Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for:

MecFlow and Terrain Q Systems

from

Polypipe Building Services

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
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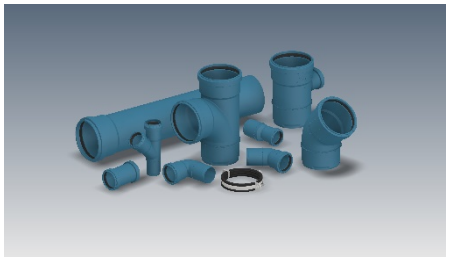
Valid until:	2027-01-04

MecFlow system

Terrain Q system



Content

1 General Information

Polypipe Ltd T/A Polypipe Building Services New Hythe Business Park College Road Aylesford ME20 7PJ Tel: +44 1622 795200 Email: commercialenquiries@polypipe.com Production plant certified by ISO 9001:2015 – Quality Management System, ISO 14001:2015 – Environmental Management System, ISO 45001:2018 – Occupational Health & Safety Management System, ISO 56002:2019 – The Process of Innovation Management, PAS 99:2012 – Integrated Management Registration	**Manufacturer and Owner of the EPD**
This EPD addresses the environmental performance of two pipe systems for building and construction applications; MecFlow and Terrain Q	**Description of the product**
1 kg of piping system	**Declared unit**
Within this study a life cycle anaylsis according to ISO 14040/44 is performed for MecFlow and Terrain Q Systems, manufactured by Polypipe Building Services (UK) and its European manufacturing supply chain. This analysis relies on transparent, plausible and documented data. All the model assumptions, which influence the results, are declared. The life cycle assessment is representative for the two products for the given system boundaries. LCA covers manufacturing of both types of piping systems from cradle to gate (A1-A3).	**Scope**
Construction products and construction services Register nº: 2012:01, ver: 2.33 | Date: 2020-09-18 | Valid until: 2021-12-31	**Name of the PCR**
The International EPD® System. EPD International AB	**Program Operator**

Declared issued	2022-01-05	**Valid until**	2027-01-04

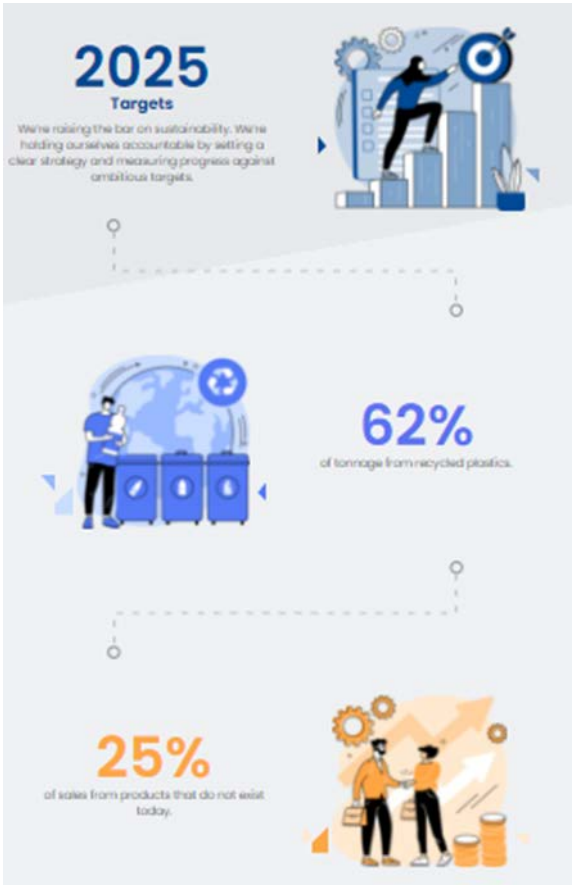
2 About the company

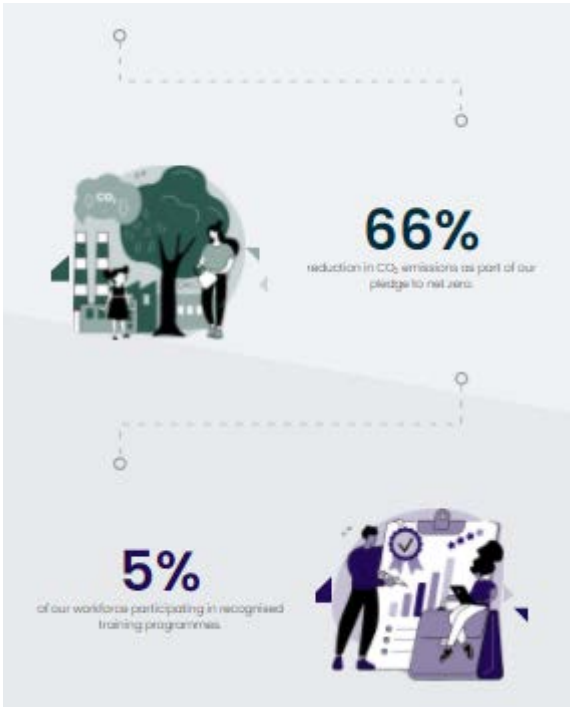
Polypipe Building Services is a trading entity of Polypipe Ltd, a UK manufacturer of plastic piping systems for water management and supply systems, servicing the residential, commercial, civil, and industrial sectors of the UK construction Industry. Part of the Genuit Group we aim to;

Help create a better built environment by developing and producing sustainable solutions to the key challenges in water, climate, and ventilation management.

Polypipe Building Services are specialists in providing engineered above ground drainage and supply systems, leveraging offsite fabrication to design and deliver solutions to mechanical and public health engineers, M&E contractors as well as local authorities. Polypipe Building Services houses well-known industry brand Terrain and has been delivering systems to commercial, high rise residential, healthcare, education, and leisure projects for nearly 60 years.

