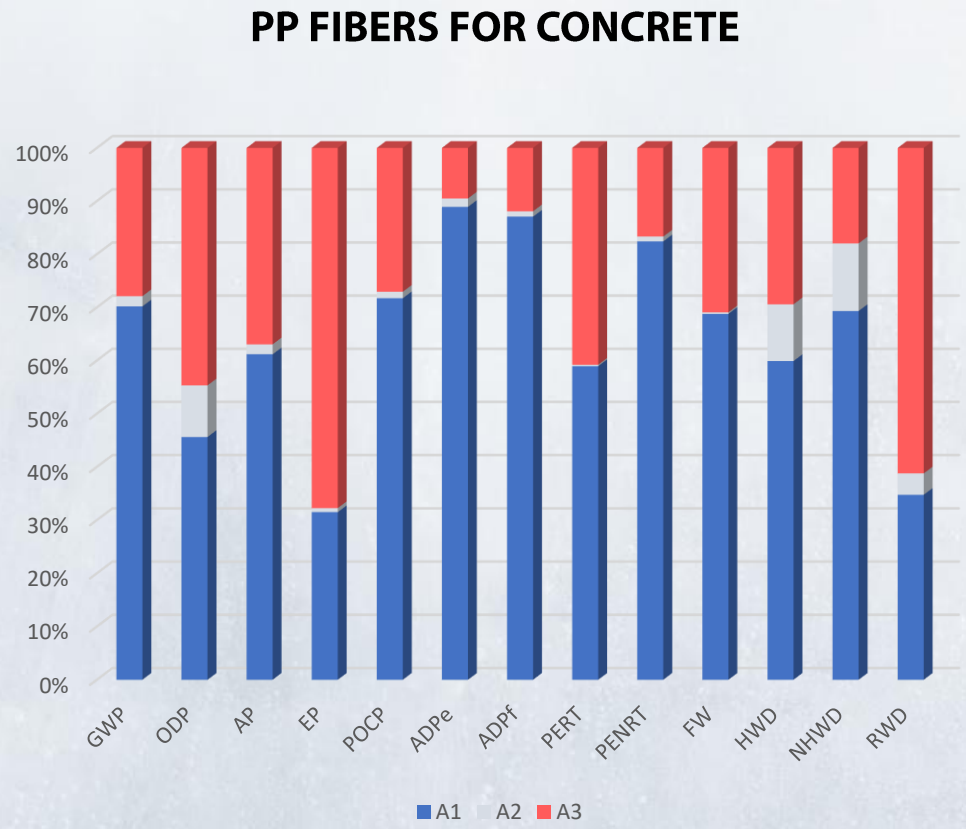
PP TWISTED MULTIFILAMENT TRANSPARENT YARN



PP TWISTED MULTIFILAMENT COLORED YARN



- INTERPRETATION -



- PROGRAMME RELATED INFORMATION -

Product group classification: UN CPC 355 Man-made fibers

The CEN standard EN 15804 serves as the core Product Category Rules

PCR 2012 Construction products and services (EN 15804:A1); Version 2.34; dated 2021-11-08, valid until 2022-02-28

PCR review was conducted by: The Technical Committee of the International EPD® System.

Independent third-party verification of the declaration and data in accordance with ISO 14025:2006

☐ EPD process certification ☒ EPD verification

Procedure for follow-up during EPD validity involves third party verifier

☒ Yes ☐ No

The EPD owner has the sole ownership, liability and responsibility of the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

- REFERENCES -

- ***General Programme Instructions*** *of the International EPD® System. Version 3.01, 2019-09-18*
- ***PCR 2012:01*** v.2.34 Construction products and services. *International EPD® System.* Date 2021-11-08, Valid until 2022-02-28
- ***EN 15804:2012+A1:2013,*** *Sustainability of construction works - Environmental Product Declarations — Core rules for the product category of construction products*
- ***ISO 14020:2000*** *Environmental labels and declarations — General principles*
- ***ISO 14025:2006*** *Environmental labels and declarations - Type III environmental declarations — Principles and procedures*
- ***ISO 14040:2006*** *Environmental management - Life cycle assessment - Principles and framework*
- ***ISO 14044:2006*** *Environmental management - Life cycle assessment - Requirements and guidelines*
- ***Ecoinvent / Ecoinvent Centre***, *www.Eco-invent.org*
- ***Residual Energy Mix 2020*** *from Renewable Energy Sources Operator & Guarantees of Origin (DAPEEP SA)*

- CONTACT INFORMATION -

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