Environmental Product Declaration

as per ISO 14025 and EN 15804 +A1

Owner of the declaration:	HUESKER Synthetic GmbH
Publisher:	Kiwa BCS Öko-Garantie GmbH - Ecobility Experts
Programme holder:	Kiwa BCS Öko-Garantie GmbH - Ecobility Experts
Declaration number:	EPD-HUESKER-096-EN
Issue date:	15.12.2020
Valid to:	14.12.2025

Fortrac® T

Highly resilient, flexible geogrid with a proven track record in soil reinforcement

1. General information

HUESKER Synthetic GmbH

Programme holder
Kiwa BCS Öko-Garantie GmbH
- Ecobility Experts
Marientorbogen 3-5
90402 Nürnberg
Germany

Declaration number
EPD-HUESKER-096-EN

This declaration is based on the Product Category Rules
PCR B - Technical textiles (draft) 2020-10-01

Issue date
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Valid to
14.12.2025

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Fortrac® T

Owner of the declaration
HUESKER Synthetic GmbH
Fabrikstraße 13-15
48712 Gescher
Germany

Declared product / declared unit
1 m^2 geogrid

Scope
Fortrac® T is a highly resilient, flexible geogrid with a proven track record in soil reinforcement. The product based on PET fiber and manufactured in Gescher and Dülmen, Germany. The EPD is based on the composition of the product 110 T (unit weight 350 g/m^2). The LCA results can also be transferred by scaling to all other Fortrac T products (e.g. 35 T, 55 T, 80 T, 150 T, 200 T), which mainly differ only in their unit weights.
Kiwa BCS Öko-Garantie GmbH – Ecobility Experts shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification
The CEN Norm EN 15804:2012+A1:2013 serves as the core PCR

Independent verification of the declaration and data according to ISO 14025:2011-10

☐internally ☒externally

PhD Niels Jonkers
(External verifier – PLUK sustainability)

2. Product

2.1 Product description

The flexible high-strength Fortrac® geogrid boasts a 20-year-plus track record in soil reinforcement applications. The geogrids are made from high-modulus, low-creep synthetic materials enclosed in a protective polymer coating. Moreover, they are manufactured in such a way as to guarantee high stability at the intersections.

2.2 Application

Fortrac® T geogrids made of PET represent future-oriented construction methods with technical and economic advantages. The Fortrac® T product group is installed and used as primary reinforcement in a wide variety of earthworks. For example in the fields of application:

- Embankments on piles
- Bridging of sinkholes
- Geogrid reinforced soil
- Landfill construction
- Sludge lagoon covers
- Industrial wastelands

2.3 Technical Data

The technical data is listed in the table below. The values for the unit weight depend on the product type and its corresponding tensile strength. For this reason, only the value ranges for Fortrac® T are given here.

Characteristic	Value	Unit
Unit weight (DIN EN ISO 9864)	185 - 530	g/m²
Tensile Strength (DIN EN ISO 10319) MD*	35 - 200	kN/m
Tensile Strength (DIN EN ISO 10319) CMD	20	kN/m
Strain at Nominal Tensile Strength (DIN EN ISO 10319) MD	≤ 10	%
Strain at Nominal Tensile Strength (DIN EN ISO 10319) CMD	≤ 10	%
Mesh size (approx.)	25 x 25	mm
Standard roll dimension (width x length)	5,0 x 200	m x m
Water permeability (DIN EN ISO 11058)	n.a.**	-
Chemical Resistance (DIN EN ISO 13438 and EN 14030)	n.a.***	-
Durability (DIN EN 13249ff, Appendix B)	Predicted to be durable for 100 years in natural soils with 4 ≤ pH ≤ 9 and soil temperatures ≤ 25 °C	

* The individual tensile strength MD can be taken from the name of the respective product article.

** Fortrac T geogrids are only used with the reinforcement function; therefore no statement is made for water permeability in these products.

*** DIN EN ISO 13438 describes a test method that is used in a modified form to assess the durability of PP, PE, AR, PA and PVA according to DIN EN 13249 ff.

