POLYGLASS Q
MAPEI GROUP

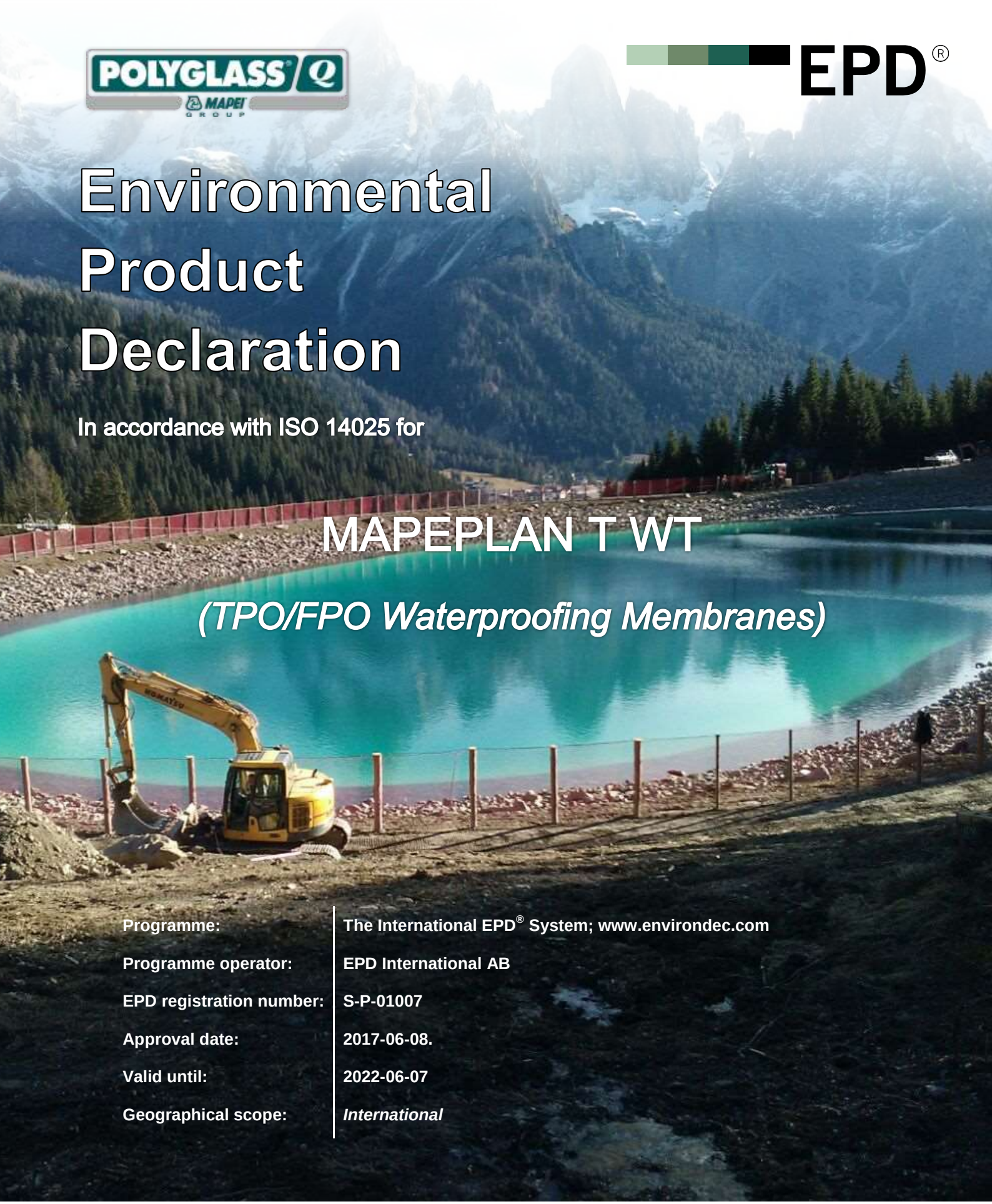
EPD®

Environmental Product Declaration

In accordance with ISO 14025 for

MAPEPLAN T WT

(TPO/FPO Waterproofing Membranes)



Programme:	**The International EPD® System; www.environdec.com**
Programme operator:	**EPD International AB**
EPD registration number:	**S-P-01007**
Approval date:	**2017-06-08.**
Valid until:	**2022-06-07**
Geographical scope:	***International***

Mapeplan® T

1. Company description / Goal & Scope

Polyglass headquarter is located in Ponte di Piave, Treviso (Italy), and takes up over 90.000 m^2 of surface with 25.000 m^2 covered. The plant has 4 production lines of polymer-bitumen membranes, one production line of thermal and acoustic insulation systems and two production lines of synthetic PVC-P and TPO/FPO membranes.

