P R O J E C T   R E P O R T :
LCA of ECORASTER E50
M A N U F A C T U R E R :
Purus Plastics

D A T E :
22 May 2025

Programme:	The International EPD® System, www.environdec.com
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Index

1 Abbreviations

B2B : Business to Business
EPD : Environmental Product Declaration
GPI : General Program Information
LCA : Life Cycle Assesment
MNR : Module Not Relevant
PCR : Product Category Rules
PET : Polyethylene
PP : Polypropylene

2 General

This LCA study has been conducted according to the requirements of the General Programme Instructions for the International EPD system (GPI 5.0.0). The PCR used for this study is PCR 2019:14 Being updated - Construction products (EN 15804+A2) (1.3.4).

2.1 MANUFACTURER

PURUS PLASTICS
Am Blätterrangen 4
95659 Arzberg
GERMANY

2.2 LCA PRACTITIONER

The LCA has been conducted by Gregory HERFRAY from the external consultancy company RECto in 2025.

2.3 DATE

This LCA has been conducted in the beginning of 2025. It is valid 5 years from the XXXX 2025.

3 Goal

The LCA study documented in this report has been carried out to support the development of a Type III declaration according to the requirements in 2019:14 Being updated - Construction products (EN 15804+A2) (1.3.4), and thereby communicate scientifically based environmental information for the declared product. The LCA is performed to investigate the environmental impacts associated with the production of ECORASTER E50 by PURUS Plastics, at the production site in ARZBERG, GERMANY. The results are to be communicated through an EPD published at the International EPD system, environdec.com.

The LCA is conducted to communicate at B2B level.

4 Scope

4.1 DECLARED UNIT

4.1.1 Definition

The declared unit is 1 m² of ECORASTER E50.
This correspond to 8.82 kg of ECORASTER E50.

Table 1 - Declared unit

Name	Value	Unit	Conversion factor to 1 kg
Declared unit	1	m²	8.82

4.1.2 Technical specifications

ECORASTER is a hard-wearing and sustainable ground reinforcement system for the stabilization of permeable ground, which has been developed, manufactured and enhanced by PURUS Plastics for more than twenty years.

The used materials guarantee high load values (DIN 1072/20 to axle load). The durable and weather-resistant material can withstand loads of up to 800 to/m². ECORASTER ground reinforcement element is certified high-quality UV- and weather-resistant (-50/+90°C).

Areas covered with ECORASTER retain the natural rainwater retention properties of the ground and are classed as "permeable".

ECORASTER systems can be enhanced with a range of different filling options: Vegetation, gravel...

This system can be used in almost any application, particularly in gardening/landscaping and civil engineering, for equestrian sports as well as forestry and agricultural applications.

The technical characteristics of the product are :

Dimensions	333 x 333 x 50 mm
Wall thickness	up to 5.0 mm
Weight/m2	8.82 kg
Weight/piece	0.98 kg
Dimensional stability	-50° / +90° C
Moisture absorption	0.01 %
Interlock	36 notched connectors/m²
Solubility	Resistant to acids, alkalis, al- cohol, oil and petrol (de-icing salt, ammonia, acid rain, etc.)
Max. open surface	Approx.. 90 %
Loadability	up to 800 t/m2 (depending on fill type)
Compressive strength	up to 20 t point axle load (DIN 1072)
UV-resistant and weatherproof	according to DIN EN ISO 4892-2 & DIN EN 60068-2-5
Environmental compatibility	environmentally neutral according to OECD 202:2004

Highly durable	according to DIN EN 124:2011 (D400)
Tensile strength	> 5 kN/m

Table 2 – Materials in ECORASTER E50

Name	Value	Unit	% in the product	Suppliers
Recycled LDPE (60 %), HDPE (20 %) and PP (20 %)	8.82	kg	100	PURUS Plastics (35 %) Wewatec (55 %) Montello (10 %)

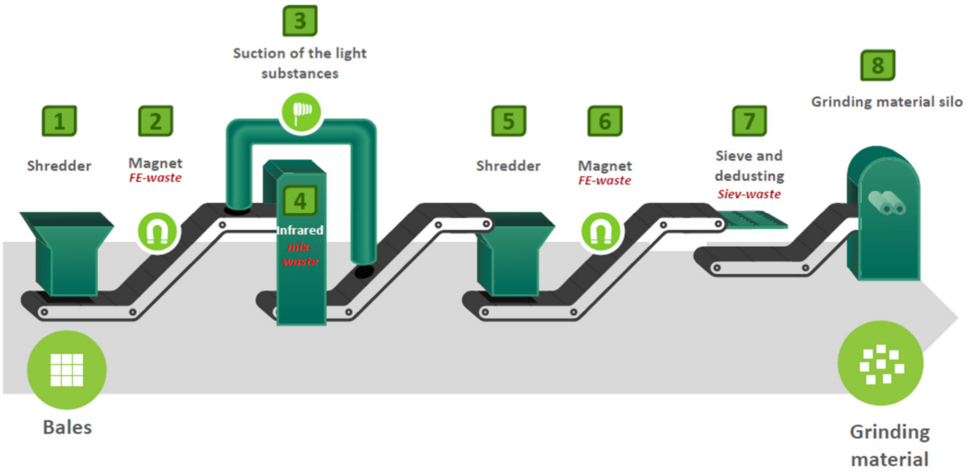
<u>Production process :</u>

ECORASTER grids are produced by PURUS Plastics. The LDPE used in the production of the grids is 100% recycled. It is obtained through the processing of waste bales (sorting, washing, separation, grinding, sorting again, and sieving).

The treated waste is then transformed into granulates. The grids are subsequently manufactured by injection molding of these pellets.

The part of the grid production process that involves plastic waste treatment is shown in Figure 1.