2.4 Placing on the market/ Application rules

For quality assurance purposes, geotextiles for use in earthworks and foundation engineering are regulated according to EN13249 ff. and marked with a CE mark by the manufacturer. For the placing on the market the regulation (EU) No. 305/2011 of March 9, 2011 applies. For the use of the products the national regulations apply.

2.5 Base materials / Ancillary materials

Fortrac® T geogrid consists of at least 50 percent polyester (PET) and a polymer coating layer.

Raw material	Value	Unit
Polyester (PET)	50 – 68	m%
Polymer coating	32 – 50	m%

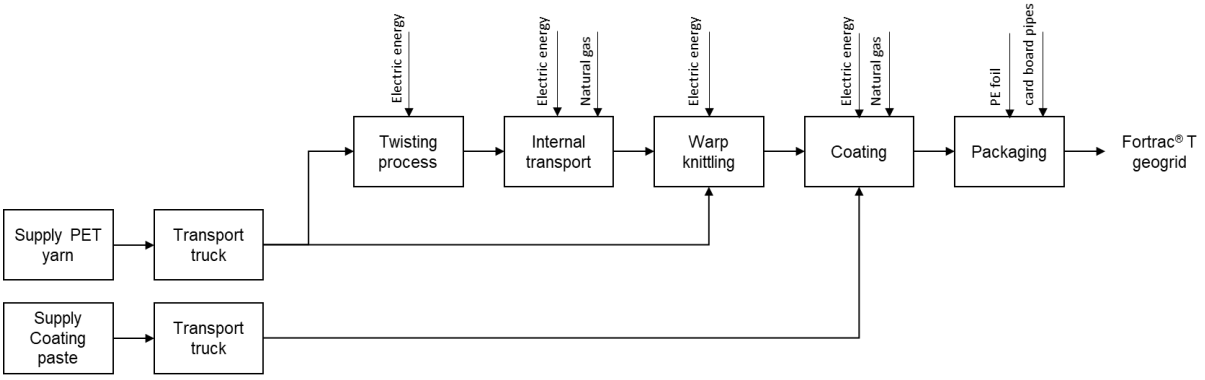
2.6 Manufacture

The yarn, which is required as the basic material for the production of the geotextile, is delivered to the Dülmen site by truck from a distance of 950 km and prepared for further processing in Gescher by means of a twisting process. There the processed yarn is delivered on pallets. This simplifies the internal transport and further processing of the yarn in the weaving / warp-knitting process.

Warp knitting is a process in which a net structure is created by intermeshing a binding thread around a longitudinal warp direction (machine direction) and a transversal weft direction (cross machine direction).

In the warp knitting process, a textile fabric is produced from several thread systems (e.g. warp, weft and binding thread) by stitch formation. It is possible to produce structures with very low elongation.

After the yarn has been processed into a synthetic mesh, the mesh is dip coated with a polymer coating. After drying, the geosynthetic mesh is rolled up on cardboard rolls, packed and stored until delivery.



2.7 Packaging

Packaging is carried out by rolling the goods onto cardboard pipes and then wrapping them in PE film.

2.8 Reference Service Life (RSL)

There's no RSL state in the 'SBR levensdurengids voor bouwproducten'. Therefore the RSL of 50 years is used as stated in the generic dataset 'Polyester weefsel' (EN: polyester fabric) out of chapter 22.46 Grondwapening en grondscheiding (EN: 22.46 Soil reinforcement and soil separation) of the program DuboCalc with database version NMD versie 1.8 - 5.01.14052018. The typical design life is up to 120 years.

3. LCA: Calculation rules

3.1 Declared unit

In accordance with the PCR B 1 m^2 geotextile is chosen as the declared unit.

