EPD

Environmental product declaration for Multiwall Polycarbonate sheets

In accordance with EN 15804+A2 and ISO 14025

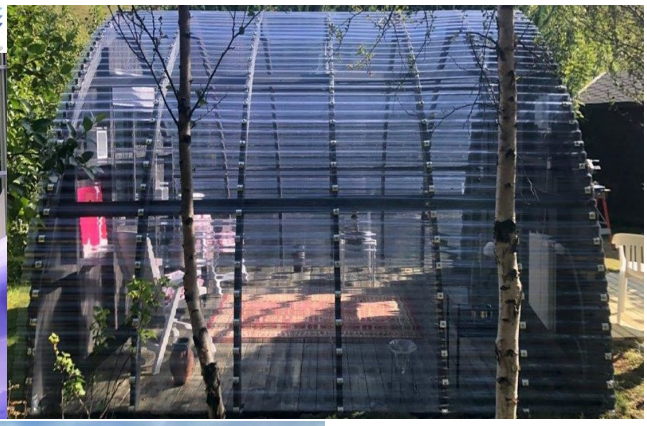
Issue date: DD.MM.2022
Valid until: DD.MM.2027

Owner of Declaration

European Polycarbonate Sheet Extruders
Kortenberglaan 71
1000 Brussel
BELGIUM

EuPC Sector Group

EPSE
EUROPEAN POLYCARBONATE SHEET EXTRUDERS



Provided by : PALRAM

Declared product(s):

Multi wall Polycarbonate sheets

Functional Unit:

1kg of multi wall Polycarbonate Sheets

Declared LCA stages with options:

A1-A3, A4, C1-C4, D

PCR (Product Category Rule):

EN 15804:2012+A2:2019

Year of Study:

2022

Validity:

This EPD is valid for 5 years from the date of publication.

Verification:

☐ **Internal** ☑ **External**

Third party verification conform to EN 15804+A2

Signature of the verifier

Bernd Brandt
bernd@brandtconsulting.eu

Manufacturing site:

The EPD is declared for Multiple manufacturers.

The EPD has been prepared by:

Arthur De Jaegher
arthur@enperas.com
arthur@enperas.com

Varun Gowda Palahalli Ramesh
varun@enperas.com

Hannah Van Hees

Mihaela Thuring
mihaela.thuring@vito.be
+32 14 33 58 97

Life cycle stages and modules (MND = module not declared)

Product stage			Construction installation stage		Use stage							End of life stage					Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Construction installation stage	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
☒	☒	☒	☒	MND	MND	MND	MND	MND	MND	MND	MND	☒	☒	☒	☒		☒

Product Description

Product name
Multiwall Polycarbonate sheet

Product description and intended use
Multiwall Polycarbonate sheets are unique engineering thermoplastics that combine a high level of mechanical, optical and thermal properties, which can be used for a wide range of glazing applications.

Description of the production process and technology
Sheets are formed by extrusion. Polycarbonate powder or pellets are heated to a molten state and pushed through a die with the desired cross section and then transported over rollers to cool down in a continuous process.

Product Composition and content
The product does not contain materials listed in the "Candidate list of Substances of Very High Concern for authorization" in a concentration over 0,1% (w/w).

Table 1 Composition of Multiwall PC sheets

Components	Composition / content / ingredients	Quantity (range)
Product	Polycarbonate granulates	80 - 90%
	Regrinded polycarbonate granulates	10 – 15 %
	UV-granulates	1 – 1,5 %
	Pigments (white, grey, brown/bronze, blue, violet, red)	0,02 – 1,1%

Technical data / Physical Characteristics

Table 2 Technical aspects of Multiwall PC sheets

Technical property	Standard	Value/Unit	Comment
Reaction to fire	EN 13501-1	B-s1, d0	Test according EN 13823
Dimensional tolerances	EN 16153	Pass/Fail	
Small hard body impact resistance	EN ISO 6603-1	Pass/Fail	
Solar energy transmittance (g)	EN 410	%	
Light transmittance (τ_v)	EN 14500	%	
Durability (YI and LT)	EN 16153	ΔA clear, ΔD coloured	Test according to EN ISO 4892-2
Thermal transmittance (U value)	EN ISO 6946	0,9 - 3,5 W/m^2K	Depending on structure and thickness
Linear thermal expansion	ISO 11359-2	65.10^{-6} K^{-1}	Coefficient

LCA STUDY

DATE OF LCA STUDY
July 2022

SOFTWARE
For the calculation of the LCA results, the software program SimaPro 9.2.0.1 (PRé Consultants, 2021) has been used in combination with a specific LCA software program for EPSE (Enperas Quadrant).