Function of the crushing and processing plant Recycling part 1



Function of the crushing and processing plant Recycling part 2

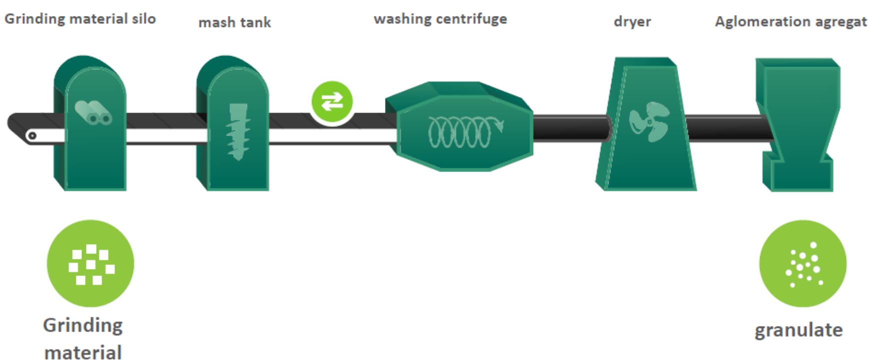


Figure 1 : Schematic representation of the plastic waste treatment process for the production of PURUS Plastics paving grids [LCA Studio, 2017]

ECORASTER grids come from the same production line; only the molds used—and consequently, the unit weight of each grid—differ.

In addition to the plastic waste treatment steps described above, the production of the grids also includes a plastic regranulation phase via extrusion, and a molding/injection phase, which is the actual step in producing the grids from plastic pellets.

In addition, PURUS Plastics products are manufactured either from plastic waste treated on-site or from recycled plastic pellets purchased from third parties, when the volume of waste processed by PURUS is insufficient to supply the secondary materials required for production.

PURUS Plastics' operations cover both the treatment of end-of-life plastic waste—which belongs to an earlier stage of the product life cycle and is excluded from the scope of this study—and the production of secondary materials and ECORASTER grids.

The identification of the contributors to be included in the modeling is therefore based on the determination of the end-of-waste status of plastic waste.

In accordance with the definition of this status provided in standard NF EN 15804+A2, and following discussions with PURUS Plastics, the contributions to the environmental impact of grid production are considered to begin at the stage of plastic waste granulation. This stage marks the point at which the material acquires economic value and can be sold.

The determination of the end-of-waste status in the case of PURUS Plastics is presented in Figure 2.

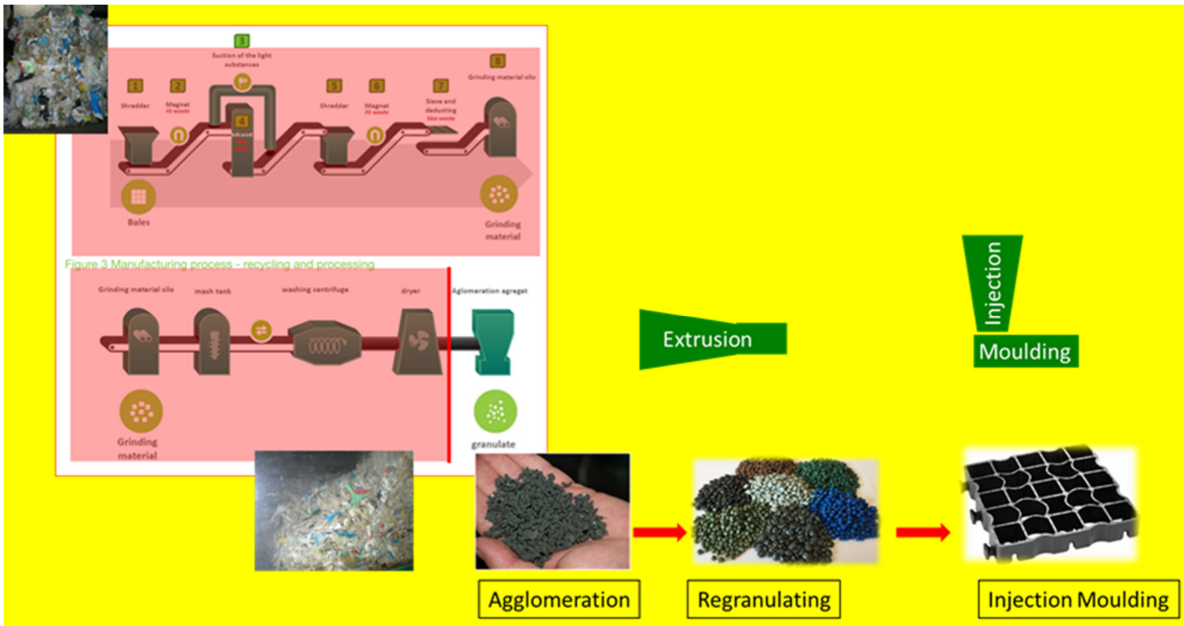


Figure 2 : "Determination of the end-of-waste status for the PURUS Plastics treatment and production chain, with the waste treatment phase highlighted in red

Thus, the modeling of ECORASTER grid production includes only the molding/injection processes.

The modeling is therefore limited to the following:

- Electricity consumption, from hydropower plants, with guarantee of origin. Specific data collection related to the ECORASTER production line was carried out by PURUS Plastics. The corresponding consumption is 580 kWh/t.
- Diesel consumption for logistics.
- Transport of recycled pellets purchased from third parties.
- Lubricating oil consumption (assumed density: 0.92 kg/L).
- Water consumption: the cooling system operates in a closed loop, and water is only consumed in the event of leaks during maintenance operations. PURUS estimates these losses at 0.07m3 per tonne of product.

A portion of the pellets used for the molding/injection process is purchased from two third-party supplier. The repartition is as follow :

- 35 % produced on site by Purus Plastics
- 55 % from Wewatec, 105 km
- 10 % from Montello (Italy), 763 km

The contribution of these pellets to the environmental impact is limited to their transport to the PURUS Plastics plant, in accordance with the previously established end-of-waste status.

All collected data refer to the production of one tonne of ECORASTER grids of all models. Since the only difference in the production process between the various models is the mold used, the data are representative of all models (according to their respective weights).

Finally, PURUS Plastics reports a production loss rate of less than 1%, which is considered negligible in this study.

4.1.3 Calculation rules for averaging data

Not relevant

3.2 SYSTEM BOUNDARIES

This study is cradle-to-gate and covers all the relevant life cycle sub modules.

The declared modules are shown in Figure 3, which follows the modular approach in PCR 2019:14 .

System boundaries (X = included in LCA; MNR = Module not relevant)																
Product			Construction process		Use							End of life				Beyond system boundary
Raw material supply	Transport	Manufacturing	Transport	Construction installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse- recovery- recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	**X**	**X**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**

Figure 3 - System boundaries according to PCR 2019:14 .

Figure 3 shows the relevant modules included in the LCA.

Module A1 – Include the contribution to the impact of the production of recycled plastic used for the production of ECORASTER. According to the end of waste status determination and the product characteristics, only an EPNR consumption is considered in A1.