Product	Unit weight [g/m^2]	Conversion factor to 1 kg
Fortrac® 110 T (representive product grade)	350	2,8571

3.2 System boundary

The Environmental Product Declaration is a Complete life cycle with a functional unit. It considers all potential environmental impacts of the product from the cradle to the end of life.
The manufacturing phase includes the production or extraction of the source materials, the transport to the respective production plant and the production of the geotextiles. All inputs (raw materials, precursors, energy and auxiliary materials) as well as the by-products and waste are considered for all life cycle phases. On the basis of experience (with the exception of raw material extraction and extraction of sand and gravel) it was assumed that the provision of the infrastructure accounts for less than 5% of the environmental impacts. Furthermore, only production-related energy consumption (excluding administration and social rooms) is considered.
It was assumed that no activities for maintenance, repair, transport and replacement, refurbishment or other material and energy flows take place during the useful life of 50 years (RSL). Modules B1 to B3 are therefore assumed to be zero. Product replacement (B4) and renovation (B5) only apply when the product is considered in a lifespan (of a building, work, etc.). Operational water and energy use are not considered.
The year 2018 represents the time reference. Due to the production locations and the main economic connections, Germany and The Netherlands are considered as the geographical reference area. However, environmental effects such as the greenhouse effect can occur with a strong spatial and temporal offset.

The following production steps are considered during the manufacturing phase:

- Production of the synthetic yarn
- Preparation of the coating paste
- Transports between the Dülmen and Gescher plants
- Production of the geotextile (twisting process, warp-knitting production, coating)
- Packaging of the geogrid
- Transport to the place of use
- Installation and removal of the geogrids
- Disposal of packaging
- End-of-life (including transport)

Secondary materials and secondary fuels are not included in the production process and are therefore not considered. The waste materials and quantities produced are included in the respective modules.

3.3 Estimates and assumptions

The energy consumption in the manufacturing process: The machines process different types of products (declared and undeclared) as well as product grades from Huesker Synthetic. It is therefore not possible to break down the energy consumption of the processing machines in order to determine a product-specific energy consumption, so that averaged energy consumption per square metre and energy consumption independent of product class are applied.
The distances for transport could be recorded for almost all raw materials. For all truck transports (suppliers, disposal transports and internal transports) A payload factor of 50%, is used for large HGVs (loading capacity '>32t'), which have about 60% share in the 'market for Transport, freight, lorry, unspecified {GLO}|' process, which effectively corresponds to delivering full and going back empty (SBK 2019). The return journey and the payload factor has already been incorporated into the Ecoinvent transport processes.

The electricity mix was chosen according to the geographical reference area (Germany) and time reference. As only the conventional electricity mix is used, no other energy sources were considered. No CO_2 certificates were considered.
The coating paste is a polymer coating. The product is approved according to regulation EC No. 1907/2006 (REACH).
According the SBK 2019, the average transport distance between the production site to the customer is assumed to be 150 km (truck).
For A5 the process and amount of the generic dataset 'Polyester weefsel' (EN: polyester fabric) out of chapter 22.46 Grondwapening en grondscheiding (EN: 22.46 Soil reinforcement and soil separation) of the program DuboCalc with database version NMD version 1.8 - 5.01.14052018. In this generic dataset 0.0013hr of the process Gr.mach.hydr. (gemiddeld) (EN: Hydraulic excavator (average)) stated for module A5 Construction.
Output materials as result of waste processing at the building site is 5% of Fortrac® 110 T. The extra needed 5% of raw material supply (A1), transport to the production location (A2), production (A3), transport to the construction site (A4) and end of life scenario (C1-D) by loss at the building site are included in module A5.
For C1 the process and amount of the generic dataset 'Polyester weefsel' (EN: polyester fabric) out of chapter 22.46 Grondwapening en grondscheiding (EN: 22.46 Soil reinforcement and soil separation) of the program DuboCalc with database version NMD version 1.8 - 5.01.14052018. In this generic dataset 0.0013hr of the process Gr.mach.hydr. (gemiddeld) (EN: Hydraulic excavator (average)) stated for module C1 demolition.

3.4 Cut-off criteria

For the process modules A1 to A3 all process-specific data was collected. Nearly all flows could be assigned potential environmental impacts through the Ecoinvent database. All flows that contribute to more than 1 % of the total mass, energy or environmental impact of the system were considered in the LCA. It can be assumed that the neglected processes would have contributed less than 5 % to the impact categories considered.

3.5 Period under review

All process-specific data was collected for the operating year 2018.