REFERENCE FLOW / DECLARED UNIT
Functional unit is the production of 1 kg of a "Multiwall Polycarbonate sheet". Multiwall sheets are typically available in thicknesses between 10 - 55 mm, with various wall structures.

Table 3 Conversion factors for Multiwall Polycarbonate sheets

Thickness (mm)	Nominal weight (kg/m²)	Conversion factor to functional unit
6	1,3	0,77
8	1,5	0,67
10	1,7	0,59
12	2	0,5
16	2,4	0,42
20	2,8	0,36
22	3	0,33
25	3	0,33
30	3,5	0,29
32	3,5	0,29
35	3,8	0,26
40	4	0,25
50	4,5	0,22
55	5	0,2

INFORMATION ON ALLOCATION
At the manufacturing sites of the EPSE members, different types of sheets are produced. In some cases, multiwall polycarbonate sheets are produced only on certain production lines, with no co-products being produced as part of the process. In some cases, only facility-level data were available for electricity use, the use of natural gas, etc. The facility-level data have been allocated to the analysed product using their respective annual production volume (physical relationship), therefore volume allocation is applied.

INFORMATION ON CUT OFF
All major raw materials and all the essential energy is included. Packaging of one of the pigments used was not included, as data was not available. The amount was very small, negligible, and considered under the cut-off threshold.

REFERENCE SERVICE LIFE
Average reference service life is of 30 years

DESCRIPTION OF GEOGRAPHICAL REPRESENTATIVITY
Europe

PRODUCTION SITES
Multiple manufacturers, multiple sites

INFORMATION ON CARBON OFFSETTING
Carbon offsetting is not allowed in the EN 15804:2012+A2:2019 and hence not considered in the calculations.

INFORMATION ON CARBONATION OF CEMENTITIOUS MATERIALS
Nothing to declare

INFORMATION ON EXCLUDED PROCESSES
Environmental impacts caused by the personnel of the production plants are not included in the LCA, e.g., waste from the cafeteria and sanitary installations, accidental pollution caused by human mistakes, or environmental effects caused by commuter traffic. Heating or cooling of the plants in order to ensure a comfortable indoor climate for the personnel for example is also neglected.

Data

Specificity
The life cycle inventory for this study is performed by EPSE and ENPERAS/VITO according to the ISO 14040 and ISO 14044 (data inventory) standards (ISO, 2006).
Specific data have been collected for the processes under operational control of EPSE companies. Generic data have been used for the processes EPSE cannot influence.

Period of data collection
Data was collected for the year 2019. The final amounts are based on the weighted averages of the 7 data providers.

Information on data collection
Company-specific data concern the data about the production of the polycarbonate sheets. All required data about the production process have been delivered to Enperas/VITO by EPSE. Enperas/VITO uses publicly available generic data for all background processes such as the production of electricity, transportation by means of a specific truck, etc. The main LCI source used in this LCA study is the Ecoinvent 3.6 database (June 2019).

Database used for background data
The main LCI source used in this study is the Ecoinvent 3.6 database (Wernet et al., 2016).

Energy mix
The European electricity mix (consumption mix + import) has been used to model electricity use in life cycle stages A3, C4 and D. The data record is from ecoinvent "medium voltage {Europe without Switzerland}| market group for | Cut-off, U" and 'Electricity, low voltage {Europe without Switzerland}| market group for | Cut-off, U'

Details of the underlying scenarios used to calculate the impacts

A1 – Raw material supply
This module considers the extraction and processing of all raw materials and energy which occur upstream to the studied manufacturing process.

A2 – Transport to the manufacturer
The raw materials are transported to the manufacturing site. The primary record was collected for each raw material from each manufacturer.

A3 – Manufacturing
This module considers the production process.

A4 – Transport to the building site

Transport type	Unit	Comment
Truck 3,5 - 7,5t, Euro5	km	Transportation from merchant to installation
Truck 7,5 - 16t, Euro5	km	Transportation from merchant to installation
Truck 16 - 32t, Euro5	km	Transportation from factory to merchant
Truck > 32t, Euro5	km	Transportation from factory to installation
Truck 0,1 – 3,5t, Euro5	km	Transportation from factory to merchant or installation
Transoceanic freight ship	km	Transportation from factory to merchant

A5 – Installation
The scope of the study is established as cradle-to-gate with options, where A4 is included but A5 is not. For the installation there are multiple build-up alternatives, depending on the application. Accounting for all of them is not possible within the framework of this study. However, the disposal of waste generated from the packaging of the final product is normally allocated to the installation phase, A5.