Module A2 – Transportation from the supplier of the bought plastics granulates to the Purus Plastics plant.

Module A3 – Include production of ECORASTER. This production is made by injection/moulding. The main inputs for the production process are secondary materials and energy in form of electricity. The electricity consumption of Purus Plastics is covered by guarantees of origin, and is from hydropower plants. The A3 module also include the production and transportation of the ECORASTER's packaging.

The system includes all known activities and all related emissions within the system boundaries.

4.1.4 Omissions of life cycle stages, processes or data needs

The study covers all relevant processes and aspects of A1-A3 stages. Installation phase (A4-A5) and use phase (B1-B7) and end of life (C1-C4, D) are not considered here.

4.1.5 Quantification of energy and material inputs and outputs

Product specific data are based on average values collected over 2024.
This data have been collected by Purus Plastics in 2024/2025.

The electricity is based on a one-year cycle. The energy inputs are then divided by the production output for one year to allocate the energy consumption per t of the product, and then by m², regarding the weight associated with this quantity.

The electricity used to manufacture ECORASTER is based on a contract with E.ON ENERGIE DEUTSCHLAND GMBH (see Annex). The electricity is produced by hydropower plants based in Spain and Sweden.

4.1.6 Quantification of PERM and PENRM

The PERM et PENRM indicators have been evaluated regarding the Lower Heating Value of each materials that includes energetical materials. No PERM contributor is included in the study. For the PENRMThe values considered are :

<u>PENRM</u>

- PET : 43 MJ/kg from [2]
- PP : 44 MJ/kg from [2]

The modelling of the corresponding flows is associated with a positive flow in A1 for the product and A3 for the packaging.

4.2 CUT-OFF CRITERIA

4.2.1 Application and assumptions

The general rules apply for exclusion of inputs and outputs in the LCA, is in compliance with the rules in PCR 2019:14 , where the omission for input-flows pr. module must be maximum 5 % of energy usage and mass and at most 1 % for unit processes.

The production losses have been cut-off.

4.2.2 Excluded processes

- Production losses < 1%

- Plastics film and strips

4.3 ALLOCATION PRINCIPLES AND PROCEDURES

4.3.1 Documentation and justification of allocation procedures

The electricity and water consumption have been allocated on a physical basis. The electricity consumption have been determined with specific measures on the dedicated production line of the ECORASTER.

The water consumption have been estimated at the factory scale. It then have been allocated to 1 t of product.

4.4 SOURCES OF SPECIFIC DATA

The specific data have been collected by Purus Plastics in 2024 and 2025. They refers to :

- Year 2024 for the bill of materials, with a stability of the formulation over the years
- Year 2024 for the energy consumption (electricity) and the water consumption. The data have
- Year 2024 for the packaging
- Year 2024 for the wastes

4.5 SOURCES OF GENERIC DATA OR LITERATURE

Generic data and background data are from and based on the ecoinvent 3.11 database, recycled content cut-off The modelling is done under OpenLCA 2.4.1. The version of the ecoinvent database used have been specifically developed to be used under the EN 15804 methodology, and provide impact assessment methods permitting to calculate all the mandatory and optional indicators for A1 and A2 version of the norm. The latest method, based on EF3.1, have been used in this study.

5 Life cycle inventory analysis (LCI)

5.1 UNIT PROCESSES

5.1.1 A1 Raw Material production

The modelling of the raw materials production for 1m² of ECORASTER is presented in Table 3.

Table 3: A1, modelling of raw materials production, for 1m² of ECORASTER

Input/output	Amount	Unit	Data used	Quality indicators G: geographical T: technological Te: temporal

Use of non renewable primary energy resources used as raw materials (PENRM)	8.82*0.8*43+0.2*44	MJ	Flow	G: Very Good T: Very good Te: Very good
Secondary materials	8.82	Kg	Flow	G: Very Good T: Very good Te: Very good

The ECORASTER is made of 80 % of PE (low and high density), and 20 % of PP.

5.1.2 A2 Raw Material transportation

The modelling of the Raw Material transports is based on the localization of the suppliers production sites, and the ECORASTER production site.

The data used is 'market for transport, freight, lorry >32 metric ton, EURO5 | transport, freight, lorry >32 metric ton, EURO5 | Cutoff, U – RER'. The average load rate considered in the ecoinvent data, 15.96 tonnes, is considered here.

Table 4: A2, modeling of the transport of raw materials for 1 m² of ECORASTER

Input/output	Amount	Unit	Data used	Quality indicators G: geographical T: technological Te: temporal
transport from Wewatec 105 km	8.82*0.55*105	kg*km	market for transport, freight, lorry >32 metric ton, EURO5 | transport, freight, lorry >32 metric ton, EURO5 | Cutoff, U - RER	G: Very Good T: Very good Te: Very good
transport from Montello 763 km	8.82*0.1*763	kg*km	market for transport, freight, lorry >32 metric ton, EURO5 | transport, freight, lorry >32 metric ton, EURO5 | Cutoff, U - RER	G: Good T: Very good Te: Very good

55 % of the plastic granulates are purchased from Wewotec (Germany) and 10 % from Montello (Italy).

5.1.3 A3 Production of the ECORASTER

The production of the ECORASTER imply the consumption of electricity, water, lubricating oil and . The data have been collected for 2024.

The electricity consumption have been determined specifically for the ECORASTER production, by a measure on its production line. The measured electricity consumption is 580,5kWh/t of produced ECORASTER (580 kWh/t for injection/moulding, 0,5 kWh/t for cooling), and 5,12 kWh/m² of ECORASTER.

Electricity is purchased from E.ON ENERGIE DEUTSCHLAND GMBH, associated with guarantee of origin. The documentation given by Purus Plastics show that the electricity from hydropower plants, based in Spain and Sweden. In accordance with the power of each plant and its location, the type of plant have been determined, both from existing data or with assumptions. The production characteristics are presented in Table 5.

