Environmental Product Declaration

In accordance with ISO 14025 and EN 15804+A1 and ISO14040

Non-reinforced EPDM membranes for waterproofing

HOLCIM

Programme:	The International EPD® System
Programme operator:	EPD International AB [www.environdec.com]
EPD reg. number:	S-P-01431
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Geographical scope:	Europe

EPD®
THE INTERNATIONAL EPD® SYSTEM

ECO PLATFORM EPD EN 15804 VERIFIED

EPD programme	The International EPD® System operated by EPD International AB, Box 210 60 SE-100 31 Stockholm, Sweden Website: www.environdec.com/ Email: info@environdec.com
Reference Product category rules (PCR)	2012:01 Construction products and construction services v.2.2 (The International EPD System, 2012:01)
EPD title	Environmental product declaration: Non-reinforced EPDM membranes for waterproofing
Independent verification of the declaration and data, according to ISO 14025:2006	■ EPD External verification ☐ EPD Process verification
LCA performed by	Inèdit Innovació SL
Third party verifier	Gorka Benito Alonso – IK inginieria
Third party verifier accredited or approved by	The International EPD® System
Procedure for follow-up of data during EPD validity involves third-party verifier	■ YES ☐ NO
Data of EPD publication	2018-12-12
EPD Validity	2023-12-12
EPD valid within the following geographical area	Europe

Results presented in this document do not constitute comparative assertions. However, the results will be disclosed to the public in EPDs, which architects and builders will be able to use to compare Holcim products with similar products presented in other EPDs that follow the same PCR. EPDs of other similar products from different programmers may not be comparable unless they comply with EN15804 and PCR 2012:01; methodology (stages under study, method, declared or functional unit, etc.) could be different and the results will be not

1. ABOUT THE COMPANY

	Holcim Solutions and Products Spain
Manufacturing site and country	*Production Plant:* C/ Libra 17, E-08228 Terrassa *Welding & warehouse:* C/Pintor Casas 9, E-08213 Polinyà
Issuer and contact information	David Pelejero (david.pelejero@holcim.com)

Holcim Solutions and Products Spain commitment with sustainability is shown by its environmental policy and vision which is based in the following principles:

- Envisioning a sustainable future
- In harmony with nature
- Value natural resources
- Reduce CO2 and other emissions

Holcim Solutions and Products Spain (Holcim) plant in Terrassa is also certified with ISO 14001:2015. Initiating Environmental Product Declaration (EPD) process for its products, **non-reinforced EPDM membranes for waterproofing** (for roofs, lining pondlining, lining agricultural and facades), will be able to present the environmental performance most transparently with EPD documentation. Thus, Holcim engaged inèdit (Inèdit Innovació SL) to evaluate the environmental profile of its Ethylene Propylene Diene Monomer (EPDM) membrane products, manufactured in C/Libra 17, Polígon Industrial Can Parellada, Terrassa, Spain, using Life Cycle Assessment (LCA) and to report the results in Environmental Product Declarations (EPD) for communication to third parties.

2. PRODUCT INFORMATION

The Table 1 shows the products specifications in material content (in % by weight) per 1 m^2 of non-reinforced EPDM flexible membrane for waterproofing.

Table 1. Material composition of non-reinforced EPDM for roofing

Material	**[% of total mass]**
Base resin (EPDM)	34.0%
Carbon Black	30.0%
Plasticizer (paraffinic oil)	20.5%
White filler (aluminium silicate)	11.5%
Activators (zinc stearate)	1.5%
Vulcanization system sulphur based crosslinking)	1.5%
Processing aids (stearic acid)	1.0%

The EPDM membrane does not use Substances of Very High Concern, as stated in REACH legislation, during the life cycle of the product.

3. LCA INFORMATION

The primary goal of this study is to assess the **cradle-to-gate with options** of the environmental impacts of **"non-reinforced EPDM (Ethylene Propylene Diene Monomer) membranes for waterproofing"** manufactured by Holcim Solutions and Products Spain.

The LCA has been performed following the PCR "2012:01 Construction products and construction services" version 2.2 (The International EPD System, 2012:01), ISO 14040 (ISO 14040, 2006), ISO 14044 (ISO 14044, 2006), ISO 14025 (ISO 14025, 2010) and EN 15804 +A1 (UNE-EN 15804, 2012). The life cycle impact assessment (LCIA) categories and other indicators considered to be of high relevance to the goals of the project are listed in this chapter.