Part of the Genuit Group, we take sustainability seriously. The Genuit sustainability framework is as follows;





3 Product description

Two polypropylene plastic systems are the objective of the study, named generically as MecFlow and Terrain Q. Both Systems are intended for building and construction applications, and they are composed of different types of pipes and fittings, according to the final application (supply and drainage), sharing the same composition and the same raw material (polypropylene).

MecFlow system: pipe and fittings

- Polypipe MecFlow pipe
- Polypipe MecFlow fittings
- Polypipe CLICKWELD

Terrain Q: pipe and fittings

- Terrain Q pipe
- Terrain Q fittings

UN CPC code for both systems:

363 Semi-manufactures of plastics

3632 Tubes, pipes and hoses, and fittings therefor, of plastics

3.1 MecFlow SYSTEM

3.1.1 Polypipe MecFlow

MecFlow is a pipe and fittings system made of multi-layered PPR CT RP, for networks of cold water, DHW, heating and air conditioning. It is a multilayer product with the following characteristics:

1. The external layer, grey with white stripes has additives to enable UV protection, which minimizes the degradation caused by sun exposure.
2. The light grey intermediate layer incorporates the addition of microfibers that reduces the thermal expansion coefficient and allows an increase in the mechanical resistance of the system. The reduced thickness of the pipe walls allows for an installation of smaller diameters compared with traditional PPR.
3. The white inner layer is resistant to disinfection processes and incorporates an anti-microbial additive and anti-fouling protection.

Figure 1. MecFlow pipes in grey color.

The main distinguishing features of the MecFlow system are; its resistance to disinfection processes, anti-microbial protection, anti-expansion microfibers, anti-fouling protection, halogen free and highest fire classification rating for plastic system Bs1d0.

MecFlow is intended for the following applications:

- Water distribution: Boosted Cold Water, LTHW, Chilled Water, Heating, including;
  - AHU systems
  - LPHW systems
  - Chillers
  - Fluid based HVAC
  - Dry Air Coolers
  - Cooling Tower
- Civil and industrial networks
- Installations of compressed air