B – Use stage (excluding potential savings)
B1, B2, B3, B4, B5, B6: Modules are not declared. Since no maintenance, replacement or operational energy use are necessary during the Reference Service Life (RSL) of the product (30 years), no environmental impacts occur during these modules.

C – End of life
The polycarbonate multi sheets are 39,0% landfilled, 32,2% incinerated and 28,8% recycled. The EU scenarios for the transport of waste are as follows:

- 50 km with a 16–32-ton EURO 5 lorry from demolition site to sorting plant/crusher/collection point and landfilling.
- 150 km with a 16–32-ton EURO 5 lorry from sorting plant and incineration/energy recovery.
- 800 km with a 16–32-ton EURO 5 lorry from sorting plant and recycling.

C1: Dismantling
It is assumed that the dismantling of the PC sheets will only cover the un-screwing the PC sheet from whatever build-up it is installed. A generic assumption is that 9 screws are necessary for the FU of 1 m2 of multiwall PC sheet, which would be between 3 and 4 screws per kg (depending on the density of the sheet), where an amount of 0,0216 kWh per screw is used. In this case we will use 4 screws, as the worst-case scenario. The dataset used to model the impacts is "Electricity, low voltage {Europe without Switzerland} | market group for | Cut-off, U".

C2-C4: The polycarbonate multiwall sheets are 39,0% landfilled, 32,2% incinerated and 28,8% recycled.

C2 – Transport to waste processing

Type of vehicle (truck/boat/etc.)	Distance (km)	Capacity utilisation (%), Density of products (kg/m^3) and assumptions
Truck 16-32 ton	50	Ecoinvent scenario
Truck 16-32 ton	150	Ecoinvent scenario
Truck 16-32 ton	800	Ecoinvent scenario

End-of-life modules – C3 and C4

Parameter	Unit	Value
Waste for re-use	kg	0
Waste for recycling	kg	0,28
Waste for energy recovery	kg	0,32
Waste for final disposal	kg	0,39

D – Benefits and loads beyond the system boundaries

The benefits beyond the system boundaries include the end-of-waste: 28,8% recycled polycarbonate and 32,2% incinerated polycarbonate of the final product at its end-of-life. Packaging waste is also considered. following the average European End of Life (EOL) scenarios (Annex C of the PEFCR guidance) from the below table.

Product	Landfill	Incineration and/or energy recovery	Recycling	Reuse
Wooden pallets	38%	32%	30%	0%
PE foil packaging	39%	32%	29%	0%
PE straps	39%	32%	29%	0%
PE packaging	39%	32%	29%	0%
Cardboard sheet	14%	11%	75%	0%
Container with PE-liner	39%	32%	29%	0%
Polystyrene packaging	39%	32%	29%	0%
Octabin	14%	11%	75%	0%