Table 2 presents the product characteristics and the declared unit and references service life used in the LCA.

Table 2. Declared unit and specifications for non-reinforced EPDM membranes for waterproof coating

Products	**Giscolene EPDM - roofing**	**PondEasy EPDM -lining**	**GeoSmart EPDM - agricultural**	**Giscolene F EPDM - facade**
Declared unit to which the data relates	1 m^2 packaged EPDM for roof waterproofing with 1,2mm thickness	1 m^2 packaged EPDM for lining pondlining waterproofing with 0,8mm thickness	1 m^2 packaged EPDM for lining agricultural ponds/lakes with 1,2mm thickness	1 m^2 packaged EPDM for façade sealing with 0,75mm thickness
Description / Specification	Roofing: EN 13956/EN 1396	Pond lining: EN 13361/EN 13362	Agricultural: EN 13361/EN 13662/ EN 13492	Facades: EN 13984/EN 14909
Thickness (mm)	Average thickness 1.2 mm	Average thickness 0.8 mm	Average thickness 1.2 mm	Average thickness 0.75 mm
Membrane weigh (kg/m^2)	1,23 kg/m^2	0,765 kg/m^2	1,23 kg/m^2	0,71 kg/m^2
Reference Service Life (RSL)	30 years[1]			

3.1. General System Boundaries

This approach is a "cradle to gate with options" and the stages consider are presented in Table 3. As there is not a specific sub-PCR for products under the scope of this study, the company has chosen to declare the EPD as a "cradle to gate with options" with a Declared Unit.

[1] The reference service life used is the one proposed by the PCR Flexible membranes for waterproofing - bitumen, plastic or rubber membranes for roof waterproofing (expired 2017-07-10; replaced).

Table 3. Life Cycle Stages and Modules defined in EN 15804 and consider in this EPD

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIGE STAGE			
Raw material supply	Transport	Manufacturing	Transport	Construction	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy	Operational water	De-construction	Transport	Waste processing	Disposal
A1	A2	A3	A4	A5	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*	C1	C2	C3	C4
X	X	X	X	X	*X*	*MND*	*MND*	*MND*	*MND*	*MND*	*MND*	*MND*	X	X	X

UPSTREAM PROCESSES

- A1 Raw material supply: extraction and processing of raw materials.

CORE PROCESSES

- A2-A3 Transportation and manufacturing: transport of raw materials and manufacturing of the construction product, packaging materials and treatment of waste generated from the manufacturing processes.

DOWNSTREAM

- A4-A5 Transport and installation: distribution of the product and installation.
- B1 Use: emissions due to release of substances from the roof covering.
- C1-C4 End of life: Waste transportation, waste processing and disposal.

The life cycle stages and life cycle modules stages to consider are defined and refer to EN 15804 standard and follows the PCR 2012:01.

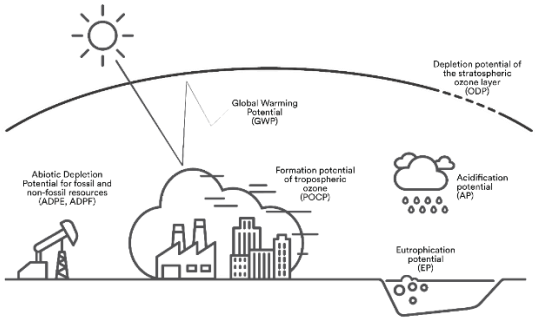
3.2. LCIA Impact Categories and other indicators

For the LCIA Impact Categories CML-IA baseline V4.2 / EU25 impact model was used (Oers, 2015). The specific impact categories under study are listed below and in Figure 1 :

CML-IA baseline:

- Abiotic depletion potential, elements (ADPe) [kg Sb eq.]
- Abiotic depletion potential, fossil fuels (ADPf) [MJ, net calorific value]
- Acidification potential (AP) [kg SO2 eq.]
- Eutrophication potential (EP) [kg (PO4)3-eq.]
- Global warming potential (GWP) [kg CO2 eq., 100 years]
- Ozone layer depletion potential (ODP) [kg CFC 11 eq.]
- Photochemical ozone creation potential (POCP) [kg C2H4 eq.]

Figure 1. LCIA Impact categories analyzed by CML-IA baseline



LCIA results represents impact potentials and do not predict actual impacts, the exceeding of thresholds, safety margins, or risks.