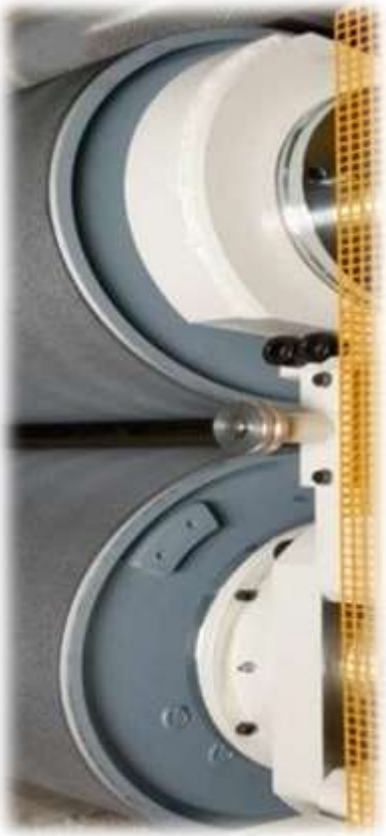


Figure 1: Production equipment

In October 2008 Polyglass was taken over by the MAPEI Group, an international Company in the chemical industry for construction, with 73 production plants in 5 continents, in 33 countries.

Polyglass SpA is ISO 14001 certified since 2010 and ISO 9001 since 1995.

The goal of the study is to provide necessary data and documentation to produce an EPD according to the requirements of PCR according to EN 15804:2014 and PCR Environdec, version 2.2, date 2017-05-30 and to have more comprehension about the environmental impacts related to Mapeplan T WT, manufactured in Polyglass SpA located in Ponte di Piave (TV - Italy), including packaging of the finished product.

Target audiences of the study are customers and other parties with an interest in the environmental impacts of **MAPEPLAN T WT.**

This analysis shall not support comparative assertions intended to be disclosed to the public.

Figure 2: Polyglass S.p.A. head quarter

2. Product description

Mapeplan T WT is a synthetic waterproofing membrane in flexible polyolefin TPO/FPO produced in multi extrusion coating process, with high quality raw materials, reinforced with glass mat.

The reference service life of the membrane, according to Polyglass experience, is estimated at least 30 years, if professionally installed and properly used.

Mapeplan T WT is compliant with the following international standards:

- EN 13361 “Geosynthetic barriers. Characteristics required for use as fluid barrier in the construction of reservoirs and dams”.
- EN 13362 “Geosynthetic barriers. Characteristics required for use as fluid barrier in the construction of canals”; EN 13491 “Geosynthetic barriers. Characteristics required for use as fluid barrier in the construction of tunnels and underground structures”.
- EN 13492 “Geosynthetic barriers. Characteristics required for use as fluid barrier in the construction of liquid waste disposal sites, transfer stations or secondary containment”, and are sold with different packaging, as follow.

PACKAGING

Pallet	14 rolls per pallet
Length of rolls	20 m, special length on request
Width of rolls	2,10 m

Figure 3: Membrane MAPEPLAN T WT on water reservoir

3. Content declaration

The main components and ancillary materials of Mapeplan T WT polymeric waterproofing membranes are the following:

Table 1: Composition

Materials	Percentage (%)
TPO/FPO Compound	> 80
Pigments	0 ÷ 10
Reinforcing material	0 ÷ 5
Other additives	0 ÷ 5

The products contains no substances of very high concern (SVHC) on the REACH Candidate List published by the European Chemicals Agency in a concentration more than 0,1 % (by unit weight).