3.6 Data quality

All process-specific data was collected for the 2018 operating year and is therefore up-to-date. The data is based on the annual average. The secondary data was taken from the database Ecoinvent (version 3.5). The database is checked regularly and thus meets the requirements of EN 15804+A1 (background data not older than 10 years). The data quality can be classified as high, since values could be specified for all process-specific data.
Exception. For the environmental profile polyester yarn, the version from the Ecoinvent 3.6 database was used, because Ecoinvent 3.5 did not include the environmental profile.

3.7 Allocation

The PET yarn residues arising during production are collected and are 100 m% recycled. The share of PET yarn (<< 1 m%) is so small that it is neglected in the life cycle inventory. Due to the coating of the finished product, which does not allow the components to be sorted into a pure PET fraction, no mechanical recycling is possible. In relation to the total production quantity, about 3 m% of waste of coated grid is generated. The standard scenario "Plastic, other" (SBK 2019) is used for the production waste. This fixed scenario assumes that 90 percent of the material gas is thermally recycled and 10 percent is materially recycled. As in the standard waste scenarios of SBK 2019, truck transport distance

150 km to the treatment plant is assumed. Further details can be found in SBK 2019 and the amendments. Other waste accounts for less than 1.0 % by mass of the final product and is not included in the balance due to its small volume. It can be expected that the impact would be much less than 5 % of the environmental impact.
The finished geotextiles are wound on cardboard pipes. The environmental impact of providing the cardboard pipes was considered in the "packaging" process.
As with production waste, the fixed scenario "plastic, other" is assumed for end-of-life waste.
For the waste disposal scenario of the transport cardboard roll and the PE foil, the SBK waste scenarios "wood 'clean', via residue" and "polyolefines (i.a. pe, pp) (i.a. pipes, foils)" were used.
Note: For the disposal of fossil products, the SBK 2019 standard scenarios use “loads” and “benefits” for the incineration and recycling of mixed plastics. For thermal recycling, it is assumed that only fossil raw materials are substituted, considering the calorific values of the raw materials of the declared product and energy and thermal efficiencies of 18 percent and 31 percent. The scenario calculates for recycling that the material "polyethylene, HDPE, granulate" is substituted. According the EN 15804+A1, loads are credited in A3 or C3 to C4 AND benefits are credited in module D.
No further allocations regarding the entire production process (information modules A1 - A3) were assumed. There are no multi-input processes. Allocations were avoided in the LCA. There are no by-products. There are no multi-input processes. Except for the allocation procedures for reuse, recycling and recovery, no further allocations were assumed for the entire life cycle.

3.8 Comparability

In principle, a comparison or evaluation of EPD data is only possible if all data sets to be compared have been created in accordance with EN 15804 and the building context or the product-specific performance characteristics have been taken into account.

4. LCA_ Results

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

Description of the system boundary															
Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from manu-facturer to place of use	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishmen	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	X	X	X	MND	MND	MND	MND	X	X	X	X	X
X=Module declared | MND=Module not declared																