Potential environmental impacts per reference flow

	Production			Construction process stage		Use stage							End-of-life stage					
	A1 Raw material	A2 Transport	A3 Manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
GWP - total (kg CO2 equiv/FU)	3,75E+00	1,05E-01	3,42E-01	6,63E-01	3,30E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,74E-02	4,98E-02	8,19E-04	8,02E-01	-1,05E+00	6,08E+00
GWP - fossil (kg CO2 equiv/FU)	3,75E+00	1,05E-01	6,04E-01	6,62E-01	4,63E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,71E-02	4,98E-02	8,08E-04	8,02E-01	-1,04E+00	6,05E+00
GWP - biogenic (kg CO2 equiv/FU)	9,10E-04	6,91E-05	-2,64E-01	4,50E-04	2,84E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,60E-04	2,03E-05	1,04E-05	5,92E-05	-1,71E-03	2,13E-02
GWP – luluc (kg CO2 equiv/FU)	1,65E-03	4,78E-05	1,69E-03	3,64E-04	4,04E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,63E-05	1,74E-05	7,62E-07	1,56E-05	-7,57E-04	3,88E-03
ODP (kg CFC 11 equiv/FU)	1,34E-07	2,26E-08	6,77E-08	1,41E-07	2,52E-09	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,12E-09	1,13E-08	6,47E-11	6,53E-09	-6,11E-08	3,89E-07
AP (kg mol H+ equiv/FU)	9,90E-03	3,72E-04	4,77E-03	3,02E-03	8,46E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,17E-04	2,03E-04	3,78E-06	2,35E-04	-2,47E-03	1,88E-02
EP - freshwater (kg P equiv/FU)	4,41E-05	1,27E-06	5,87E-05	8,30E-06	1,74E-07	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,96E-06	3,91E-07	9,42E-08	7,85E-07	-2,29E-05	1,18E-04
EP - marine (kg N - equiv/FU)	2,09E-03	9,03E-05	6,39E-04	8,49E-04	3,60E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,75E-05	6,03E-05	1,14E-06	1,41E-04	-5,34E-04	3,93E-03
EP – terrestrial (mol N – equiv/FU)	2,14E-02	1,01E-03	8,06E-03	9,46E-03	3,64E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,39E-04	6,67E-04	1,39E-05	1,03E-03	-5,87E-03	4,24E-02
POCP (kg NMVOC equiv/FU)	6,93E-03	3,38E-04	2,29E-03	2,98E-03	1,04E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,59E-05	2,04E-04	3,46E-06	2,76E-04	-1,83E-03	1,32E-02
ADP – minerals&metals (kg Sb equiv/FU)	1,58E-05	1,98E-07	4,36E-06	1,99E-06	1,98E-08	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,06E-08	9,69E-08	1,10E-09	4,41E-08	-4,14E-07	2,26E-05
ADP fossil (MJ/FU)	9,35E+01	1,58E+00	1,34E+01	9,81E+00	1,76E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,63E-01	7,50E-01	1,10E-02	2,63E-01	-2,41E+01	1,20E+02
WDP (m3 world eq. deprived/FU)	4,63E+00	5,58E-03	2,66E-01	3,61E-02	9,27E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,55E-03	2,09E-03	3,66E-05	9,52E-03	-8,68E-01	4,96E+00

GWP total = Total Global Warming Potential (Climate Change); GWP – fossil = Global Warming Potential (Climate Change) fossil, GWP-biogenic= Global Warming Potential (Climate change) biogenic GWP-luluc = Global Warming Potential (Climate Change) land use and land use change; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; EP-marine = Eutrophication Potential, marine; EP-marine = Eutrophication Potential, terrestrial; POCP = Photochemical Ozone Creation; ADP-minerals&metals = Abiotic Depletion Potential – minerals and metals; ADP fossil = Abiotic Depletion Potential – Fossil Fuels; WDP = water use (Water (user) deprivation potential, deprivation-weighted water consumption

Resource use

Resource use	Production			Construction process stage		Use stage							End-of-life stage					
	A1 Raw materia	A2 Transport	A3 Manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacemen	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
PERE (MJ equiv/FU)	1,37E+00	3,53E-02	3,53E+00	2,13E-01	6,06E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,43E-01	1,04E-02	1,53E-03	2,09E-02	-4,35E+00	5,93E+00
PERM (MJ equiv/FU)	3,89E-02	0,00E+00	2,34E+00	0,00E+00	-6,01E-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	0,00E+00	0,00E+00	0,00E+00	1,78E+00
PERT (MJ equiv/FU)	1,41E+00	3,53E-02	5,88E+00	2,13E-01	4,55E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,43E-01	1,04E-02	1,53E-03	2,09E-02	-4,35E+00	7,71E+00
PENRE (MJ equiv/FU)	9,04E+01	1,61E+00	-2,16E+00	1,00E+01	4,93E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,15E-01	7,55E-01	1,39E-02	3,05E-01	-2,44E+01	1,07E+02
PENRM (MJ equiv/FU)	3,61E-02	0,00E+00	1,76E+01	0,00E+00	-4,75E+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	1,29E+01
PENRT (MJ equiv/FU)	9,04E+01	1,61E+00	1,54E+01	1,00E+01	1,81E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,15E-01	7,55E-01	1,39E-02	3,05E-01	-2,44E+01	1,20E+02
SM (kg/FU)	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	0,00E+00	0,00E+00	0,00E+00	5,31E-01	0,00E+00
RSF (MJ equiv/FU)	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	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF (MJ equiv/FU)	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	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW (m^3 water eq/FU)	1,16E-01	1,74E-04	9,16E-03	1,05E-03	1,04E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,63E-04	5,42E-05	2,59E-06	4,70E-04	-2,33E-02	1,28E-01