Table 5: electricity production characteristics, based on E.ON documentation

Country	Plant Name	Installed Capacity (kW)	Plant Type	Source for Plant Type	Certified Energy (MWh
Spain	C.H. VADILLOS	4400	Run-of-river	Hypothesis (based on capacity and context)	1376
Spain	HIDROELECTRICA DE OLVERA	1935	Run-of-river	Hypothesis (based on capacity and context)	146
Spain	QUINTANA DEL PUENTE	1400	Run-of-river	https://www.iberdrolaespana.com/about-us/business-lines/hydoelectric-energy/miranda-barazar-b	472
Spain	TORO	4000	Run-of-river	Hypothesis (based on capacity and context)	495
Total Run Of River Spain					**2489**
Spain	C.H. CAMPORRIONDI	15200	Reservoir	https://database.earth/energy/power-plant/camporriondi	2864
Spain	C.H. MENUZA	13858	Reservoir	https://database.earth/energy/power-plant/menuza	5956
Spain	C.H. RESTAÑO	14400	Reservoir	Hypothesis (based on capacity and context)	2713
Total Reservoir Spain					**11533**
Sweden	Ängabäck	7000	Run-of-river	Hypothesis (based on capacity and context)	119
Sweden	Åby	916	Run-of-river	Hypothesis (based on capacity and context)	18
Sweden	Fröslida	2400	Run-of-river	Hypothesis (based on capacity and context)	50
Sweden	Nyebro	1400	Run-of-river	Hypothesis (based on capacity and context)	20
Sweden	Skeen	4300	Run-of-river	Hypothesis (based on capacity and context)	93
Sweden	Värmeshult	700	Run-of-river	Hypothesis (based on capacity and context)	14
Total run of river Sweden					**314**
Sweden	Bjurfors övre	42420	Reservoir	Hypothesis (based on capacity and context)	716
Sweden	Dabbsjö	26000	Reservoir	Hypothesis (based on capacity and context)	431
Sweden	Gideå Kraftverk	15100	Reservoir	Hypothesis (based on capacity and context)	206
Sweden	Harrsele	233000	Reservoir	Hypothesis (based on capacity and context)	1076
Sweden	Hylte	27000	Reservoir	Hypothesis (based on capacity and context)	187
Sweden	Järnvägsforsen	100000	Reservoir	Hypothesis (based on capacity and context)	1863
Sweden	Karsefors	31400	Reservoir	Hypothesis (based on capacity and context)	736
Sweden	Knäred	11800	Reservoir	Hypothesis (based on capacity and context)	274
Sweden	Skogaby	13800	Reservoir	Hypothesis (based on capacity and context)	278
Sweden	Tåsjön	15000	Reservoir	Hypothesis (based on capacity and context)	211
Sweden	Traryd	13500	Reservoir	Hypothesis (based on capacity and context)	320
Sweden	Viforsen	10000	Reservoir	Hypothesis (based on capacity and context)	247
Sweden	Volgsjöfors kraftverk	20000	Reservoir	Hypothesis (based on capacity and context)	120
Total Reservoir Sweden					**6665**
Total					**21001**

This show that 13 % of the electricity production is from run-of-river plants, and 87 % from reservoir plants. According to those characteristics, the electricity used by Purus Plastics have been modelled as follows. The presented modelling is adapted from generic data to correspond to the E.ON mix for Purus Plastics.

Table 6: A3 modelling of the high voltage production regarding E.ON's mix for Purus Plastics, for 1 kWh

Input	Amount	Unit	Data used	Quality indicators G: geographical T: technological Te: temporal	Comments
electricity, high voltage, E.ON mix	0.02113234860 55104	kWh	market for electricity, high voltage | electricity, high voltage *mix EON| EN15804GD, U - DE	G: Very Good T: Very good Te: Very good	
electricity, high voltage, run-of-river	0.13	kWh	electricity production, hydro, run-of-river | electricity, high voltage | EN15804GD, U - DE	G: Very Good T: Very Good Te: Very good	
electricity, high voltage, reservoir	0.87	t	electricity production, hydro, reservoir, non-alpine region | electricity, high voltage | EN15804GD, U - DE	G: Very Good T: Very good Te: Very good	
Output	**Amount**	**Unit**	**Data used**	**Quality indicators G: geographical T: technological Te: temporal**	**Comments**
electricity, high voltage, E.ON mix	1	kWh	Flow		
Dinitrogen monoxide	5E-6	kg	Flow		
Ozone	4.15772755242 894E-6	kg	flow		

Table 7: A3 modelling of the electricity transformation from high to medium voltage, for 1 kWh

Input	Amount	Unit	Data used	Quality indicators G: geographical T: technological Te: temporal	Comments
electricity, high voltage, E.ON mix	1.00482092667 137	kWh	market for electricity, high voltage | electricity, high voltage *mix EON| EN15804GD, U - DE	G: Very Good T: Very good Te: Very good	
Output	**Amount**	**Unit**	**Data used**	**Quality indicators G: geographical T: technological Te: temporal**	**Comments**
electricity, mediume voltage, E.ON mix	1	kWh	Flow		

Table 8: A3 modelling of the medium voltage production regarding E.ON's mix for Purus Plastics, for 1 kWh

Input	Amount	Unit	Data used	Quality indicators G: geographical T: technological Te: temporal	Comments
electricity, medium voltage, E.ON mix	0.97451900065 8267	kWh	electricity voltage transformation from high to medium voltage *Mix EON | electricity, medium voltage | EN15804GD, U - DE	G: Very Good T: Very good Te: Very good	

Sulfur hexafluoride, liquid	1.13E-7	kg	market for sulfur hexafluoride, liquid | sulfur hexafluoride, liquid | EN15804GD, U - RER	G: Very Good T: Very Good Te: Very good	
Transmission network, electricity, medium voltage	1.86277676887616E-8	km	market for transmission network, electricity, medium voltage | transmission network, electricity, medium voltage | EN15804GD, U - GLO	G: Very Good T: Very good Te: Very good	
Output	**Amount**	**Unit**	**Data used**	**Quality indicators G: geographical T: technological Te: temporal**	**Comments**
electricity, medium voltage, E.ON mix	1	kWh	Flow		
Sulfur hexafluoride, to air	1.13E-7	kg	Flow		

The water consumption have been determined for one ton of product on a yearly basis. This correspond to 0,07 m3/t, and to 0,0006174 m3/m² of ECORASTER.

A consumption of 0,5 l of lubricating oil for one tone of product is also taken into acount, corresponding to 0,00441 l/m² of ECORASTER. A density of 0,92 kg/l is considered.