4. Declared Unit and RSL (Reference Service Life)

The declared unit is 1m² of finished product having a 2,0 mm thickness, including packaging.

as follows:

- Wooden pallet
- Cardboard
- LDPE used as wrapping material

The reference service life of the membrane, according to Polyglass experience, is estimated at least 30 years, if professionally installed and properly used.

5. System Boundaries & additional technical information

The approach is a “cradle to gate with options”.

The following modules have been considered:

- A1-A3 (production stage): extraction and transport of raw materials, packaging included, production process.

- A4-A5 (Construction process stage): transport of the finished product to final customers and installation into the building.

- C1-C4 (End-of-life stage): de-construction, demolition (C1), transport to waste processing (C2), waste processing for reuse, recovery and/or recycling (C3), disposal (C4).

Table 2: System boundaries (X=included, MND= module not declared)

Product stage			Assembly stage		Use stage							End of life stage				
Raw materials	Transport	Manufacturing	Transport	Assembly	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	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	MND

A brief description of the production process is the following:

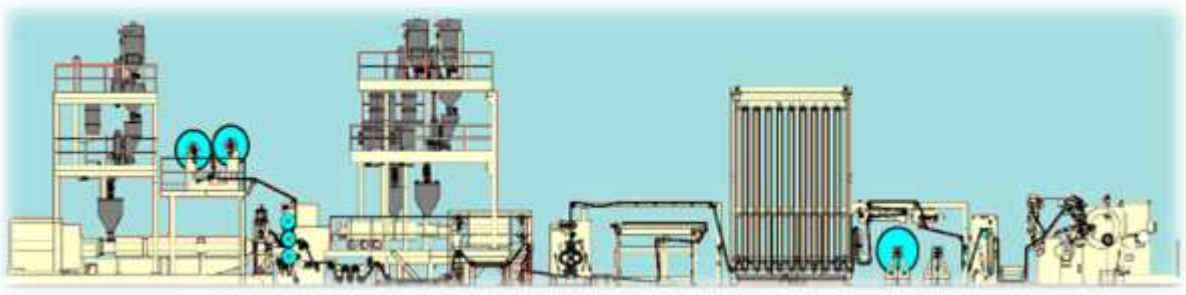


Figure 4: Production process detail

The production process of TPO/FPO waterproofing membranes is a multi extrusion coating process. The production plant produces waterproofing membranes with an internal reinforcing material made of glass mat.

TPO/FPO granulate is stored in silos and sent to multi extrusion coating plant.

The hot melt compound comes out from the extruders where the reinforced material is combined and totally encapsulated.

The membrane is cooled and finally sent to the packaging area, ready to ship.

Table 3: Transport to the building site (A4) - referred to 1 kg of finished product

Name	Value	Unit
Means of transport : truck euro 4 with 27 tons of payload & ship with a 27500 DWT		
Litres of fuel (truck)	~ 2E-03	l/kg*100km
Litres of fuel (ship)	~ 2E-04	l/kg*100km
Transport distance	1800	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	~1200	kg/m^3
Capacity utilisation volume factor	100	%

Table 4: Installation (A5) - referred to 1 kg of finished product

Name	Value	Unit
Auxiliary	-	kg
Water consumption	-	m_3
Other resources	-	kg
Electricity consumption	0,005	kWh/kg
Other energy carriers	-	MJ
Material loss (membrane)	3	%
Overlaps (membrane)	5	%
Output substances following waste treatment on site	-	kg
Dust in the air	-	kg
VOC in the air	-	kg

Table 5: End of Life (C1-C4) - referred to 1 kg of finished product

Name	Value	Unit
Collected separately	-	kg
Collected as mixed construction waste	-	kg
Reuse	0,46	kg
Transport to recycling /disposal facility	100	km
Energy recovery	-	kg
Landfilling	0,54	kg

Figure 5: Membrane MAPEPLAN T WT on water reservoir

6.Cut-off rules & allocation

Criteria for the exclusion of inputs and outputs (cut-off rules) in the LCA and information modules and any additional information are intended to support an efficient calculation procedure. They are not applied in order to hide data.