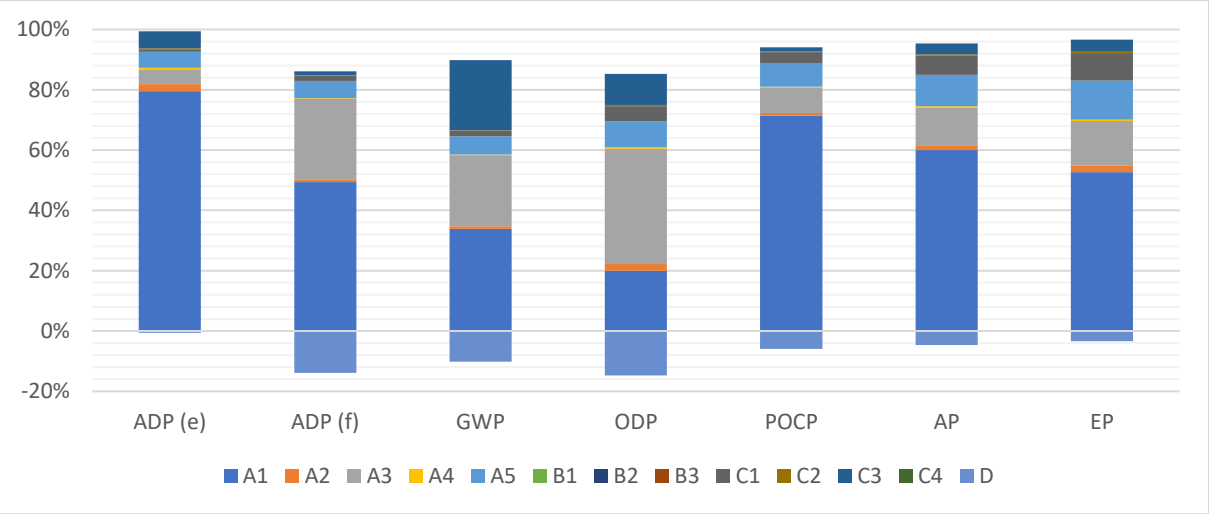
Results of the LCA – Environmental impact: 1 m² geogrid Fortrac® T														
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**C1**	**C2**	**C3**	**C4**	**D**
ADP(e)	[kg Sb-eq]	2,89E-06	8,46E-08	1,77E-07	1,99E-08	1,94E-07	0,00E+00	0,00E+00	0,00E+00	2,30E-08	1,82E-08	2,06E-07	0,00E+00	-2,18E-08
ADP(f)	[kg Sb-eq]	1,32E-02	2,23E-04	7,18E-03	5,24E-05	1,53E-03	0,00E+00	0,00E+00	0,00E+00	4,72E-04	4,79E-05	3,25E-04	0,00E+00	-3,72E-03
GWP	[kg CO_2-eq]	1,22E+00	2,97E-02	8,50E-01	7,00E-03	2,19E-01	0,00E+00	0,00E+00	0,00E+00	6,82E-02	6,40E-03	8,37E-01	0,00E+00	-3,66E-01
ODP	[kg CFC 11eq]	5,00E-08	5,55E-09	9,55E-08	1,31E-09	2,15E-08	0,00E+00	0,00E+00	0,00E+00	1,24E-08	1,19E-09	2,56E-08	0,00E+00	-3,68E-08
POCP	[kg Ethen-eq]	1,35E-03	1,76E-05	1,60E-04	4,15E-06	1,48E-04	0,00E+00	0,00E+00	0,00E+00	6,91E-05	3,80E-06	2,67E-05	0,00E+00	-1,12E-04
AP	[kg SO_2-eq[	4,81E-03	1,29E-04	1,01E-03	3,03E-05	8,36E-04	0,00E+00	0,00E+00	0,00E+00	5,18E-04	2,77E-05	2,88E-04	0,00E+00	-3,74E-04
EP	[kg $(PO_4)^{3-}$eq]	6,72E-04	2,60E-05	1,90E-04	6,11E-06	1,65E-04	0,00E+00	0,00E+00	0,00E+00	1,16E-04	5,59E-06	5,10E-05	0,00E+00	-4,32E-05
ADPe=Depletion of abiotic resources-elements | ADPf=Depletion of abiotic resources-fossil fuels | AP=Acidification of soil and water | ODP=Ozone layer depletion | GWP=Global warming | EP=Eutrophication | POCP=Photochemical oxidants creation														

Results of the LCA –Resource Use: 1 m² geogrid Fortrac® T														
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	[MJ]	7,35E-01	4,87E-03	1,49E-01	1,15E-03	5,74E-02	0,00E+00	0,00E+00	0,00E+00	5,78E-03	1,05E-03	5,95E-02	0,00E+00	-1,17E-01
PERM	[MJ]	0,00E+00	0,00E+00	8,39E-02	0,00E+00	4,20E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	7,35E-01	4,87E-03	2,33E-01	1,15E-03	5,78E-02	0,00E+00	0,00E+00	0,00E+00	5,78E-03	1,05E-03	5,95E-02	0,00E+00	-1,17E-01
PENRE	[MJ]	2,00E+01	4,94E-01	1,24E+01	1,16E-01	3,25E+00	0,00E+00	0,00E+00	0,00E+00	1,06E+00	1,06E-01	6,45E-01	0,00E+00	-7,82E+00
PENRM	[MJ]	8,06E+00	0,00E+00	2,46E+00	0,00E+00	4,05E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	2,81E+01	4,94E-01	1,48E+01	1,16E-01	3,29E+00	0,00E+00	0,00E+00	0,00E+00	1,06E+00	1,06E-01	6,45E-01	0,00E+00	-7,82E+00
SM	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m³]	1,38E-02	7,88E-05	9,65E-04	1,85E-05	9,42E-04	0,00E+00	0,00E+00	0,00E+00	1,30E-04	1,70E-05	1,18E-03	0,00E+00	-6,08E-04
PERE=renewable primary energy ex. raw materials | PERM=renewable primary energy used as raw materials | PERT=renewable primary energy total | PENRE=non-renewable primary energy ex. raw materials | PENRM=non-renewable primary energy used as raw materials | PENRT=non-renewable primary energy total | SM=use of secondary material | RSF=use of renewable second-ary fuels | NRSF=use of non-renewable secondary fuels | FW=use of net fresh water														