Table 9: A3 modelling of the ECORASTER production, for 1m²

Input/output	Amount	Unit	Data used	Quality indicators G: geographical T: technological Te: temporal	Comments
electricity, medium voltage, E.ON mix	5,12	kWh	electricity, medium voltage, E.ON mix	G: Very Good T: Very good Te: Very good	
Lubricating oil	0,00441 *0,92	Kg	Lubricating oil {RER}| market for lubricating oil | Cut-off, U	G: Very Good T: Very Good Te: Very good	
tap water	0,0006174	t	market for tap water | tap water | Cutoff, U - Europe without Switzerland	G: Very Good T: Very good Te: Very good	

The ECORASTER production is associated with wastes production.

Data about those wastes have been collected at the factory level, and is not specific. Regarding a total production of 14165,37 ton on the year 2024, generated wastes are :

- Plastic wastes: 0,000374858 t/t
- Paper wastes: 0,000158485 t/t
- Commercial wastes: 0,001195168 t/t
- Wood wastes: 0,000528754 t/t
- Waste oil: 0,00021249 t/t
- Waste oil filters: 5,08282E-05 t/t

This correspond, for 1 m² of ECORASTER, to :

- Plastic wastes: 3,30625E-06 t/UF
- Paper wastes: 1,39784E-06 t/UF
- Commercial wastes: 1,05414E-05 t/UF

- Wood wastes: 4,66361E-06 t/UF
- Waste oil: 1,87416E-06 t/UF
- Waste oil filters: 4,48305E-07 t/UF

The input tap water used for production elimination is modelled with a flow for average wastewater treatment corresponding to the total quantity of tap water consumed, for a value of 0,0006174 m3.

Table 10: A3 modelling of the wastes associated to 1m² ECORASTER production

Input/output	Amount	Unit	Data used	Quality indicators G: geographical T: technological Te: temporal	Comments
Plastic wastes	3,30625 E-06	kg	market group for waste plastic, mixture | waste plastic, mixture | EN15804GD, U - RER	G: Good T: Good Te: Very good	
Paper wastes	1,39784 E-06	kg	market group for waste paperboard | waste paperboard | EN15804GD, U - RER	G: Very Good T: Very good Te: Very good	
Commercial wastes	1,05414 E-05	kg	market group for municipal solid waste | municipal solid waste | EN15804GD, U - RER	G: Good T: Good Te: Very good	
waste wood	4,66361 E-06	kg	market group for waste wood, untreated | waste wood, untreated | EN15804GD, U - RER	G: Very Good T: Good Te: Very good	
Hazardous wastes	1,87416 E-06+4,48305E-07	kg	market for hazardous waste, for incineration | hazardous waste, for incineration | EN15804GD, U - Europe without Switzerland	G: Good T: Good Te: Very good	Oil + Oil filters
Wastewater, average	0,0006174	m3	market for wastewater, average | wastewater, average | EN15804GD, U - Europe without Switzerland	G: Good T: Very Good Te: Very good	

Finally, the packaging of the ECORASTER is integrated in the modelling. According to Purus Plastics documentation, a pallet represent 57.33 m² of ECORASTER. The pallet used is produced by Purus Plastics from recycled plastics, with the same process than ECORASTER. The production characteristics are slightly different, both regarding the composition and the production consumptions, that are, for one ton of Pallet :

- Electricity consumption : 600,5 kWh/t
- Plastic from Purus Plastics process only : 27 % LDPE, 16 % HDPE, 57 % PP
- Water consumption : 0.07 m3
- Lubricating oil : 0,5 l

The pallet used is the FIDUS 1210, for a weight of 6.2 kg.

Table 11: A3 modelling of the pallet production for ECORASTER, for 1m² of ECORASTER

Input/output	Amount	Unit	Data used	Quality indicators G: geographical T: technological Te: temporal	Comments
electricity, medium voltage, E.ON mix	600,5/1000*6.2/57.33	kWh	electricity, medium voltage, E.ON mix	G: Very Good T: Very good Te: Very good	

Lubricating oil	0,00441 *0,92/1 000*6.2 /57.33	Kg	Lubricating oil {RER}| market for lubricating oil | Cut-off, U	G: Very Good T: Very Good Te: Very good	
tap water	0.07/10 00*6.2/ 57.33	t	market for tap water | tap water | Cutoff, U - Europe without Switzerland	G: Very Good T: Very good Te: Very good	

The packaging also includes plastic film and strips. As the data is missing, and considering the low weight of those materials regarding the product's weight, those elements have been cut-off.

5.1.4 Modelling of the whole Life Cycle of the ECORASTER

There is no production losses to consider for the ECORASTER production. The modelling of the Life Cycle of the ECORASTER is presented in table Table 12.

Table 12: A1-A3 modelling

Module	Amount	Unit	Data used
A1	1	Item(s)	A1, modelling of raw materials production
A2	1	Item(s)	A2, modeling of the transport of raw materials
A3	1	Item(s)	A3 modelling of the ECORASTER production
	1	Item(s)	A3 modelling of the wastes associated to ECORASTER production
	1	Item(s)	A3 modelling of the packaging for ECORASTER

5.1.5 Data quality assessment

The data quality of the applied generic data is assessed in accordance with the data quality method listed in Annex E in EN 15804. According to the requirements in PCR 2019:14 , specific manufacturer data has been used for the foreground data, when available. The data quality is assessed for each use of generic and adapted ecoinvent data.

Temporal Aspect :

The generic datasets are from the last version of the ecoinvent database (3.11).

The specific data have been collected by Purus Plastics in 2024/2025 and correspond to 2024 for the production of ECORASTER.

Both generic and specific data are then above the limits defined in EN15804 for the temporal representativeness.

<u>Geographical aspect :</u>

Specific data have been collected on the production site of Purus Plastics in Germany (Arzberg).

Raw materials suppliers have been identified and their localization is known.

Generic data are from ecoinvent, and the most accurate available data have been chosen in the modelling, for raw materials, process and energy consumption. Some generic data have been adapted to get a better representativeness, by the modification of the energy mix used in the modelling in coherence with specific data information's.

Technological aspect :

The technologies modelling for the product relies on specific data collection from the producer and reflect this physical reality as much as possible through the generic data used, while taking into account the representativeness of the technological and geographical combination as much as possible.