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water

Waste categories & output flows

Waste categories and output flows

	Production			Construction process stage		Use stage							End-of-life stage					
	A1 Raw material	A2 Transport	A3 Manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
Hazardous waste disposed (kg/FU)	6,30E-06	4,00E-06	1,74E-05	7,61E-05	4,16E-07	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,09E-07	1,97E-06	1,80E-08	6,93E-07	-8,16E-06	1,07E-04
Non-hazardous waste disposed (kg/FU)	1,40E-01	7,00E-02	1,68E-01	3,15E-01	1,45E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,70E-03	3,59E-02	4,09E-05	4,02E-01	-2,66E-02	1,28E+00
Radioactive waste disposed (kg/FU)	2,19E-05	1,06E-05	5,67E-05	6,55E-05	1,13E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,42E-06	5,12E-06	5,17E-08	1,20E-06	-2,76E-05	1,68E-04
Components for re-use (kg/FU)	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	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling (kg/FU)	0,00E+00	0,00E+00	5,11E-02	0,00E+00	1,92E-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	2,88E-01	0,00E+00	-5,31E-01	5,31E-01
Materials for energy recovery (kg/FU)	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	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy (MJ/FU)	0,00E+00	0,00E+00	7,01E-03	0,00E+00	1,91E+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	-1,91E+00	1,91E+00

Impact categories additional to EN 15804+A2

	Production			Construction process stage		Use stage							End-of-life stage					
	A1 Raw material	A2 Transport	A3 Manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
PM (disease incidence eq/FU)	7,08E-08	6,77E-09	2,94E-08	4,55E-08	1,18E-09	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,66E-10	3,46E-09	5,91E-11	2,06E-09	-1,47E-08	1,60E-07
IRP (kg U235 eq/FU)	1,95E-01	7,11E-03	6,86E-02	4,35E-02	7,49E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,60E-03	3,28E-03	3,74E-05	1,07E-03	-6,44E-02	3,26E-01
ETP - fw (CTUe/FU)	5,49E+01	1,32E+00	2,28E+01	9,37E+00	1,70E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,23E-01	6,01E-01	8,83E-03	2,26E+00	-1,03E+01	9,20E+01
HTP - c (CTUh/FU)	3,46E-08	4,34E-11	1,13E-09	5,30E-10	3,82E-11	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,35E-11	1,69E-11	2,81E-13	1,53E-10	-5,44E-10	3,65E-08
HTP - nc (CTUh/FU)	4,51E-08	1,40E-09	2,43E-08	1,04E-08	2,74E-10	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,60E-10	6,55E-10	8,03E-12	1,53E-09	-8,61E-09	8,42E-08
SQP (/)	4,55E+00	1,10E+00	3,74E+01	4,99E+00	1,74E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,86E-01	5,17E-01	6,66E-03	2,89E-01	-2,85E+01	4,92E+01

PM = Particulate Matter (Potential incidence of disease due to PM emissions); IRP = Ionizing Radiation Potential – human health effects (Potential Human exposure efficiency relative to U235); ETP-fw = Ecotoxicity – freshwater; (potential comparative toxic unit); HTP- c = Human Toxicity – cancer effects; HTP-nc = Human Toxicity – non cancer effects; SQP = Soil Quality Index, land use related impacts

Information on Biogenic Carbon content

There is no biogenic carbon content in the product. Uptake of biogenic CO2 within the pallets and the carton is reported in module A3, release in module A5.

	Biogenic carbon content (kg C / FU)
Biogenic carbon content in product (at the gate)	0,00E+00
Biogenic carbon content in accompanying packaging (at the gate)	7,58E-02