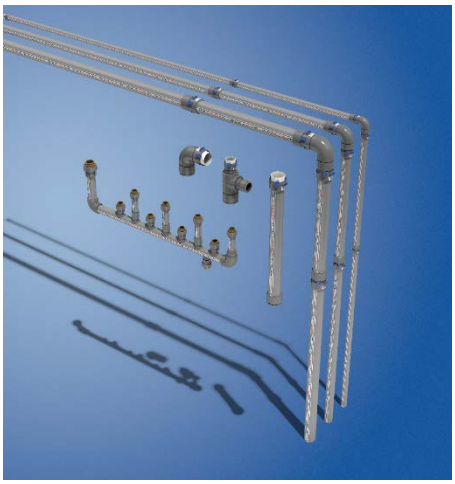
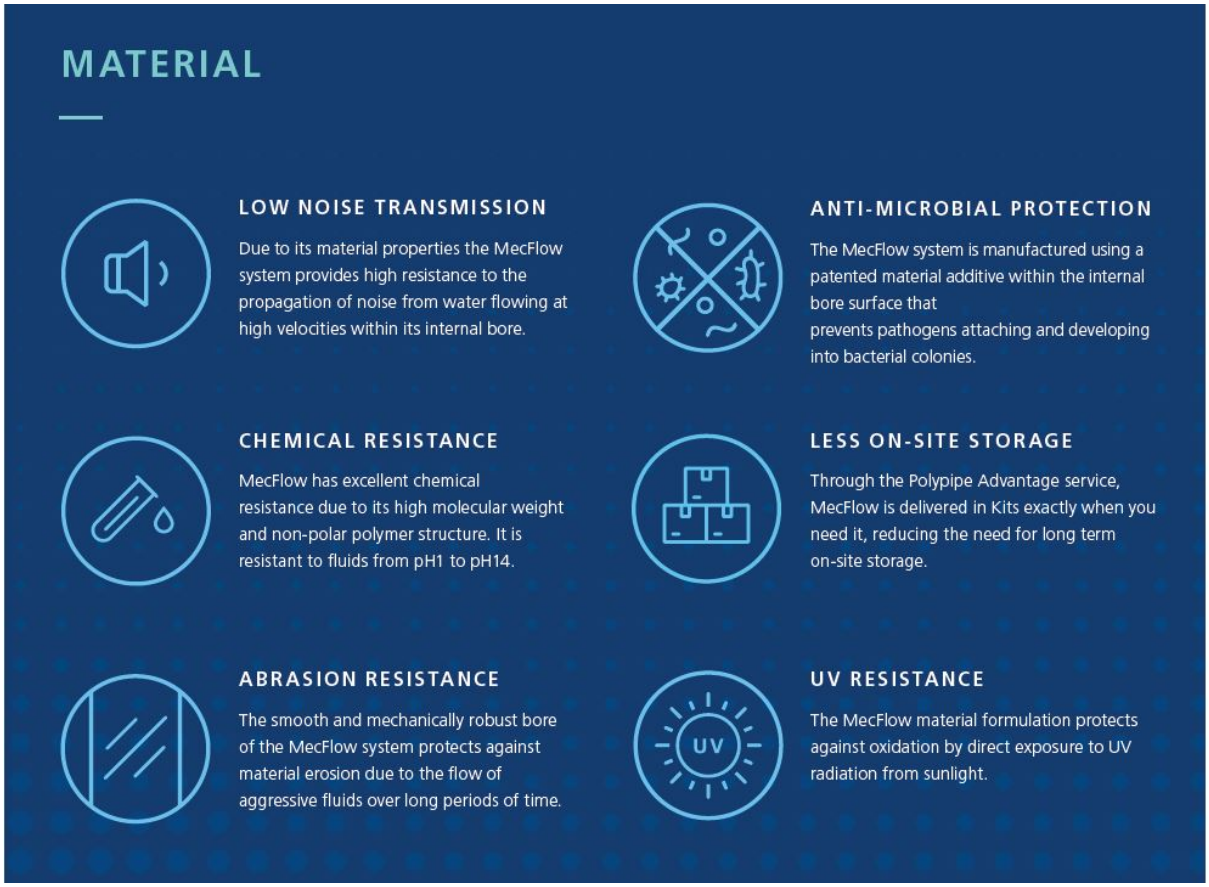
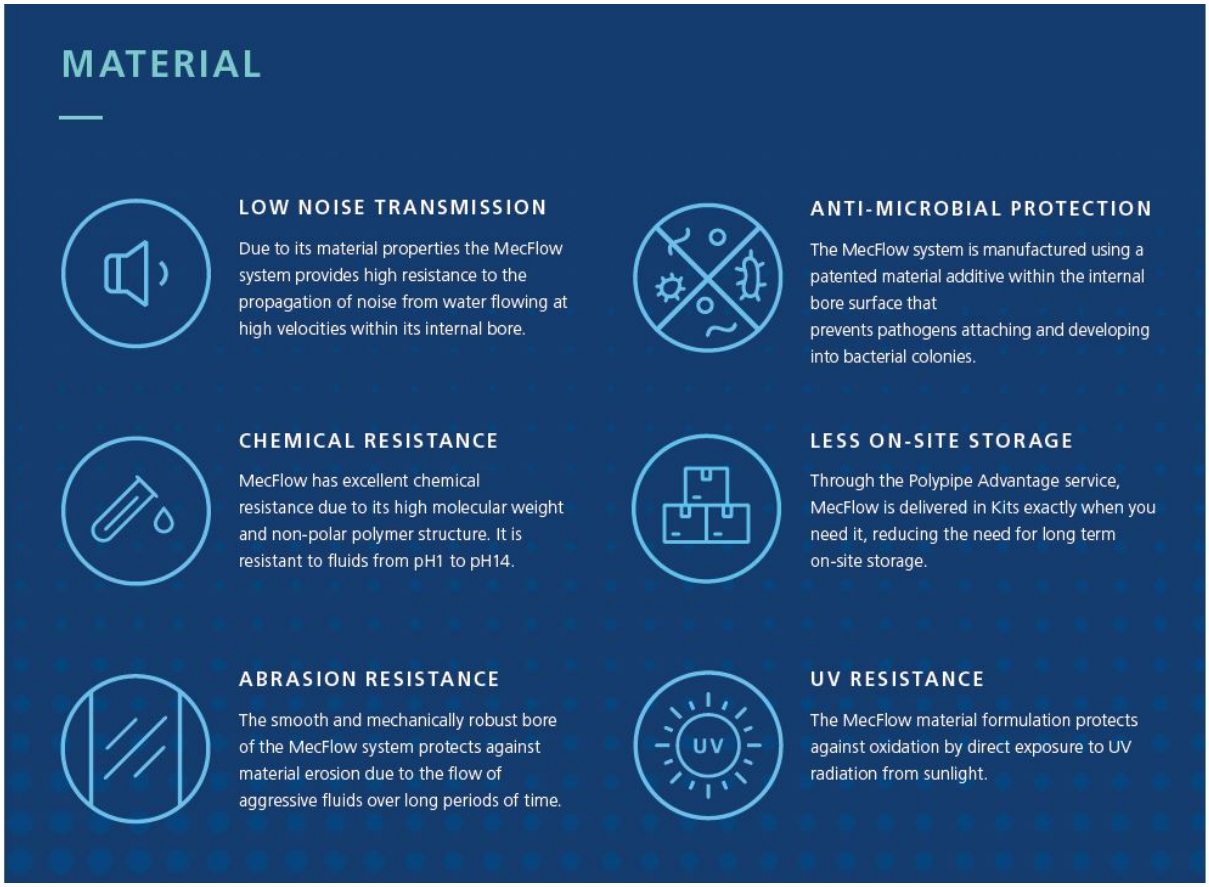


Figure 2. MecFlow system.

MecFlow is produced in a wide range of diameters and lengths, being the most common between 4 and 5,8 m. MecFlow offers a number of benefits:





3.1.2 Polypipe CLICKWELD Technology

Polypipe's CLICKWELD technology is a unique jointing method, used with the MecFlow system, consisting of an electrofusion male and female part connected to pipework. The unique jointing method means there is no need for clamping as the clips fix the joint in place ahead of welding. The system saves up to 75% in installation time when compared to traditional installation methods. Its applications include;

- Water distribution: Boosted Cold Water, LTHW, Chilled Water, Heating, including;
    - AHU systems
    - LPHW systems
    - Chillers
    - Fluid based HVAC
    - Dry Air Coolers
    - Cooling Tower
- Civil and industrial networks
- Installations of compressed air
- Agriculture
- Fire Sprinklers