More precisely, the quality data have been assessed for the specific and principal generic data with a methodology inspired by the one proposed by the PEF (Product Environmental Footprint) of the European Commission. The criteria used and their definitions are displayed in Table E.2 of NF EN 15804+A2 :

Table 13: quality evaluation for the most important specific data

Specific data	Tech	Geo	Temp	Precision	Global	Comments
A1 Raw materials characteristics	1	1	1	1	1	The recycled plastics sources are well known, and their composition is clearly documented
A2 Distances	1	1	1	1	1	Each suplier is well known and identified, the associated distance is of good quality
A3 production process	1	1	1	2	1,25	Some of the inputs have been measured on the dedicated production line, some other have been determined at the factory scale and allocated

Table 14: quality evaluation for the most important generic data

Specific data	Tech	Geo	Temp	Global	Plausability/ Completeness/ Consistancy	Comments
electricity, medium voltage, E.ON mix	1	2	1	1.33	Yes/Yes/Yes	The modelling of electricity rely on an exhaustive description of the power plants involved in the GO's. The distibution losses, linked to the localization of the plants, have not specifically be taken into acount
market for transport, freight, lorry >32 metric ton, EURO5 | transport, freight, lorry >32 metric ton, EURO5 | Cutoff, U - RER	2	1	1	1.33	Yes/Yes/Yes	The EURO5 class is an assumption, the load percentage is chosen by default
market for chemical, organic | chemical, organic | Cutoff, U - GLO	3	2	1	2	Yes/Yes/Yes	Used as a proxy for Methylisothiazolinone
polyester fibre production, finished | fibre, polyester | Cutoff, U *modif - DE	1	1	1	1	Yes/Yes/Yes	Generic data have been adapted for a better geographical representativness

ethylene vinyl acetate copolymer production | ethylene vinyl acetate copolymer | Cutoff, U *modif - DE	1	1	1	1	Yes/Yes/Yes	Generic data have been adapted for a better geographical representativness
market for residues, MSWI-WWT-SLF, sludge from pulp and paper production | residues, MSWI-WWT-SLF, sludge from pulp and paper production | EN15804GD, U - Europe without Switzerland	1	2	1	1.33	Yes/Yes/Yes	Used for both chemical and paper pulp

Table 15: declaration of sources and share of primary data for GWP-GHG results for A1-A3

Process	Source type	Source	Reference year	Data category	Share of primary data, of GWP-GHG results for A1-A3
electricity, medium voltage, E.ON mix	Collected data Database, adapted	EPD owner Ecoinvent v3.11	2024	50 % Primary data 50 % generic data	32 %
market for transport, freight, lorry >32 metric ton, EURO5 | transport, freight, lorry >32 metric ton, EURO5 | Cutoff, U - RER	Database, adapted	Ecoinvent v3.11	2024	50 % Primary data 50 % generic data	17 %
Other process	Database	Ecoinvent v3.11	2024	Genreci data	0 %
Total share of primary data, of GWP-GHG results for A1-A3					**49 %**

6 Life cycle impact assessment (LCIA)

6.1 LCIA PROCEDURES AND CALCULATIONS

The LCIA results are calculated using the Environmental Footprint (EF 3.1) and impact methodology for classification and characterisation of input and output flows. This is in accordance with PCR 2019:14. This calculation is perfomed by the use of the specific method implemented in the OpenLCA ecoinvent database version dedicated to LCAs under the EN 15804 methodology. The following environmental impact categories are calculated:

- Global warming (GWP) (Baseline model of 100 years of the IPCC (based on IPCC 2021))
- Global warming fossil (GWPf) (Baseline model of 100 years of the IPCC (based on IPCC 2021))
- Global warming biogenic (GWPb) ((Baseline model of 100 years of the IPCC (based on IPCC 2021))

- Global warming land use and land use change (GWPluluc) ((Baseline model of 100 years of the IPCC (based on IPCC 2021))
- Global warming potential except emissions and uptake of biogenic carbon (GWP-IOBC/GHG)((Baseline model of 100 years of the IPCC (based on IPCC 2021))
- Ozone depletion (ODP)(Steady-state ODPs as in (WMO 1999))
- Acidification for soil and water (AP)(Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008))
- Eutrophication fresh water (EP F)(EUTREND model (Struijs et al, 2009) as implemented in ReCiPe)
- Eutrophication marine (EP M) (EUTREND model (Struijs et al, 2009) as implemented in ReCiPe)
- Eutrophication terrestrial (EP T) (Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008))
- Photochemical ozone creation (POCP) (LOTOS-EUROS, Van Zelm et al., 2008, as applied in ReCiPe)
- Depletion of abiotic resources-elements (ADPe)(CML Guinée et al. (2002) and van Oers et al. (2002).
- Cumulative ADP 2020 (Oers & al, 2020))
- Depletion of abiotic resources-fossil fuels (ADPf)(CML Guinée et al. (2002) and van Oers et al. (2002).)
- Water use (WDP)(Available Water Remaining (AWARE) in UNEP, 2016)
- Particulate matter (PM)(PM method recommended by UNEP (UNEP 2016))
- Ionizing radiation (IRP)(Human health effect model as developed by Dreicer et al. 1995 (Frischknecht et al, 2000))
- Eco toxicity freshwater (ETP-fw)(USEtox 2.1. (Rosenbaum et al, 2008))
- Human toxicity cancer effect (HTP-c)(USEtox 2.1. model (Rosenbaum et al, 2008))
- Human toxicity non cancer effect (HTP-nc)(USEtox 2.1. model (Rosenbaum et al, 2008))
- Soil quality (SQP)(Soil quality index based on LANCA (Beck et al. 2010 and Bos et al. 2016))
- Components for re-use (CRU)
- Materials for recycling (MFR)
- Materials for energy recovery (MER)
- Exported electrical energy (EEE)
- Exported thermal energy (EET)
- Use of renewable primary energy resources used as energy carrier (PERE)
- Use of renewable primary energy resources used as raw materials (PERM)
- Total use of renewable primary energy resources (PERT)
- Use of non renewable primary energy resources used as energy carrier (PENRE)
- Use of non renewable primary energy resources used as raw materials (PENRM)
- Total use of non renewable primary energy resources (PENRT)
- Use of secondary materials (SM)
- Use of renewable secondary fuels (RSF)
- Use of non renewable secondary fuels (NRSF)
- Use of net fresh water (FW)
- Hazardous waste disposed (HWD)
- Non hazardous waste disposed (NHWD)
- Radioactive waste disposed (RWD)

6.2 LCIA RESULTS

The estimated impact results of the LCIA are relative expressions and do not indicate the impacts endpoints, the exceeding of thresholds, safety margins or risks.