Global Warming Potential	*The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.* *It is split up in 4:* - *Global Warming Potential total (GWP-total) which is the sum of GWP-fossil, GWP-biogenic and GWP-luluc* - *Global Warming Potential fossil fuels (GWP-fossil): The global warming potential related to greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc).* - *Global Warming Potential biogenic (GWP-biogenic) : The global warming potential related to carbon emissions to air (CO_2, CO and CH4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.*[1] - *Global Warming Potential land use and land use change (GWP-luluc): The global warming potential related to carbon uptakes and emissions (CO_2, CO and CH4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).*
Ozone Depletion Potential	*Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), Which break down when they reach the stratosphere and then catalytically destroy ozone molecules.*
Acidification Potential	*Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating, and transport.*
Eutrophication Potential	*The potential to cause over-fertilization of water and soil, which can result in increased growth of biomass and following adverse effects.* *It is split up in 3:* - *Eutrophication Potential – freshwater: The potential to cause over-fertilization of freshwater, which can result in increased growth of biomass and following adverse effects.* - *Eutrophication Potential – marine: The potential to cause over-fertilization of marine water, which can result in increased growth of biomass and following adverse effects.* - *Eutrophication Potential – terrestrial: The potential to cause over-fertilization of soil, which can result in increased growth of biomass and following adverse effects.*
Photochemical ozone Creation Potential	*Chemical reactions brought about by the light energy of the sun creating photochemical smog. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.*
Abiotic Depletion Potential for non-fossil resources	*Consumption of non-renewable resources, thereby lowering their availability for future generations. Expressed in comparison to Antimony (Sb).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
Abiotic Depletion Potential for fossil resources	*Measure for the depletion of fossil fuels such as oil, natural gas, and coal. The stock of the fossil fuels is formed by the total amount of fossil fuels, expressed in Megajoules (MJ).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*

[1] Carbon exchanges from native forests shall be modelled under GWP - luluc (including connected soil emissions, derived products or residues), while their CO_2 uptake is excluded.

Ecotoxicity for aquatic fresh water	*The impacts of chemical substances on ecosystems (freshwater).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
Human toxicity (carcinogenic effects)	*The impacts of chemical substances on human health via three parts of the environment: air, soil and water.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
Human toxicity (non-carcinogenic effects)	*The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
Particulate matter	*Accounts for the adverse health effects on human health caused by emissions of Particulate Matter (PM) and its precursors (NO_X, SO_X, NH_3)*
Resource depletion (water)	*Accounts for water use related to local scarcity of water as freshwater is a scarce resource in some regions, while in others it is not.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
Ionizing radiation - human health effects	*This impact category deals mainly with the eventual impact on human health of low dose ionizing radiation of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.*
Land use related impacts	*The indicator is the "soil quality index" which is the result of an aggregation of following four aspects:* - *Biotic production* - *Erosion resistance* - *Mechanical filtration* - *Groundwater* *The aggregation is done based on a JRC model. The four aspects are quantified through the LANCA model for land use.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*

Additional information on Release of dangerous substances to indoor air, soil and water during the use stage

Indoor air

Not relevant for the considered applications

Soil and water

Not relevant for the considered applications

BIBLIOGRAPHY

- ISO 14040:2006: Environmental Management-Life Cycle Assessment-Principles and framework.
- ISO 14044:2006: Environmental Management-Life Cycle Assessment-Requirements and guidelines.
- ISO 14025:2006: Environmental labels and Declarations-Type III Environmental Declarations-Principles and procedures.
- EN 15804+A2:2019. CEN TC350. Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products. European standard.
- NBN/DTD B 08-001 (BE-PCR)
- European Commission, PEFCR Guidance document, - Guidance for the development of Product Environmental Footprint Category Rules (PEFCRs), version 6.3, December 2017.
- Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230. Available at: <http://link.springer.com/10.1007/s11367-016-1087-8> [2019].
- Project report of EPSE: Life cycle assessment for solid and multiwall polycarbonate sheets produced by the European Polycarbonate Sheet Extruders; December 2021, authors: Mihaela Thuring, Hannah Van Hees and Varun Gowda Palahalli Ramesh

General information

Owner of the EPD, Responsible for the data, LCA and information	European Polycarbonate Sheet Extruders Kortenberglaan 71 1000 Brussel BELGIUM
Based on following PCR documents	EN 15804:2012+A2:2019 NBN/DTD B 08-001 and its complement EN16757:2017
Author(s) of the LCA and EPD	Mihaela Thuring / Arthur De Jaegher / Varun Gowda Palahalli Ramesh / Hannah Van Hees mihaela.thuring@vito.be / arthur@enperas.com / varun@enperas.com
Identification of the project report	Life cycle assessment for solid and multiwall polycarbonate sheets produced by the European Polycarbonate Sheet Extruders
Verification	External independent verification of the declaration and data according to EN ISO 14025 and relevant PCR documents Verifier: Bernd Brandt, bernd@brandtconsulting.eu

Comparing EPDs is not possible unless they are conform to the same PCR and taking into account the building context.

Members of EPSE