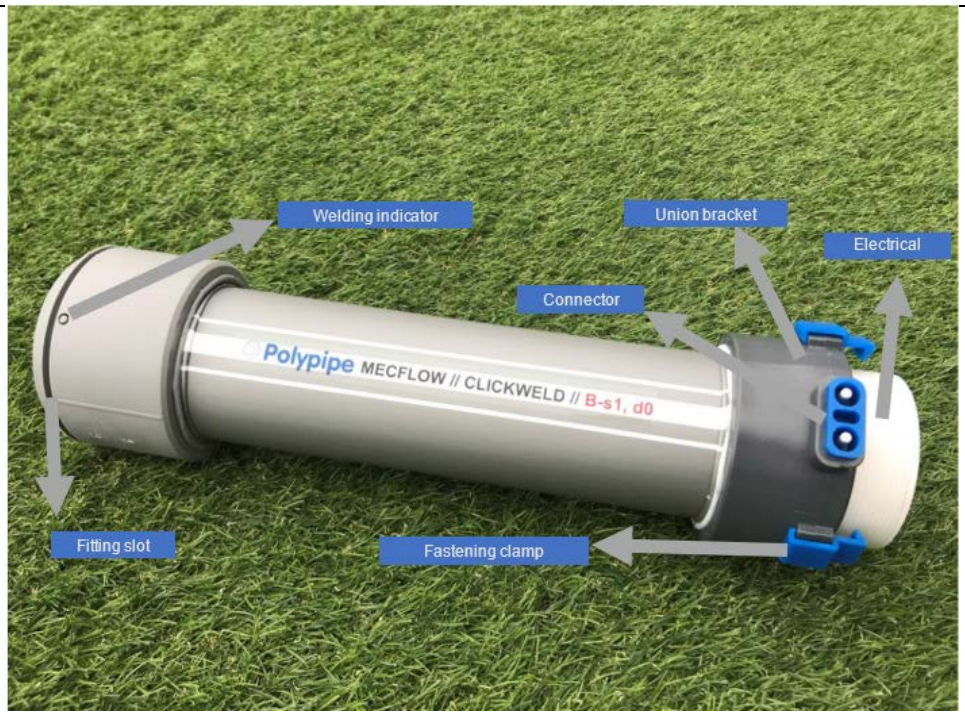


Figure 3. Polypipe CLICKWLD Technology.

3.2 Terrain Q SYSTEM

3.2.1 Terrain Q pipes and fittings

Terrain Q is a noise-reducing drainage system made from multilayer polypropylene. This system achieves a fire classification rating of B, s1-d0 and is halogen free.

This push-fit polypropylene system has the following characteristics:

1. The outer layer made of PP provides UV, impact and fire resistance.

2. The middle layer contains mineral reinforced plastic which delivers high stability, noise insulation as well as halogen free B, s1-d0 fire performance.

3. The inner layer is abrasion resistant, has an anti-fouling additive for anti-encrustation protection and can withstand extreme temperatures (from -20 ºC 95 ºC).

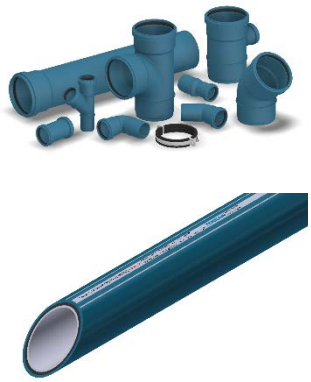
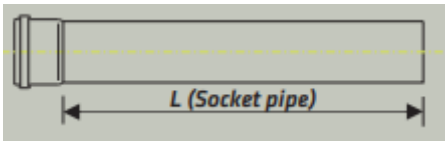


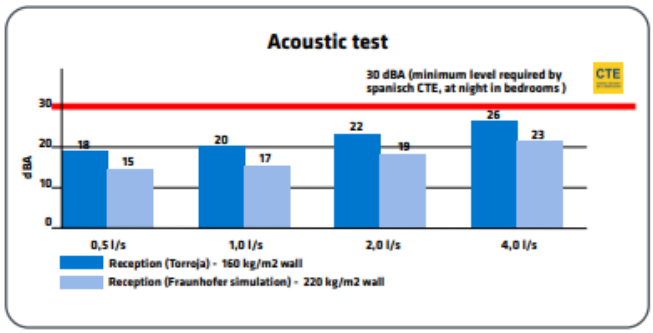
Figure 4. Terrain Q: pipe and fittings.

Terrain Q is intended for the following applications:

- Wastewater drainage
- Rainwater drainage
- Siphonic drainage
- Ventilation systems
- Aerothermic systems



DIAMETER (mm)	THICKNESS (mm)	LENGHT (L) (m)
40	1.8	0,50 1,00 3,00
50	1.8	0,50 1,00 3,00
75	2.3	0,50 3,00
90	2.8	0,50 3,00
110	3.4	0,50 1,00 3,00
125	3.9	1,00 3,00
160	4.9	1,00 3,00
200	6.2	0,80 3,00
250	7.7	3,00
315	9.7	3,00



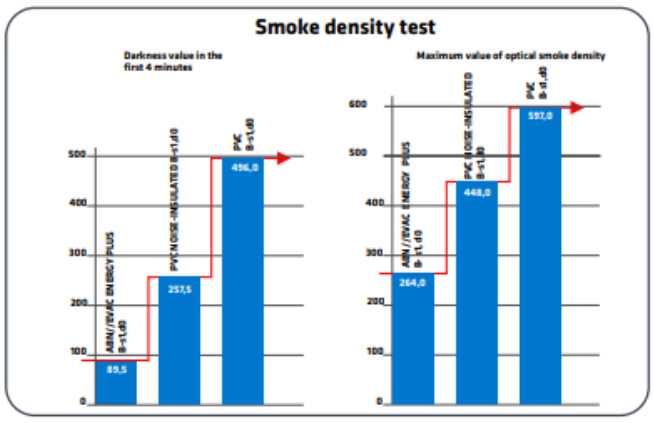


Figure 5. Terrain Q system: Characteristics.

4 LCA information

4.1 Scope of the LCA

The aim of this LCA is to provide clear and reliable information for customers (B2B) regarding the environmental impact linked to the production of two ranges of piping systems; MecFlow and Terrain Q.