Results of the LCA – Output flows and waste categories: 1 m² geogrid Fortrac® T														
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	[kg]	1,21E-03	2,95E-07	5,45E-05	6,95E-08	6,37E-05	0,00E+00	0,00E+00	0,00E+00	4,45E-07	6,36E-08	1,56E-06	0,00E+00	-6,93E-06
NHWD	[kg]	9,18E-02	2,83E-02	1,44E-02	6,65E-03	9,99E-03	0,00E+00	0,00E+00	0,00E+00	1,06E-03	6,09E-03	1,19E-02	0,00E+00	-2,34E-03
RWD	[kg]	2,99E-05	3,13E-06	1,40E-05	7,36E-07	9,49E-06	0,00E+00	0,00E+00	0,00E+00	6,93E-06	6,73E-07	2,24E-06	0,00E+00	-2,61E-06
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	0,00E+00	0,00E+00	1,05E-03	0,00E+00	2,13E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,50E-02	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE	[MJ]	0,00E+00	0,00E+00	1,07E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,79E+00
HWD=hazardous waste disposed | NHWD=non hazardous waste disposed | RWD=radioactive waste disposed | CRU=Components for re-use | MFR=Materials for recycling | MER=Materials for energy recovery | EE=Exported energy														

5. LCA: Interpretation

The following figure shows the influence of the different life stages. As shown in figure below, the raw material (A1) and the manufacture (A3) have the greatest influence on the life cycle of Fortrac® T



6. Scaling

Total environmental impacts (Module A1-D) of specific product grades of Fortrac ® T are shown in the following table. For other Fortrac® T product grades the scaling function (last column) can be used.

Product grade	Unit	35 T	55 T	80 T	110 T	150 T	200 T	Scaling function
Unit weight	**[g/m²]**	**185**	**240**	**320**	**350**	**440**	**530**	**x**
ADP(e)	[Kg Sb]	1,65E-06	2,17E-06	2,93E-06	3,59E-06	4,54E-06	5,37E-06	1,11E-08x - 4,49E-07
ADP(f)	[Kg Sb]	1,34E-02	1,55E-02	1,81E-02	1,93E-02	2,22E-02	2,44E-02	3,23E-05x + 7,69E-03
GWP	[Kg CO_2 Equiv.]	1,90E+00	2,24E+00	2,68E+00	2,87E+00	3,37E+00	3,73E+00	5,36E-03x + 9,54E-01
ODP	[Kg CFC-11 Equiv.]	1,43E-07	1,57E-07	1,69E-07	1,76E-07	1,90E-07	2,02E-07	1,68E-10x + 1,15E-07
POCP	[Kg Ethene Equiv.]	9,15E-04	1,13E-03	1,45E-03	1,67E-03	2,05E-03	2,36E-03	4,30E-06x + 1,15E-04
AP	[Kg SO_2 Equiv.]	4,53E-03	5,39E-03	6,59E-03	7,28E-03	8,69E-03	9,79E-03	1,56E-05x + 1,69E-03
EP	[Kg PO_4^{3-} Equiv.]	7,74E-04	8,97E-04	1,07E-03	1,19E-03	1,40E-03	1,57E-03	2,36E-06x + 3,38E-04

7. References

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