Following the PCR and in accordance to EN15084 (European Commission, 2012) the following additional indicators are reported. The information about the method and software used for the analysis on each parameter is also mentioned below.

EN 15804 Parameters describing resource use

- Renewable primary energy as energy carrier (PERE) [MJ]
- Renewable primary energy resources as material utilization (PERM) [MJ]
- Total use of renewable primary energy resources (PERT)[MJ]
- Non-renewable primary energy as energy carrier (PENRE) [MJ]
- Non-renewable primary energy as material-utilization (PENRM) [MJ]
- Total use of non-renewable primary energy resources (PENRT) [MJ]
- Use of secondary material (SM)[kg]
- Use of renewable secondary fuels (RSF) [MJ]
- Use of non-renewable secondary fuels (NRSF) [MJ]
- Use of fresh water (FW) [m3]

EN 15804 Other environmental information describing waste categories

- Hazardous waste disposed (HWD) [kg]
- Non-hazardous waste disposed (NHWD) [kg]
- Radioactive waste disposed (RWD) [kg]

EN 15804 Other output flows

- Components for reuse (CRU) [kg]
- Materials for recycling (MFR) [kg]
- Materials for energy recovery (MER) [kg]
- Export energy (EE) [MJ per energy carrier]

3.3. Geographical and time boundaries

This study represents Holcim's EPDM flexible membrane manufacturing facility in Polígon Industrial Can Parellada, Terrassa, Spain. It also considers the plant in Polinyà, Barcelona, where part of the process takes part and because part of the distribution leaves from there. The geographical coverage for this study is based in the EU. Production of the membranes occurs in

Spain and the installations and end of life are evaluated for Spain and the rest of the EU. Spain and European data are used in the first place and if missing global data will be used.

The primary data related with the production is from year 2017. Background data for upstream and downstream processes (i.e. raw materials, energy resources, transportation and ancillary materials) are to be obtained from primary data or from databases (Ecoinvent v3.2 database) and the time boundaries will depend on the process used. Specific data from the real process has been used for all raw and ancillary materials, energy consumption, waste production and emissions to air, soil and water. The electricity production used for the calculations is from the average and renewable mix for 2017 in Spain and is explained in Annex II.

3.4. Cut-off criteria

The cut-off criteria for flows are described in the PCR 2012:01 and in EN 15804. All inflows from the upstream (A1) and core modules (A2-A3) are included and for some of the downstream stages (A4-A5; B1 and C1-C4). All available energy and material flow data have been included in the model. In cases where no matching life cycle inventories were available to represent a flow, proxy data have been applied based on conservative assumptions regarding environmental impacts. The assumptions of the key processes used in the life cycle inventory and results are described in Annex I.

3.5. Software, allocation rules and data quality

The LCA model was created using an excel calculator, Simapro and Gabi software and Ecoinvent V3.2 LCA database.

As several products are manufactured at the same plant (EPDM for roofing, for lining, facades or other uses), Holcim used mass allocation to report data. Mass allocation was selected since the environmental burden in the industrial process (energy consumption, emissions, etc.) is primarily governed by the mass throughput of each sub-process.

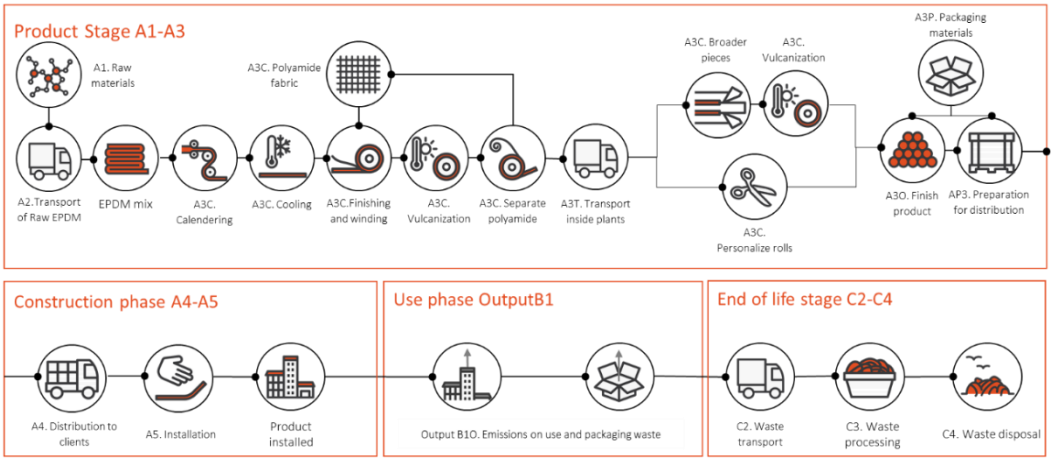
Data from the production process by Holcim is measured as primary data. This data is of the highest precision, followed by calculated data, literature data, and estimated data. Each input and output of the LCA performed has a related description for the origin of the data and assumptions on the data used in the excel calculator. More information on data quality and a sensitive analysis has been carried on in LCA report.

4. LIFE CYCLE INVENTORY ANALYSIS

Primary data for the manufacturing of non-reinforced EPDM membranes for roofing, lining pondlining, lining agricultural and facades were collected from the Terrassa and Polinyà plants. Data were provided from Holcim for the 2017 calendar year.

The environmental performance includes any activity within the “cradle to gate” with options and is reported separately by the modules of life cycle stages listed below and represented in Figure 2.

Figure 2. EPDM overview



A description of the life cycle of the product related with each stage of the LCA is made below:

(A1) The main material input into the manufacturing process is EPDM mix in form of uncured compound and (A2) is provided mainly by two suppliers. (A3) When arrived at Terrassa plant the mix is heated, stirred and extruded into a profile. The membrane is then pressed by calendering to achieve the specified thickness, cooled, cut and rolled up along with protective polyamide sheeting. EPDM scrap generated during the before-mentioned steps can be directly looped back as a material input, before the subsequent curing process that alters the rubber material irreversibility, making it unfit as a scrap input. Curing entails to roll the membrane and wrapped it to create pressure and placed in an oven. Once cured, the membrane maintains its shape and size. The finished product is cooled in the rollers and separated from the polyamide. Part of the final product need to be in a broader shape to sell (not for facades) and this process is made in Polinyà plant. (A3T) For this it is needed a transport between Terrassa and Polinyà plants and another step were some membranes are joined with EPDM strips and have a localized vulcanization before packaging. (A3P) Part of the personalization is made in Terrassa and some in Polinyà. The personalization of the rolls for customers is made by rolling the membranes in a cardboard tube and wrapped with raffia. The packaging also requires labels, adhesive tapes, straps, rubber separators, film, DM and boxes depending on the final use for the preparation for transport. (A3O) During the finishing and packaging process the generated waste is treated by recycling, energy recovery, incineration or landfill. (A4) EPDM for roofing, lining pondlining, lining agricultural and facades is then placed in pallets and distributed to the client from both plants. This analysis assumes that the non-reinforced EPDM membrane is installed in roofing and facades with synthetic adhesive, and manual installation for the other uses.

The inputs for use stages (B modules) for the EPDM membranes in this study are not included. Still outputs of the system have been considered as there are emissions related with the use phase and waste from the unpacking (B1O).

The product has a Reference Service Life of 30 years and at the end of the membrane's useful life, the membrane is assumed to be sent to energy recovery, material recovery or landfill and the other components are recycled, incinerated and landfilled assuming average data for Europe related with waste treatments (C2-C4).

5. ENVIRONMENTAL PERFORMANCE-RELATED INFORMATION

All results are related with the declared unit and represents the potential impacts for 1 m2 packaged EPDM for waterproofing coating with the specific thickness for each use by Holcim Solutions and Products Spain. The results are divided into 3 life cycle stages according the PCR 2012:01 develop by EPD® System: UPSTREAM (A1); CORE (A2-A3) and DOWNSTREAM (A4-C4).

5.1. Potential impact over the environment for EPDM for roof waterproofing

Table 4 present the life cycle results for **1 m² packaged EPDM for roof waterproofing with 1,2mm thickness**, used in Spain and EU.

Table 4. LCA Results for EPDM for roofing

		A1	A2-A3	A4-C4
Parameters	**Units**	**UPSTREAM**	**CORE**	**DOWNSTREAM**
GWP	[kg CO_2eq]	2.31E+00	1.83E+00	8.52E-01
ODP	[kg CFC-11eq]	6.94E-07	3.09E-07	8.08E-08
AP	[kg SO_2eq]	1.10E-02	7.24E-03	1.49E-03
EP	[kg PO_4^{3-} eq]	2.33E-03	1.53E-03	4.39E-03
POCP	[kg C_2H_4eq]	5.46E-04	3.52E-04	8.91E-05
ADPE	[kg Sb eq]	3.84E-05	1.51E-05	7.78E-07
ADPF	[MJ]	3.84E-05	4.05E+01	6.89E+00
PERE	[MJ]	2.45E+00	2.93E+00	2.71E-01
PERM	[MJ]	2.16E-01	1.09E-01	9.90E-03
PERT	[MJ]	2.67E+00	3.04E+00	2.80E-01
PENRE	[MJ]	8.52E+01	3.98E+01	6.90E+00
PENRM	[MJ]	1.15E-04	2.72E-03	2.08E-05
PENRT	[MJ]	8.52E+01	3.98E+01	6.90E+00
SM	[kg]	0.00E+00	8.86E-08	0.00E+00
FW	[m3]	2.13E-02	1.40E-02	1.76E-03
HWD	[kg]	1.69E-01	1.45E-05	3.53E-06
NHWD	[kg]	8.50E-02	9.21E-02	1.89E+00
RWD	[kg]	3.66E+00	1.67E-04	4.56E-05
MFR	[kg]	0.00E+00	6.24E-03	7.99E-01
MER	[kg]	0.00E+00	9.62E-02	8.01E-02
EE	[MJ]	0.00E+00	2.72E+00	2.54E+00

5.2. Potential impact over the environment for EPDM for lining pondlining waterproofing

Table 5 present the life cycle results for **1 m² packaged EPDM PondEasy for lining pondlining waterproofing with 0,8mm thickness**, used in Spain and EU.

Table 5. LCA Results for EPDM for lining pondlining

		A1	A2-A3	A4-C4
Parameters	**Units**	**UPSTREAM**	**CORE**	**DOWNSTREAM**
GWP	[kg CO_2eq]	1.44E+00	9.74E-01	5.33E-01
ODP	[kg CFC-11eq]	4.32E-07	1.37E-07	5.02E-08
AP	[kg SO_2eq]	6.84E-03	3.72E-03	9.30E-04
EP	[kg PO_4^{3-} eq]	1.45E-03	8.25E-04	2.74E-03
POCP	[kg C_2H_4eq]	3.39E-04	1.85E-04	5.59E-05
ADPE	[kg Sb eq]	2.39E-05	6.34E-06	4.83E-07
ADPF	[MJ]	2.39E-05	1.87E+01	4.29E+00
PERE	[MJ]	1.53E+00	2.50E+00	1.69E-01
PERM	[MJ]	1.34E-01	5.72E-02	6.15E-03
PERT	[MJ]	1.66E+00	2.56E+00	1.75E-01
PENRE	[MJ]	5.30E+01	1.81E+01	4.29E+00
PENRM	[MJ]	7.14E-05	1.70E-03	1.18E-05
PENRT	[MJ]	5.30E+01	1.81E+01	4.29E+00
SM	[kg]	0.00E+00	8.86E-08	0.00E+00
FW	[m3]	1.32E-02	8.31E-03	1.10E-03
HWD	[kg]	1.05E-01	2.41E-02	2.19E-06
NHWD	[kg]	5.29E-02	5.31E-02	1.19E+00
RWD	[kg]	2.28E+00	5.20E-01	2.84E-05
MFR	[kg]	0.00E+00	3.88E-03	5.11E-01
MER	[kg]	0.00E+00	5.99E-02	5.12E-02
EE	[MJ]	0.00E+00	1.69E+00	1.60E+00

5.3. Potential impact over the environment for EPDM for lining agricultural waterproofing

Table 6 present the life cycle results for **1 m² packaged EPDM GeoSmart for lining agricultural waterproofing with 1,2mm thickness**, used in Spain and EU.