The **declared unit (DU)** in both cases is **1 kg of piping system**, including both pipe and accessories. MecFlow scenario was based on a 75 mm diameter pipe while Terrain Q study was based on a 110 mm diameter. Selection of these two piping sizes was made according to the most common market scenarios.

Due to the scope of the LCA (cradle-to-gate), reference service life is not applicable in the study. However, the minimum guaranteed service life of both families is **50 years**. Depending on the application, these products can be part of a building or installation without needing any kind of maintenance or replacement for this period.

4.2 Data Quality

Data used in the LCA calculation has been obtained from Polypipe's partner manufacturing facility ABN Pipe systems located in Spain during the period of 2017 and 2018. Coupled to that, transportation to POLYPIPE in Aylesford is also included. According with the contracts signed with different Terrain Q suppliers, electricity consumed by the manufacturing facility is produced by renewable energies. In order to reflect this, the electric mix used in the production stage (A3) corresponds to the Spanish renewable Terrain Q mix for 2018 (5.62 g CO_{2e}/kWh).

Secondary data has been obtained from Ecoinvent v.3.6 database, using the software SimaPro 9.1.0.11. to carry out the assessment.

Recycling, waste and Terrain Q data has been allocated based on the production mass, according with the PPP (polluter Pays principle).

The impact model used corresponds to CML2001, ReCiPe, Cumulative Energy Demand, EDIP and AWARE water footprint methodologies.

Geographic scope of the LCA includes Europe, and the reference time is 2017.

4.3 System diagram:

A1. Raw materials supply

This first module includes the extraction and production of all raw matters required for the manufacturing process, as well as the energy consumption involved on those stages upstream the manufacturing process. Specifically, it includes the production of polypropylene granulate, main raw matter used in the production of the pipes, as well as other main raw matters such glass, ammonia polyphosphate, and other additives used in small amounts.

A2. Transport

Transport of raw materials to the manufacturing facility has been modelled under this module, taking into account the location of the suppliers and average transportation units from Ecoinvent database. Transportation for all raw materials takes place by road and boat.

A3. Manufacturing

This module includes the manufacturing of the two ranges of piping systems. It includes all stages of pipe manufacturing; compound production, pipe extrusion, calibrating, cutting and final packaging/conditioning for further shipping to customers. Energy (electricity, oil, etc) and auxiliary materials involved in the manufacturing stage are also included under this module.

A4. Transport to the dealership

Transport of pipes from the factory to POLYPIPE facilities as dealership has been modelled under this module, taking into account the location of the suppliers and average transportation units from Ecoinvent database. Transportation for all raw materials takes place by road and railway.

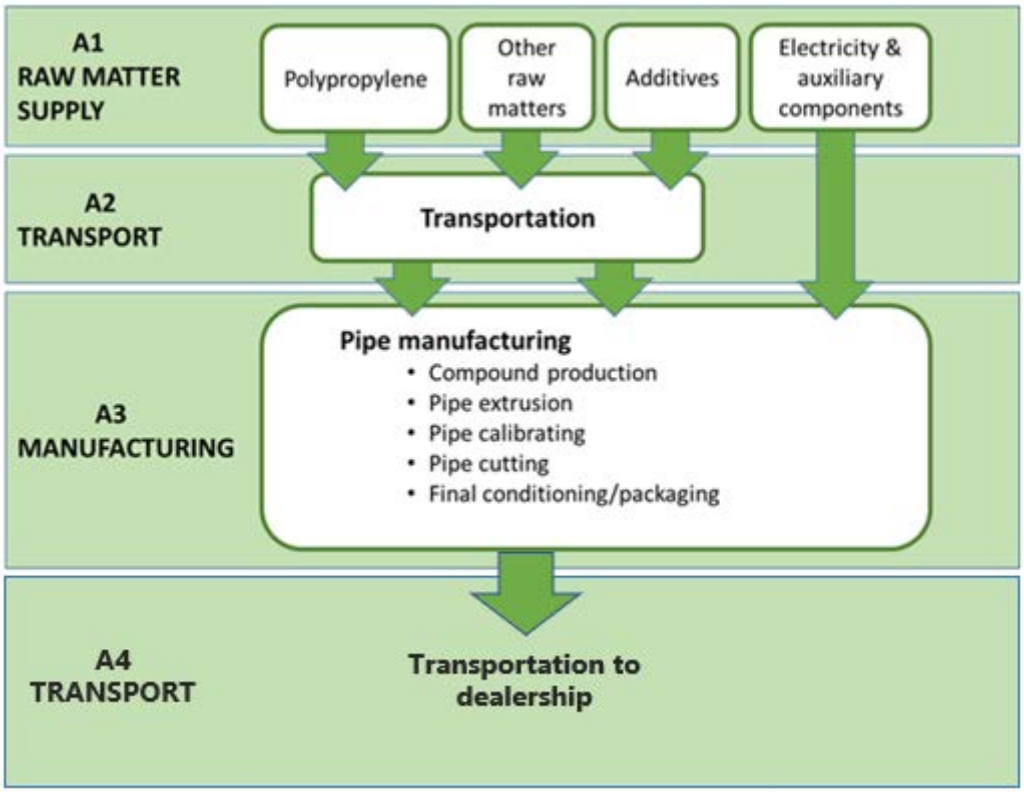


Figure 6. System diagram for MecFlow and Terrain Q pipe ranges.

4.4 System boundaries:

Boundary for the LCA has been set in a **cradle-to-gate** approach, thus only Modules A1-A4 (mandatory) has been addressed.

The objective of this EPD is to address the environmental footprint of manufacturing both MecFlow and Terrain Q pipes. These pipes are intended for a wide number of applications, leading to a great variability of cases for both Construction and end of life stages, which are outside the scope of the EPD. After its installation in buildings, footprint of the use stage may be considered negligible compared with the previous stages, as pipes do not require any maintenance or replacement during its service life (over 50 years).