In Table 17 – Table 34 the LCIA and LCI results are shown divided into the modules A1-A3, C1-C4 for the product. The remaining modules are not relevant (see section 0). Furthermore, *Renewable primary energy resources used as raw materials* and *Non-renewable primary energy resources used as raw materials* are shown. These results have been calculated based on the heating values for the input materials.

6.2.1 Results

Table 16 – LCIA results for the declared unit (1 m² ECORASTER)

Core environmental impact indicators (MANDATORY)		A1	A2	A3	Total A1-A3
Global warming potential - total (GWP-total)	kg CO2 eq.	0,00E+00	1,32E-01	2,72E-01	4,04E-01
Global warming potential - fossil fuels (GWP-fossil)	kg CO2 eq.	0,00E+00	1,31E-01	6,81E-02	2,00E-01
Global warming potential - biogenic (GWP-biogenic)	kg CO2 eq.	0,00E+00	4,40E-05	2,81E-02	2,81E-02
Global warming potential - land use and land use change (GWP-luluc)	kg CO2 eq.	0,00E+00	5,95E-05	1,76E-01	1,76E-01
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq.	0,00E+00	1,77E-09	2,74E-09	4,51E-09
Acidification potential, accumulated exceedance (AP)	mol H+ eq.	0,00E+00	4,58E-04	3,48E-04	8,06E-04
Eutrophication potential - freshwater (EP-freshwater)	kg P eq.	0,00E+00	1,43E-05	2,62E-05	4,05E-05
Eutrophication potential - marine (EP-marine)	kg N eq.	0,00E+00	1,48E-04	6,63E-05	2,14E-04
Eutrophication potential - terrestrial (EP-terrestrial)	mol N eq.	0,00E+00	1,60E-03	6,35E-04	2,24E-03
Photochemical ozone creation potential (POCP)	kg NMVOC eq.	0,00E+00	6,58E-04	3,16E-04	9,74E-04
Abiotic depletion potential - non-fossil resources (ADPE)	kg Sb eq.	0,00E+00	3,73E-07	2,30E-06	2,67E-06
Abiotic depletion potential - fossil resources (ADPF)	MJ, net calorific value	0,00E+00	1,88E+00	6,36E-01	2,52E+00
Water (user) deprivation potential (WDP)	m3 world eq. deprived	0,00E+00	1,12E-02	5,69E+00	5,70E+00
Additional mandatory environmental impact indicators (MANDATORY)		A1	A2	A3	Total A1-A3
Global warming potential (GWP-GHG)	kg CO2 eq.	0,00E+00	1,32E-01	2,69E-01	4,01E-01

Table 17 – Resource use (LCI) results for the declared unit (1 m² ECORASTER)

Indicators describing resource use (MANDATORY)		A1	A2	A3	Total A1-A3
Use of renewable primary energy as energy carrier (PERE)	MJ, net calorific value	0,00E+00	2,61E-02	1,97E+01	1,97E+01
Use of renewable primary energy resources used as raw materials (PERM)	MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renewable primary energy (PERT)	MJ, net calorific value	0,00E+00	2,61E-02	1,97E+01	1,97E+01
Use of non renewable primary energy as energy carrier (PENRE)	MJ, net calorific value	-3,12E+02	1,88E+00	6,36E-01	-3,10E+02
Use of non renewable primary energy resources used as raw materials (PENRM	MJ, net calorific value	3,12E+02	0,00E+00	0,00E+00	3,12E+02
Total use of non renewable primary energy resource (PENRT)	MJ, net calorific value	0,00E+00	1,88E+00	6,36E-01	2,52E+00
Use of secondary material (SM)	kg	8,82E+00	1,40E-03	3,07E-03	8,82E+00
Use of renewable secondary fuels (RSF)	MJ, net calorific value	0,00E+00	1,82E-04	7,69E-04	9,51E-04
Use of non-renewable secondary fuels (NRSF)	MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Net use of fresh water (FW)	m3	0,00E+00	2,78E-04	1,32E-01	1,33E-01

Table 18 – End of life (LCI) results for the declared unit (1 m² ECORASTER)

Environmental information describing waste categories (MANDATORY)		A1	A2	A3	Total A1-A3
Hazardous waste disposed (HWD)	kg	0,00E+00	3,07E-03	5,32E-03	8,39E-03
Non-hazardous waste disposed (NHWD)	kg	0,00E+00	1,68E-02	6,95E-01	7,12E-01
Radioactive waste disposed (RWD)	kg	0,00E+00	3,98E-07	8,21E-07	1,22E-06
Environmental information describing output flows (MANDATORY)		A1	A2	A3	Total A1-A3
Components for re-use (CRU)	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling (MFR)	kg	0,00E+00	1,16E-03	2,88E-03	4,05E-03
Materials for energy recovery (MER)	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported electrical energy (EEE)	MJ, net calorific value	0,00E+00	1,70E-04	5,25E-04	6,96E-04
Exported thermal energy (EET)	MJ, net calorific value	0,00E+00	1,92E-04	4,28E-04	6,20E-04

BIOGENIC CARBON CONTENT PER DECLARED UNIT (1 m²)		
Parameter	**Unit**	**At the factory gate**
Biogenic carbon content in product	kg C	0
Biogenic carbon content in accompanying packaging	kg C	0

6.3 RELATIONSHIP OF THE LCIA RESULTS TO THE LCI RESULTS

LCIA are relative expressions and do not predict impacts category endpoints, the exceeding of thresholds, safety margins or risks.

Table 19 shows the processes contributing the most to the specific impact categories, and how much they contribute to the given impact category.

Table 19: Maximum contribution to impact categories for ECORASTER

Environmental Impact				
Impact Category	**Unit**	**Contribution**	**Process**	**% of category**
Global warming fossil	kg CO2-Equiv.	A2	Granulate transport	65.87 %
Ozone depletion	kg R11-Equiv.	A3	Electricity ECORASTER production	51.18 %
Acidification for soil and water	kg SO2-Equiv.	A2	Granulate transport	56.86 %
Eutrophication freshwater	kg P-Equiv.	A3	Electricity ECORASTER production	57.17 %
Eutrophication marine	kg N Equiv.	A2	Granulate transport	69.01 %
Eutrophication terrestrial	mole of N Equiv.	A2	Granulate transport	71.64 %
Photochemical ozone creation	kg Ethene-Equiv.	A2	Granulate transport	67.54 %
Depletion of abiotic resources-elements	kg Sb-Equiv.	A3	Electricity ECORASTER production	82.83 %
Depletion of abiotic resources-fossil fuels	MJ	A2	Granulate transport	74.74 %
Water scarcity	M^3	A3	Electricity ECORASTER production	98.52 %
Respiratory inorganics	Disease incidence	A2	Granulate transport	73.83 %
Ionising radiation – human health	kBq U235 Equiv.	A3	Electricity ECORASTER production	52.1 %
Ecotoxicity freshwater	CTUe	A3	Electricity ECORASTER production	41.81 %
Cancer human health effect	CTUh	A3	Electricity ECORASTER production	58.81 %
Non-cancer human health effects	CTUh	A3	Electricity ECORASTER production	60.37 %

8 Life cycle interpretation

8.1 RESULTS

ECORASTER shows a quite equilibrated contribution to the impacts between stages A2 and A3. For instance, if the total GWP indicator shows that the A3 phase have a major contribution, the declination of the GWP between fossil, biogenic and Land Use/Land Use change shows that the transport phase is preponderant for the fossil GWP, as the energy consumption in A3 is only electrical from hydropower plants.

On the other hand, the biogenic and Luluc GWP are strongly affected by the hydroelectricity, what affect the balance for the total value : for the A3 phase, the Luluc part of GWP represent 65 % of the total value.

The A2 module is the biggest contributor to the eutrophication marine and terrestrial, whereas the hydroelectricity, which has a direct influence on freshwater quality, give the biggest importance to the A3 module for the eutrophication of freshwater.

The POCP, abiotic depletion/fossil resource and consumption of non-renewable primary energy are mainly linked to the A2 transport phase, as this phase imply the biggest use of energetical consumption of fossil resources.

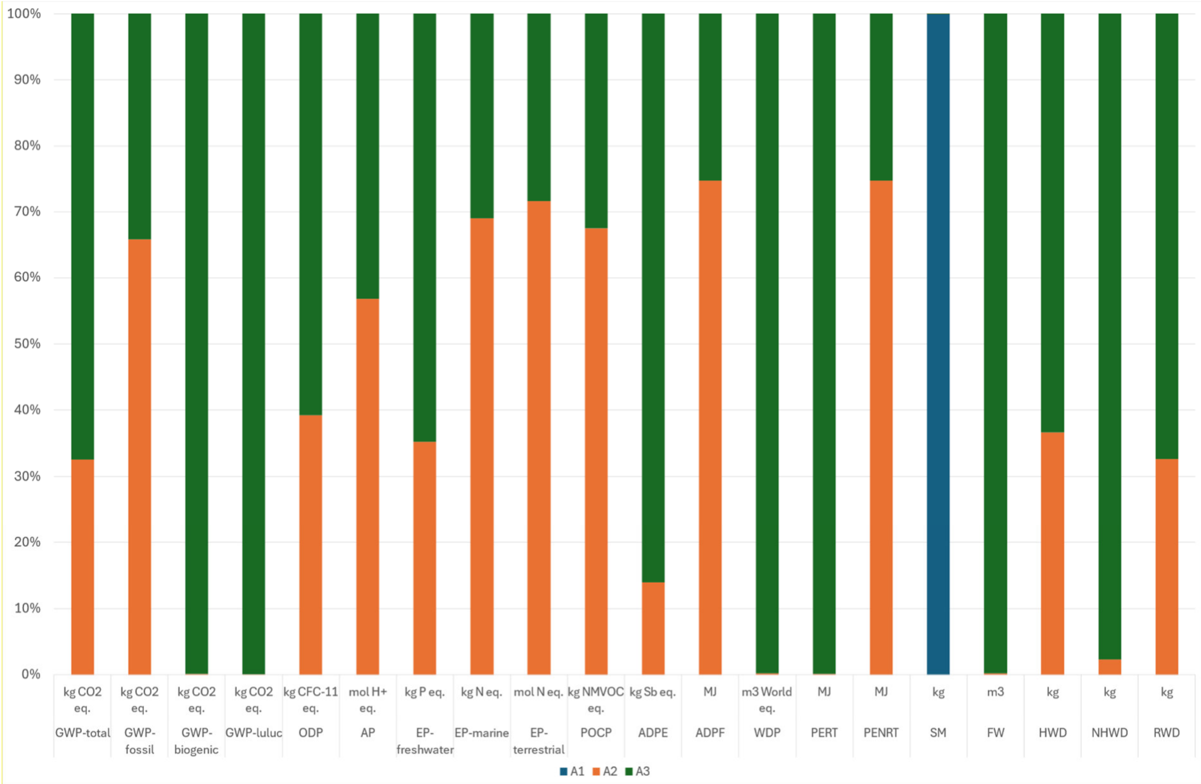


Figure 4 Relative contribution on environmental impact categories for the LCA modules A1-A3 for ECORASTER

8.2 ASSUMPTIONS AND LIMITATIONS

Results are generally restricted by the quality of the data given in the report.

The study is also limited by assumptions that have been made during the modelling.
For instance, the hydropower plant type considered for the modelling is partly linked to assumptions made on the base of the location and their technical characteristics. This should be validated to ensure the representativeness of the modelling. Another limitation regarding this point is linked to the fact that the distribution losses due to the localization of the plants (Spain and Sweden) have not been specifically modelled.

The study is also limited by the mass allocation made to estimate the water consumption needed to produce the ECORASTER, instead of collecting specific data for this only product.

8.3 VARIANCE FROM THE MEANS

The LCA report does not contain processes based on average LCIA means or processes declared from different sources.

8.4 DATA QUALITY ASSESSMENT

Specific data is used for processes where data have been provided and been available. In the other case, However, estimates and alternative generic processes have been used as described in 4.1.

A data quality assessment have been made and is presented in every table detailing the modelling.

The generic datasets for the primary ingredients in ECORASTER from ecoinvent are less than three years old.

The overall data quality representativeness is regarded as high.

9 Documentation on additional information

No additional information. The requirements in PCR 2019:14 is given in the EPD

10 References

EN 15804:2012+A2:2019/AC:2021, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

GENERAL PROGRAMME INSTRUCTIONS FOR THE INTERNATIONAL EPD SYSTEM version 5.0.0 2024-06-19

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

PCR 2019:14 - Construction products (EN 15804+A2) (2.0.0)