Table 6. LCA Results for EPDM for lining agricultural

		A1	A2-A3	A4-C4
Parameters	**Units**	**UPSTREAM**	**CORE**	**DOWNSTREAM**
GWP	[kg CO_2eq]	2.31E+00	1.86E+00	8.45E-01
ODP	[kg CFC-11eq]	6.94E-07	3.13E-07	7.91E-08
AP	[kg SO_2eq]	1.10E-02	7.36E-03	1.46E-03
EP	[kg PO_4^{3-} eq]	2.33E-03	1.60E-03	4.39E-03
POCP	[kg C_2H_4eq]	5.46E-04	3.65E-04	8.77E-05
ADPE	[kg Sb eq]	3.84E-05	1.52E-05	7.53E-07
ADPF	[MJ]	3.84E-05	4.10E+01	6.75E+00
PERE	[MJ]	2.45E+00	3.61E+00	2.69E-01
PERM	[MJ]	2.16E-01	1.14E-01	9.62E-03
PERT	[MJ]	2.67E+00	3.72E+00	2.79E-01
PENRE	[MJ]	8.52E+01	4.04E+01	6.75E+00
PENRM	[MJ]	1.15E-04	2.73E-03	1.90E-05
PENRT	[MJ]	8.52E+01	4.04E+01	6.75E+00
SM	[kg]	0.00E+00	9.97E-08	0.00E+00
FW	[m3]	2.13E-02	1.55E-02	1.73E-03
HWD	[kg]	1.69E-01	6.22E-02	3.45E-06
NHWD	[kg]	8.50E-02	9.44E-02	1.89E+00
RWD	[kg]	3.66E+00	1.34E+00	4.47E-05
MFR	[kg]	0.00E+00	6.24E-03	8.07E-01
MER	[kg]	0.00E+00	9.62E-02	8.08E-02
EE	[MJ]	0.00E+00	2.72E+00	2.55E+00

5.4. Potential impact over the environment for EPDM for facades waterproofing

Table 7 present the life cycle results for **1 m² packaged EPDM for facades waterproofing with 0,75mm thickness**, used in Spain and EU.

Table 7. LCA Results for EPDM for facades

		A1	A2-A3	A4-C4
Parameters	**Units**	**UPSTREAM**	**CORE**	**DOWNSTREAM**
GWP	[kg CO_2eq]	1.34E+00	6.08E-01	4.43E-01
ODP	[kg CFC-11eq]	4.01E-07	3.58E-08	4.62E-08
AP	[kg SO_2eq]	6.35E-03	1.99E-03	8.49E-04
EP	[kg PO_4^{3-} eq]	1.34E-03	5.47E-04	1.91E-03
POCP	[kg C_2H_4eq]	3.15E-04	1.07E-04	4.94E-05
ADPE	[kg Sb eq]	2.22E-05	1.01E-06	4.45E-07
ADPF	[MJ]	2.22E-05	6.55E+00	3.94E+00
PERE	[MJ]	1.42E+00	3.82E+00	1.27E-01
PERM	[MJ]	1.24E-01	1.00E-01	5.66E-03
PERT	[MJ]	1.54E+00	3.92E+00	1.32E-01
PENRE	[MJ]	4.92E+01	5.58E+00	3.94E+00
PENRM	[MJ]	6.63E-05	1.54E-03	1.09E-05
PENRT	[MJ]	4.92E+01	5.58E+00	3.94E+00
SM	[kg]	0.00E+00	1.62E-02	0.00E+00
FW	[m3]	1.23E-02	5.37E-03	9.13E-04
HWD	[kg]	9.78E-02	4.32E-06	1.97E-06
NHWD	[kg]	4.91E-02	4.19E-02	8.68E-01
RWD	[kg]	2.11E+00	1.34E-05	2.61E-05
MFR	[kg]	0.00E+00	3.60E-03	3.72E-01
MER	[kg]	0.00E+00	5.56E-02	3.71E-02
EE	[MJ]	0.00E+00	1.57E+00	1.10E+00

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ANNEX I. ELECTRICITY MIX

As the electricity in A3 accounts for more than 30% of the total energy in stage A1 to A3 the energy sources behind are documented in the EPD in Table 8.

Table 8. Characteristics of electricity sources used on this EPD

Imp. Categories	Electricity mix 2017 / Other results: Electricity, medium voltage {ES}| market for | Alloc Def, S	Renewable sources electricity 2017
Functional unit	1 kWh at user	1 kWh at user
Global warming (GWP100a)	4.88E-01 kg CO2eq.	2.54E-01 kg CO2eq.
System boundaries and sources	Electiricity generation in 2017 for Spain. It incorporates loses during generation, transmissions to medium voltage and distribution. For renewable sources only with renewable energy. Electricity mix for Spain 2017 from REE (Red Electrica Española). More detail on types of origin in each type of electricity using Ecoinvent process "Electricity high voltage, ES".	