Due to this, all stages downstream the manufacturing process has been excluded from the lifecycle, and thus, according to the PCR instructions, A1-A4 modules have been addressed.

According to PCR and General Programme Instructions, recycling of non-compliant product has been omitted, as this material is grinded and re-used in the same process.

Table 1. System boundaries for the EPD

Product stage			Const. process stage		Use stage							End of Life Stage				Resource recovery stage
Raw materials	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Terrain Q 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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

4.5 Content declaration

Following tables shows the declared composition for MecFlow and Terrain Q families. In both cases, polypropylene is the main raw matter used on its manufacture. No hazardous substances or listed under ECHA's SVHC list (Substances of Very High Concern) are included in the formulation of any of the products.

Table 2. Content declaration for MecFlow Family per DU (1 kg)

MecFlow Family			
Materials / chemical substances	**CAS nº**	**kg**	**Environmental / hazardous properties**
Polypropylene	9010-79-1	0,855	Non hazardous
Glass fibre	6599-17-3	0,046	Non hazardous
Other components (UV, antifouling, antimicrobial, fittings, etc.)	---	0,018	Non hazardous
Brass alloy	---	0,081	Non hazardous

Table 3.Content declaration for Terrain Q Family per DU (1 kg)

Terrain Q Family			
Materials / chemical substances	**CAS nº**	**kg**	**Environmental / hazardous properties**
Polypropylene	9010-79-1	0,800	Non hazardous
Ammonia polyphosphate	68333-79-9	0,174	Non hazardous
Other components (UV, antifouling, antimicrobial, fittings, etc.)	---	0,022	Non hazardous

Packaging

Due to their length and market, pipes are packaged using wood and plastic strips. Both materials have been taken into account in the life cycle inventory of the manufacturing module (A3). No additional packaging is used on the product

Recycled material

In the case of both MecFlow and Terrain Q pipe systems, no external recycled material is used as raw material. As mentioned before, non-compliant product is grinded and fully recycled within the same production process, but according with EPD procedures, this process is not included in the LCA assessment.

However, all wastes generated (wood, core board, etc.) are properly managed and recycled in by waste mangers. This is properly reflected in the waste routes included under the A4 module.

5 Environmental performance

Next tables show the environmental performance of both MecFlow and Terrain Q families, disaggregating them by each one of the three modules addressed and the 8 impact categories addressed.

Table 4. Main Impact categories addressed in the EPD

Global warming potential (GWP)
Climate Change is defined as the change in global temperature caused by the release of gases with greenhouse effect, such carbon dioxide (CO_2) and other gases such methane (CH_4), nitrogen dioxide (NO_2) and chlorofluorocarbons (CFCs). This category quantifies how the process contributes to the release of greenhouse gases, based in the model developed by the UN's Intergovernmental Panel on Climate Change (IPCC).

Depletion potential of the stratospheric ozone layer (ODP)
This category quantifies the effect of the process over the ozone layer. Damage to the ozone layer reduces its ability to prevent ultraviolet (UV) light entering the earth's atmosphere, increasing the amount of carcinogenic UVB light reaching the earth's surface.

Acidification potential (AP)
This category quantifies the impact of the release of oxides of nitrogen and sulphur in the atmosphere, soil and water, where the acidity of the medium can be modified, affecting the flora and fauna that inhabit it, as well as affecting human health and construction materials.

Eutrophication potential (EP)
Eutrophication is defined as the enrichment of ecosystems (water, soil, etc.) as result of the presence of nutrients, mainly nitrogen and phosphorous. In the aquatic environment, the high concentration of these nutrients leads to greater production of plankton, algae and aquatic plants, and the deterioration of water quality

Formation potential of tropospheric ozone (POCP)
Photochemical ozone formation takes place in the atmosphere by the degradation of volatile organic compounds (VOC) in presence of light and nitrogen oxides (NOx). This phenomenon can be local (photochemical smog) or regional (tropospheric ozone) and is harmful to both plants and humans, causing irritation, respiratory problems and damage to the respiratory system.

Abiotic depletion potential
It evaluates the impact of the activity on different non-renewable natural resources, such as ores containing metals, petroleum, mineral raw materials. A resource is considered non-renewable when its cycle exceeds 500 years.

Water scarcity potential
It evaluates the impact of the process over the water resources.

5.1 Environmental performance for MecFlow family

Next tables show the environmental impact of the MecFlow piping system, broken down in the three modules addressed (raw matters, transport and production). For all categories analyzed, results shows that raw matter production is the main contributor to the environmental impact of MecFlow pipes, followed by pipe production and transportation.

Table 5. Environmental performance for MecFlow family (Declared Unit:1 kg of piping system)

PARAMETER	UNIT	A1	A2	A3	A4	TOTAL (A1-A4)
Global warming potential (GWP)	kg CO_2 eq.	2.08	0.37	0.45	0.25	**3.15**
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	6.31E-08	6.84E-08	4.94E-08	4.52E-08	**2.26E-07**
Acidification potential (AP)	kg SO_2 eq.	3.37E-02	9.11E-04	2.75E-03	6.17E-04	**0.04**
Eutrophication potential (EP)	kg PO_4^{3-} eq.	1.38E-02	1.95E-04	8.41E-04	1.34E-04	**0.01**
Formation potential of tropospheric ozone (POCP)	kg C_2H_4 eq.	1.45E-03	4.51E-05	1.99E-04	3.02E-05	**1.73E-03**
Abiotic depletion potential – Elements	kg Sb eq.	2.10E-03	9.40E-06	5.59E-06	6.19E-06	**2.12E-03**
Abiotic depletion potential – Fossil resources	MJ, net calorific value	64.24	5.55	6.87	3.67	**80.33**
Water scarcity potential	m^3 eq.	1.38	0.02	0.23	0.01	**1.64**

(*) INA: Indicator not assessed

Regarding energy consumption, raw matter production is the most intensive stage for non-renewable primary MecFlow system, while pipe production is the main consumer of primary energy from renewable sources.