The following procedure is followed for the exclusion of inputs and outputs:

- All inputs and outputs to a unit process are included in the calculation, for which data are available.
- Less than 0,1% of the total mass inputs/outputs of the unit process A3, are cut-off (see table 6).

Input flows are covered for the whole formula.

Table 6: Cut-off criteria

Process excluded from study	**Cut-off criteria**	**Quantified contribution from process**
A3: production (auxiliary materials)	Less than 10^{-4} kg/kg of finished product	Less than 0,1%
A3: production (particle emissions to air / not compliant finished product)	Less than 10^{-5} kg/kg of finished product	Less than 0,1%

For the allocation procedure and principles, consider the following table (Table 7):

Table 7: Allocation procedure and principles

Module	**Allocation Principle**
A1; A2	All data are referred to 1 m^2 of product. • A1: electricity is allocated to the reference line production
A3; A4	All data are referred to 1 m^2 of packaged product. • A3-wastes: all data are allocated to the whole plant production.
A5; C1; C2; C3, C4	All data are referred to 1m^2 of packaged product. • A5: all wastes coming from packaging material are considered to be disposed in a landfill (100%); if we consider a European profile also for wastes coming from packaging materials, we would have a difference below 1% for each environmental indicators. • C3 - C4: according to *"European Commission DG ENV Final Report Task 2 – Management of C&D waste",* 46% is to be considered as recycle/reuse and remaining percentage is to be considered as disposed in a landfill. NOTE: **No benefits coming from recycling waste treatment process have been considered in this study.**

7. Environmental performance & interpretation

Following tables show environmental impacts and indicators for the product considered according to CML methodology (2001 - Jan2016).

Table 8: Mapeplan T WT Environmental categories (according to EN 15804 and PCR Environdec, version 2.2, date 2017-05-30)

Modules	GWP_{100} (Kg CO2 eq.)	ADPe (element) (Kg Sb eq.)	EP (Kg PO34- eq.)	AP (Kg SO2 eq.)	POCP (Kg ethylene eq.)	ODP (Kg R-11 eq.)	ADPf (fossil) (MJ)
A1-A3	5,25E+00	6,02E-06	1,79E-03	2,40E-02	2,76E-03	7,42E-09	1,49E+02
A4	1,49E-01	1,12E-08	1,85E-04	1,02E-03	-1,79E-04	4,86E-14	2,02E+00
A5	1,10E-01	3,06E-09	2,86E-05	4,34E-05	3,36E-05	1,97E-13	1,44E-01
C1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
C2	1,59E-02	1,28E-09	1,55E-05	6,24E-05	-2,26E-05	5,30E-15	2,18E-01
C3	2,56E-03	4,46E-09	4,08E-06	1,71E-05	1,84E-06	2,66E-15	4,74E-02
C4	1,79E-02	6,32E-09	1,45E-05	1,06E-04	8,36E-06	1,69E-14	2,32E-01

GWP100: Global Warming Potential; **ADPe**: Abiotic Depletion Potential (elements); **EP**: Eutrophication Potential; **AP**: Acidification Potential; **POCP**: Photochemical Ozone Creation Potential; **ODP**: Ozone Depletion Potential; **ADPf**: Abiotic Depletion Potential (fossil)

Table 9: Mapeplan T WT other environmental indicators

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4
RPEE	MJ	7,58E+00	9,30E-02	3,18E-02	0,00E+00	1,10E-02	3,76E-03	2,82E-02
RPEM	MJ	-	-	-	-	-	-	-
TPE	MJ	7,58E+00	9,30E-02	3,18E-02	0,00E+00	1,10E-02	3,76E-03	2,82E-02
NRPE	MJ	1,62E+02	2,04E+00	1,76E-01	0,00E+00	2,18E-01	4,86E-02	2,40E-01
NRPM	MJ	-	-	-	-	-	-	-
TRPE	MJ	1,62E+02	2,04E+00	1,76E-01	0,00E+00	2,18E-01	4,86E-02	2,40E-01
SM	kg	6,3E-02	-	-	-	-	-	-
RSF	MJ	-	-	-	-	-	-	-
NRSF	MJ	-	-	-	-	-	-	-
W	m3	5,34E-02	2,10E-03	1,26E-04	0,00E+00	2,50E-04	5,64E-05	1,66E-04

RPEE Renewable primary energy as energy carrier; **RPEM** Renewable primary energy as material utilisation; **TPE** Total use of renewable primary energy sources; **NRPE** Non-renewable primary energy as energy carrier; **NRPM** Non-renewable primary energy as material utilization; **TRPE** Total use of non-renewable primary energy sources; **SM** Use of secondary materials; **RSF** Renewable secondary fuels; **NRSF** Non-renewable secondary fuels; **W** Net use of fresh water

Table 10: Mapeplan T WT waste production & other output flows

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4
NHW	Kg	6,77E-02	-	9,7E-02	-	-		1,08
HW	Kg	-	-	-	-	-	-	-
RW	Kg	-	-	-	-	-	-	-
Components for re-use	Kg	-	-	-	-	-	-	-
Materials for recycling	Kg	-	-	-	-	-	0,92	-
Materials for energy recovery	Kg	-	-	-	-	-	-	-
Exported energy	MJ	-	-	-	-	-	-	-
HW Hazardous waste disposed; **NHW** Non-hazardous waste disposed; **RW** Radioactive waste disposed								

To calculate results for different thicknesses (1,3, 1,5, 2,0 and 2,5 mm), please use following multiplicative coefficients for the environmental indicators considered (EIx).

Table 11: Calculation rules for Environmental Categories of different thickness

	1,3 mm thickness	1,5 mm thickness	2,0 mm thickness	2,5 mm thickness
Mapeplan T WT	$EI_{2,0}$ * **0,65**	$EI_{2,0}$ * **0,75**	$EI_{2,0}$ * **1**	$EI_{2,0}$ * **1,25**

$EI_{2,0}$: Environmental Indicator for Mapeplan T WT with 2,0 mm thickness.

Tables above show absolute results for each of the environmental impact categories and indicators. They underline that the product stage (**A1 – A3)** has the highest contribution for each of them and weights up to 99% (i.e. ADP element) of the total impact in the whole system boundary.

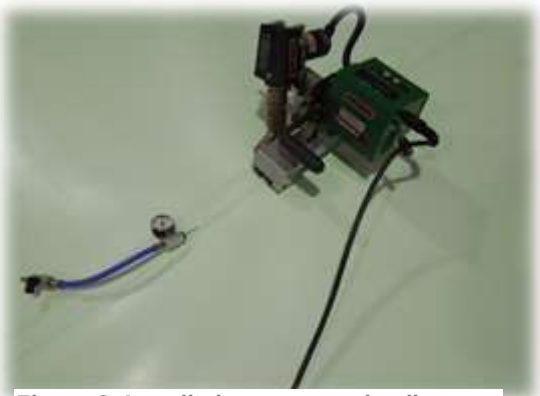


Figure 6: Installation process detail

In particular, TPO/FPO compounds and reinforcing materials (module **A1**), which are some of the main components in Mapeplan T WT, carry a significant impact for all environmental categories. Electricity consumption considerably affects the GWP_{100}, ADP (fossil) and ODP values.

In terms of GWP_{100}, module **A5** gives a relevant contribution, as during the installation phase it's necessary to consider a membrane overlap (around 5%).
Transportation modules (**A2, A4**) have a substantial importance while **C2** module has a negligible contribution.

Figure 7: Membrane MAPEPLAN T WT installed on water tank

Only for transportation modules (**A2**, **A4** and **C2)**, POCP shows a negative contribution, due to nitrogen dioxide and monoxide emission factors as reported in CML 2001 (Jan. 2016) methodology.

Following Table shows relative contributes for all environmental categories considered in this EPD.

Table 12: Environmental Impacts as percentage of Mapeplan T WT

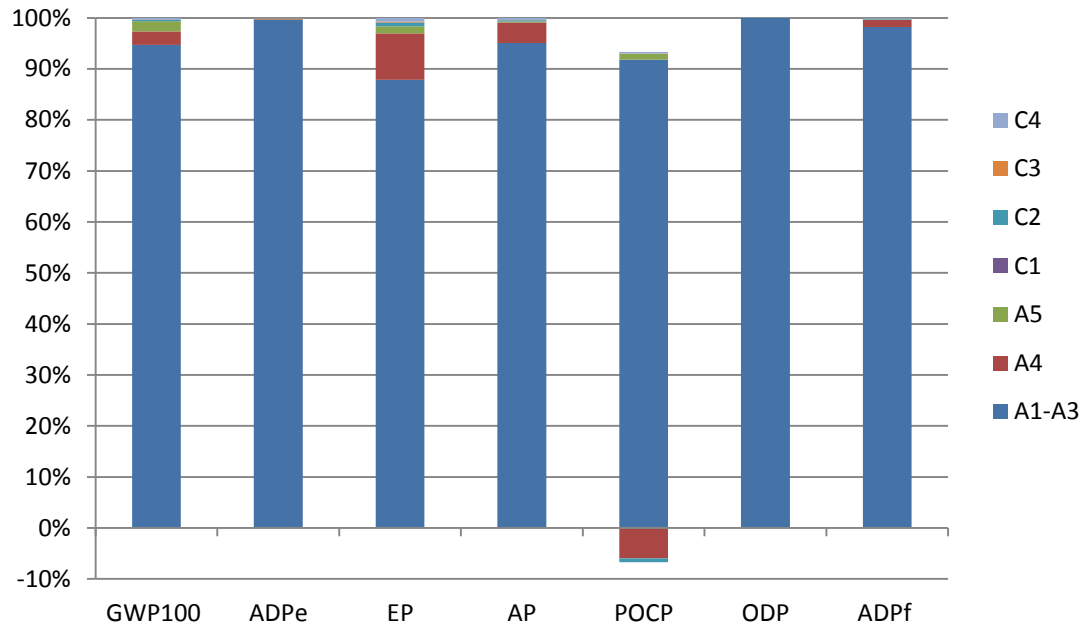
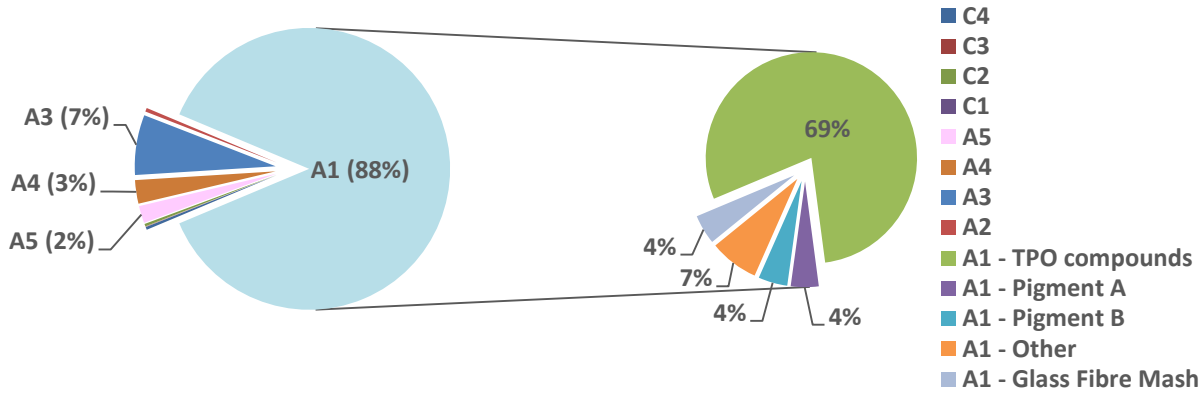


Table below shows a detail on GWP_{100}.

Table 13: Modules A2, C1, C2, C3 and C4 give a relative contribution below 0,5% (not pointed out on the piechart below)



More details about electrical mix used in this EPD (Italian grid mix – 2013) is shown below.

Data source	Amount	Unit
GaBi (v6) database	0,429	Kg CO_2-eqv/kWh

8. Data Quality

Table 14: Data quality

Dataset & Geographical reference	Database (source)	Temporary reference
A1		
TPO compounds	Ecoinvent 3.3 Database	2010
Reinforcing materials	ThinkStep Database	2016
Additives	ThinkStep & Ecoinvent 3.3 Database	2010 - 2015
Electricity grid mix (IT)	ThinkStep Database	2013
A2-A4 (Transport)		
Truck transport (27ton payload – GLO)	ThinkStep Database	2015
Ocean ship (27500 DWT payload)	ThinkStep Database	2015
Electricity mix (EU)	ThinkStep Database	2012
Diesel for transport (EU)	ThinkStep Database	2012
Heavy fuel oil for ship transport (EU)	ThinkStep Database	2012
A3 (Production)		
Wastes (EU & DE)	ThinkStep Database & PlasticEurope	2005-2013
Packaging (EU)	ThinkStep Database & PlasticEurope	2005-2013
Diesel mix (EU)	ThinkStep Database	2011
Waste water treatment (EU)	ThinkStep Database	2010
Landfill for plastic waste (EU)	ThinkStep Database	2016
Landfill for inert matter (EU)	ThinkStep Database	2016
A5 (Installation)		
Electricity grid mix (IT)	ThinkStep Database	2013
Landfill for plastic waste (EU)	ThinkStep Database	2016
Landfill for wood waste (EU)	ThinkStep Database	2016
Landfill for paper waste (EU)	ThinkStep Database	2016
Landfill for metal waste (EU)	ThinkStep Database	2016
C1-C4 (End of Life)		
Truck transport (9,3ton payload – GLO)	ThinkStep Database	2016
Electricity grid mix (IT)	ThinkStep Database	2013
Landfill for inert matter (EU)	ThinkStep Database	2016
Construction waste treatment (DE)	ThinkStep Database	2016

Transport datasets have a global or European representativeness.

All datasets are not more than 10 years old (according to EN 15804 § 6.3.7 “data quality requirements”). Exceptions are about generic dataset used for packaging materials, coming from PlasticEurope, which are referred to 2005.

Primary data are collected during 2016 and representative for the entire annual production.

9. Verification and Registration

EPD of construction products may not be comparable if they do not comply with EN 15804

“Environmental product declarations within the same product category from different programs may not be comparable.

CEN standard EN15804 served as the core PCR	
PCR:	PCR 2012:01 Construction products and Construction services, Version 2.2, 2017-05-30
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair:Massimo Marino Contact via info@environdec.com
Independent verification of the declaration and data, according to ISO 14025	☒ EPD Process Certification (Internal) ☐ EPD Verification (external)
Third party verifier:	Certiquality S.r.l. Number of accreditation: 003H rev14
Accredited or approved by:	Accredia

10. References

- GENERAL PROGRAMME INSTRUCTIONS OF THE INTERNATIONAL EPD® SYSTEM. VERSION 2.5;
- PCR 2012:01 “PRODUCT GROUP CLASSIFICATION: MULTIPLE UN CPC CODES CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES”, VERSION 2.2;
- PCR 2014:12 “FLEXIBLE SHEETS FOR WATERPROOFING – BITUMEN, PLASTIC OR RUBBER SHEETS FOR ROOF WATERPROOFING”;
- EN 13361 “GEOSYNTHETIC BARRIERS. CHARACTERISTICS REQUIRED FOR USE AS FLUID BARRIER IN THE CONSTRUCTION OF RESERVOIRS AND DAMS”;
- EN 13362 “GEOSYNTHETIC BARRIERS. CHARACTERISTICS REQUIRED FOR USE AS FLUID BARRIER IN THE CONSTRUCTION OF CANALS”;
- EN 13491 “GEOSYNTHETIC BARRIERS. CHARACTERISTICS REQUIRED FOR USE AS FLUID BARRIER IN THE CONSTRUCTION OF TUNNELS AND UNDERGROUND STRUCTURES”;
- EN 13492 “GEOSYNTHETIC BARRIERS. CHARACTERISTICS REQUIRED FOR USE AS FLUID BARRIER IN THE CONSTRUCTION OF LIQUID WASTE DISPOSAL SITES, TRANSFER STATIONS OR SECONDARY CONTAINMENT”.

Contact information:

EPD owner:	Polyglass SpA www.polyglass.com
LCA author:	Mapei SpA www.mapei.it; Environmental Sustainability Office
Programme operator:	EPD International AB info@environdec.com