Table 6. Use of resources for MecFlow system (Declared Unit:1 kg of piping system).

PARAMETER		UNIT	A1	A2	A3	A4	TOTAL A1-A4
Primary MecFlow resources – Renewable	Use as MecFlow carrier	MJ, net calorific value	2.14	0.09	6.72	0.06	9.00
	Used as raw materials	MJ, net calorific value	INA	INA	INA	INA	INA
	TOTAL	MJ, net calorific value	2.14	0.09	6.72	0.06	9.00
Primary MecFlow resources – Non-renewable	Use as MecFlow carrier	MJ, net calorific value	73.09	6.02	10.16	3.99	93.26
	Used as raw materials	MJ, net calorific value	INA	INA	INA	INA	INA
	TOTAL	MJ, net calorific value	73.09	6.02	10.16	3.99	93.26
Secondary material		kg	INA	INA	INA	INA	INA
Renewable secondary fuels		MJ, net calorific value	INA	INA	INA	INA	INA
Non-renewable secondary fuels		MJ, net calorific value	INA	INA	INA	INA	INA
Net use of fresh water		m^3	2.08E-02	1.51E+00	1.29E-01	1.61E-01	8.51E-02

Regarding waste production at the process, most of the wastes generated during the process are catalogued as non-hazardous wastes.

Table 7. Waste production for declared unit in MecFlow system (Declared Unit:1 kg of piping system).

PARAMETER	A1	A2	A3	A4	TOTAL (A1-A4)
Hazardous waste disposed (kg)	2.67E-04	1.46E-05	9.46E-06	9.64E-06	**3.01E-04**
Non-hazardous waste disposed (kg)	1.89E-01	2.77E-01	8.42E-02	1.82E-01	**7.33E-01**
Radioactive waste disposed (kg)	4.62E-05	3.87E-05	4.76E-05	2.56E-05	**1.58E-04**

5.2 Environmental performance for Terrain Q System

Due to the common characteristics for both pipe families, similar results can be observed regarding the environmental performance. For Terrain Q system, raw materials and pipe production are also the key contributing processes for the environmental impact of Terrain Q system.

Table 8. Environmental performance for Terrain Q System (Declared Unit:1 kg of piping system).

PARAMETER	UNIT	A1	A2	A3	A4	TOTAL (A1-A4)
Global warming potential (GWP)	kg CO_2 eq.	1.89	0.37	0.45	0.25	2.96
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	7.39E-08	6.75E-08	4.94E-08	4.52E-08	2.36E-07
Acidification potential (AP)	kg SO_2 eq.	7.25E-03	1.53E-03	2.75E-03	6.17E-04	0.01
Eutrophication potential (EP)	kg PO_4^{3-} eq.	1.75E-03	2.53E-04	8.41E-04	1.34E-04	2.98E-03
Formation potential of tropospheric ozone (POCP)	kg C_2H_4 eq.	4.58E-04	5.94E-05	1.99E-04	3.02E-05	7.46E-04
Abiotic depletion potential – Elements	kg Sb eq.	6.64E-05	9.85E-06	5.59E-06	6.19E-06	8.81E-05
Abiotic depletion potential – Fossil resources	MJ, net calorific value	59.64	5.49	6.87	3.67	75.67
Water scarcity potential	m^3 eq.	1.29	0.02	0.23	0.01	1.55

Similar results can be observed also regarding the use of resources, with a greater contribution of raw matter production on non-renewable energy consumption.

Table 9. Use of resources for Terrain Q family (Declared Unit:1 kg of piping system).

PARAMETER		UNIT	A1	A2	A3	A4	TOTAL (A1-A4)
Primary Terrain Q resources – Renewable	Use as Terrain Q carrier	MJ, net calorific value	1.21	0.08	6.72	0.06	8.07
	Used as raw materials	MJ, net calorific value	INA	INA	INA	INA	INA
	TOTAL	MJ, net calorific value	1.21	0.08	6.72	0.06	8.07
Primary Terrain Q resources – Non-renewable	Use as Terrain Q carrier	MJ, net calorific value	67.44	5.95	10.16	3.99	87.53
	Used as raw materials	MJ, net calorific value	INA	INA	INA	INA	INA
	TOTAL	MJ, net calorific value	67.44	5.95	10.16	3.99	87.53
Secondary material		kg	INA	INA	INA	INA	INA
Renewable secondary fuels		MJ, net calorific value	INA	INA	INA	INA	INA
Non-renewable secondary fuels		MJ, net calorific value	INA	INA	INA	INA	INA
Net use of fresh water		m^3	1.41E+00	1.27E-01	1,61E-01	8.51E-02	**1.78**

As observed in the MecFlow system, most of the wastes generated in the process are catalogued as non-hazardous wastes.

Table 10. Waste production for declared unit in Terrain Q system.

PARAMETER	A1	A2	A3	A4	TOTAL (A1-A4)
Hazardous waste disposed (kg)	1.40E-05	1.41E-05	9.46E-06	9.64E-06	4.73E-05
Non-hazardous waste disposed (kg)	1.19E-01	2.58E-01	8.42E-02	1.82E-01	6.44E-01
Radioactive waste disposed (kg)	3.78E-05	3.82E-05	4.76E-05	2.56E-05	1.49E-04

6 Interpretation of LCA Results

The majority of the environmental impact for both products lie in the raw material production, and more specifically in the polypropylene production, as it is the main component in both pipes. Production stage is the second main contributor to the environmental footprint of both product systems, mainly as result of the energy consumed in the process.

Next figures (7) show the impact over GHG emissions and primary energy consumption for both systems. Results show a slightly higher impact for the MecFlow scenario in both cases. This can be explained by the differences in its composition (presence of glass fiber and brass alloy), as GHG linked to production process and transportation of raw materials are nearly the same.

However, it must be taken into account than applications and technical properties for both systems are different, and thus, comparison between them holds no further interest.

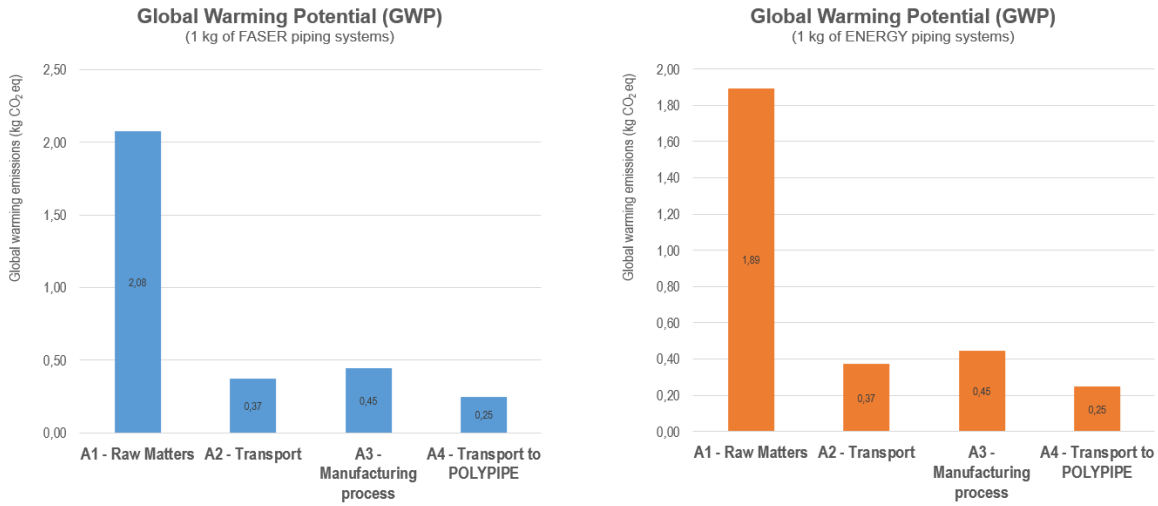


Figure 7. GHG emissions for the three stages analyzed in both piping systems.

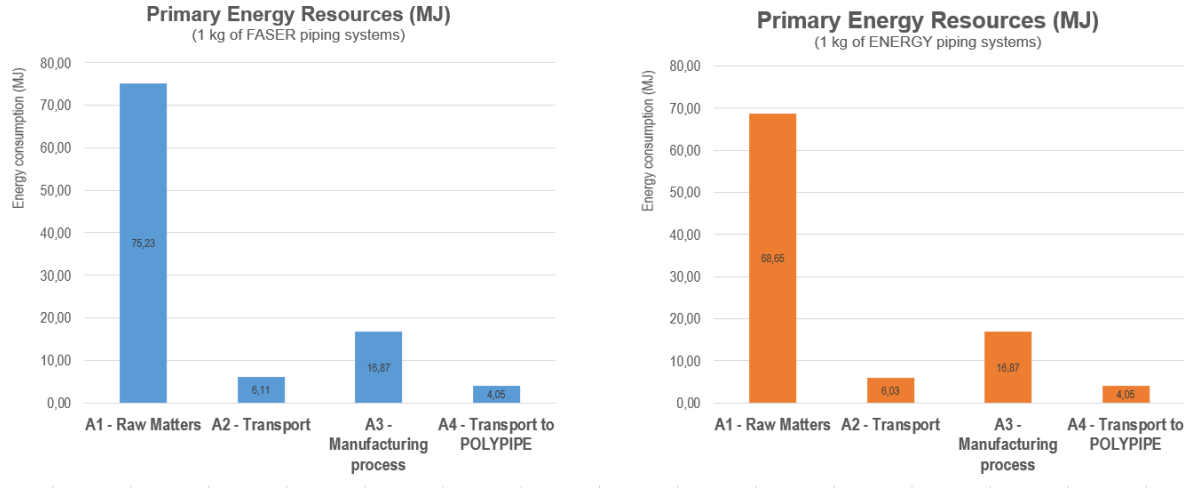


Figure 8. Primary energy resource consumption for both piping systems dissagregated on the three production stages.

7 References

General Programme Instructions of the International EPD® System. Version 3.0.

1. PCR Construction Products and Construction Services (2012:01), version 2.3
2. UNE-EN 15804:2012+A1:2013 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.
3. ISO 14040:2006: Environmental Management-Life Cycle Assessment-Principles and framework.
4. ISO 14044:2006: Environmental Management-Life Cycle Assessment-Requirements and guidelines.
5. ISO 14025:2006: Environmental labels and declarations-Type III Environmental Declarations Principles and procedures.

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9 Programme-related information and verification

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programm es may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

Programme:	The **International EPD® System** EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com
EPD registration number:	S-P-03637
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Valid until:	227-01-04
Product Category Rules:	PCR 2012:01 Construction products and construction services. Version 2.33
Product group classification:	UN CPC 3632 Tubes, pipes and hoses, and fittings therefor, of plastics
Reference year for data:	2021
Geographical scope:	Europe

CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
PCR review was conducted by: The Technical Committee of the International EPD® System.

Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
Third party verifier: Rubén Carnerero Acosta (Independent verifier) Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ No