ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019 for:

Polyethylene pipes for the conveyance of fluids and protection of cables in industrial and civil sectors

PCR 2019:14	Construction products
CPC code	3632 - Tubes, pipes and hoses, and fittings therefor, of plastics
Programme	The International EPD® System, www.environdec.com
Programme operator	EPD International AB
Geographical scope	Global
EPD number registration	S-P-02634
Date of publication	01/04/2021
Date of validity	01/04/2026

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SUMMARY

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ENVIRONMENTAL PRODUCT DECLARATION

An Environmental Product Declaration (EPD) is defined by the ISO 14025 as a Type III declaration which quantifies environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function.

The EPD methodology is based on the Life Cycle Assessment (LCA) tool that follows ISO series 14040.

This EPD has been approved by an independent verifier for validation in compliance with the reference standard published by the International EPD® System (General Program Instructions for the International EPD® System) and with PCR 2019:14 Construction Products Version 1.1 and EN 15804 used as core PCR.

Programme:	The International EPD® System EPD International AB, Box 210 60 100 31 Stockholm (Sweden) www.environdec.com info@environdec.com
Product Category Rule (PCR):	PCR 2019:14 Construction Product Version 1.1
PCR review conducted by:	Technical Committee of the International EPD® System (info@environdec.com)
Independent third-party verification of the declaration and data, according to ISO 14025 (2006):	EPD Verification
Third part verifier:	Guido Croce Approved by: The International EPD® System Technical Committee, supported by the Secretariat
Procedure for follow-up ofa data during EPD validity involves third part verifier:	Yes

EPDs in the same product category but developed with different programmes are not comparable. EPDs of construction products are not comparable if they do not comply with EN 15804. All stages of the life cycle were analyzed and accounted for in this study.

This EPD and further information are available on the website www.environdec.com

COMPANY INFORMATION

Owner of EPD: Idrotherm 2000 S.p.a.

Contacts: Dott. Marco Michelotti - m.michelotti@idrotherm2000.com
Raffaella Sartini - r.sartini@idrotherm2000.com

Product-related or management system-reated certifications: UNI EN ISO 9001 - UNI EN ISO 14001 - UNI ISO 45001

Name and location of production sites:

Idrotherm 2000 - Castelnuovo di Garfagnana, Lucca - Italy
Idrotherm 2000 - Castelvecchio Pascoli (Barga), Lucca - Italy

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THE COMPANY

With over 40 years of expertise Idrotherm 2000 has a worldwide leading role in the production of thermoplastic pipes with a renowned proficiency for creating innovative solutions in a broad range of applications, including the supply of drinking water, distribution of fuel gas, industrial applications, electric cable protection, telecommunications, irrigation, geothermal and hot water supply, district heating, drainage and sewerage systems.

Our commitment in the development of modern piping systems, based on continuously renovated raw materials, cutting-edge manufacturing and quality control equipment, flexible packaging technologies and an efficient delivery logistics, has established our role at international level.

The advanced extrusion lines in our manufacturing sites are equipped with state-of-the-art online control devices, thus providing piping systems with sizes ranging from 8 to 1200 mm with mono or multilayer structures and customised lengths.

From our headquarters in Castelnuovo di Garfagnana (Lucca), Italy, our sales network and technical support team offer a valuable distribution of piping systems also contributing to the design of new and reliable solutions for specific uses and strict requirements in complex projects.

The environmental sustainability is a fundamental in our approach to the development and production of piping systems which have to ensure a long-term protection of valuable resources, such as water and energy, no contaminations from conveyed waste products and utmost security in the distribution of fuel gas or industrial fluids.

Our management system for quality, environment and safety is compliant with international standards ISO 9001, ISO 14001 and ISO 45001.

POLYETHYLENE PIPES

Polyethylene (PE) pipes fulfil a broad variety of requirements, which are specifically described in European and international product standards or technical specifications for each application.
Their main benefits include a wide range of dimensions, smooth internal bores with superior flow properties, ease of handling on site, excellent corrosion and chemical resistance, reliably low leakage rates and an outstanding performance throughout the full lifecycle often exceeding 100 years. At the end of their life cycle, they can be recycled, thus giving a significant contribute to the circular economy.
Furthermore, the lightweight and flexibility of polyethylene pipes makes installations easier as less equipment is required for handling, whereas longer lengths, also as coiled pipes, mean fewer butt-welded joints or electrofusion fittings.
PE pipes are ideally suited to installation by a number of trenchless or minimum excavation techniques especially for crossings under roads, railways, rivers, airport runways, etc., with major advantages both for the reduced environmental impact and social disturbance and related cost saving of new underground networks or rehabilitation of old pipelines.
PE pipes are mostly manufactured according to EN and ISO standards and are ranked by their nominal outside diameter (DN) and standard dimension ratio (SDR), equivalent to the ratio of the nominal outside diameter and the nominal wall thickness.
For applications under pressure (supply of drinking water, sewerage and gas distribution) the nominal pressure (PN) is used to designate the maximum operating pressure with a minimum design coefficient and the material minimum required strength (MRS).
PE pipes are available both as black monolayer and coextruded structures with a coloured outer layer according to the intended application (blue for drinking water, orange for gas distribution, brown for sewerage and other colours for specialty markets). Furthermore, they may also have an additional peelable layer for superior installation techniques.
For most applications PE pipes are certified by external accredited bodies according to the relevant reference standards.

Range of applications:

Drinking water supply

Polyethylene pipes made of PE80, PE100 and PE100 RC (reised crack resistance), black in colour with blue identification stripes or multilayer (black inner layer/blue outer layer), compliant with EN 12201 and ISO 4427, national regulations for drinking water, EN 1622 for organoleptic properties and, in case of PE100 RC, compliant with the technical specification PAS 1075 (Type 1, 2 and 3) for alternative installations (sandless bed in open trench or no dig).

Sewerage and drainage under pressure

Polyethylene pipes made of PE100 and PE100 RC (raised crack resistance), black in colour with brown identification stripes or multilayer (black inner layer/brown outer layer), compliant with EN 12201 and ISO 4427 and, in case of PE100 RC, compliant with the technical specification PAS 1075 (Type 1, 2 and 3) for alternative installations (sandless bed in open trench or no dig).

Fuel gas distribution

Polyethylene pipes made of PE100 and PE100 RC (raised crack resistance), black in colour with orange identification stripes or multilayer (black inner layer/orange outer layer), compliant with EN 1555 and ISO 4437 and, in case of PE100 RC, compliant with the technical specification PAS 1075 (Type 1, 2 and 3) for alternative installations (sandless bed in open trench or no dig).

Industrial fluids (chemical plants, fire protection and compressed air)

Polyethylene pipes made of PE100 and PE100 RC (raised crack resistance), black in colour or multilayer (black inner layer/coloured outer layer), compliant with EN ISO 15494 and, in case of PE100 RC, compliant with the technical specification PAS 1075 (Type 1, 2 and 3) for alternative installations (sandless bed in open trench or no dig).

Electric cable protection

Polyethylene pipes made of HDPE or PE100, black in colour with red optional identification stripes, compliant respectively with DIN 16874 or DIN 16876 and EN ISO 15494.

Soil and waste discharge and non-pressure sewerage

Polyethylene pipes made of HDPE, black in colour, compliant with EN 1519 or EN 12666 for installations within the building structure and both outside and within the building structure respectively. Also available as structured-wall pipes compliant with EN 13476 (Type A).

Biogas and drainage

Polyethylene pipes made of HDPE, black in colour and with slotted structures, for the collection of biogas and leachate in landfills.

Irrigation

Polyethylene pipes made of HDPE, black in colour, for irrigation systems with self-propelled machines in all fields of agriculture and horticulture.

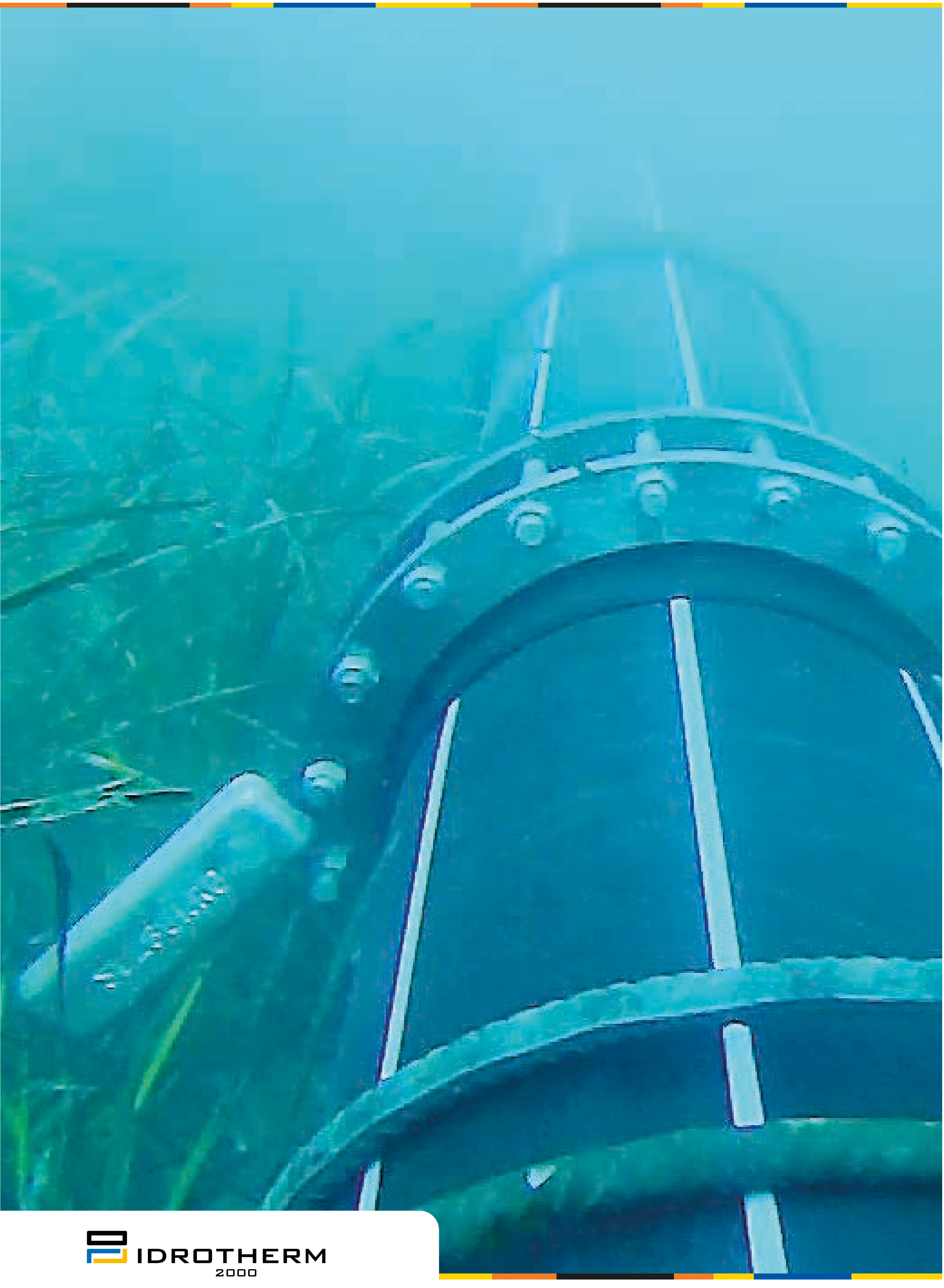
Telecommunications

Polyethylene miniducts made of HDPE, also available in fender and bundle structures, for the protection of optical fibres in telecommunication industry.

Product characteristics – Typical values

	Reno Scarico Reno Scarico HB Idroplus White Stark Cablex Standard Biogas/Drainage Monoducts for telecoms	Reno 80	Reno 100 Reno Gas 100 Reno 100 Scarico Reno 100 Industria Cablex Extra	Renovation VRC Renovation VRC+ Renovation Gas VRC Renovation VRC+ Gas Renovation VRC Scarico Renovation VRC+ Scarico Renovation VRC Industria
PE type	HDPE	PE80	PE100	PE100 RC
Minimum Required Strength	–	8 MPa	10 MPa	10 MPa
Density	952 kg/cm^3	957 kg/cm^3	959 kg/cm^3	959 kg/cm^3
Melt Flow Rate (190 °C – 5.0 kg)	0,3 – 0,8 g/10 min	0,38 g/10 min	0,24 g/10 min	0,24 g/10 min
Tensile strength at yield	21 MPa	23 MPa	24 MPa	24 MPa
Elongation at break	–	>350%	>350%	>350%
Tensile modulus	1000 MPa	1000 MPa	1050 MPa	1050 MPa
FNCT - Full notch creep test	–	>100 h	>300 h	≥8760 h
NPT - Notched pipe test	–	–	≥500 h	≥8760 h
SHT - Strain hardening test	–	–	<Gp> ≥ 40 MPa	<Gp> ≥ 50 MPa
CRB - Cracked round bar	–	–	≥ $0{,}9 \times 10^6$ cycles	≥ $1{,}5 \times 10^6$ cycles
PLT - Point Loading Test	–	–	–	≥ 8760 h
Vicat softening temperature (B50)	70 °C	70 °C	74 °C	74 °C
Thermal conductivity	0,4 W/m · °C			
Thermal expansion coefficient	0,2 mm/m · °C			

PE80, PE100 and PE100 RC are supplied either as black compounds (carbon black content 2.0 - 2.5%) or pigmented compounds for different application fields.



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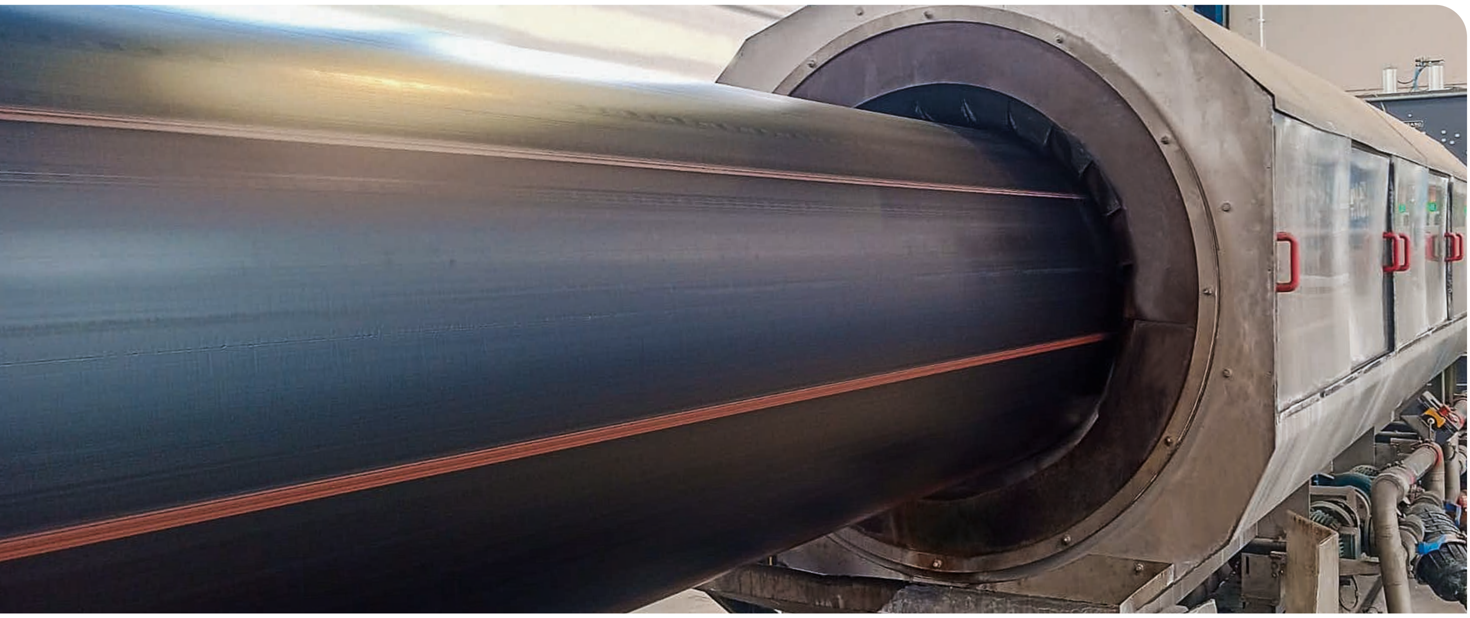


MANUFACTURE OF POLYETHYLENE PIPES

The manufacture of PE pipes is carried out using the extrusion technology. The fundamental steps are to heat, melt, mix and convey the raw materials into the pipe shape and hold it during the cooling time, in order to produce a solid wall pipe. The raw materials are supplied as pellets, as bulk in tankers or packed in plastics bags, and are available both as finished compounds or non-pigmented resins which may require additives for special uses.

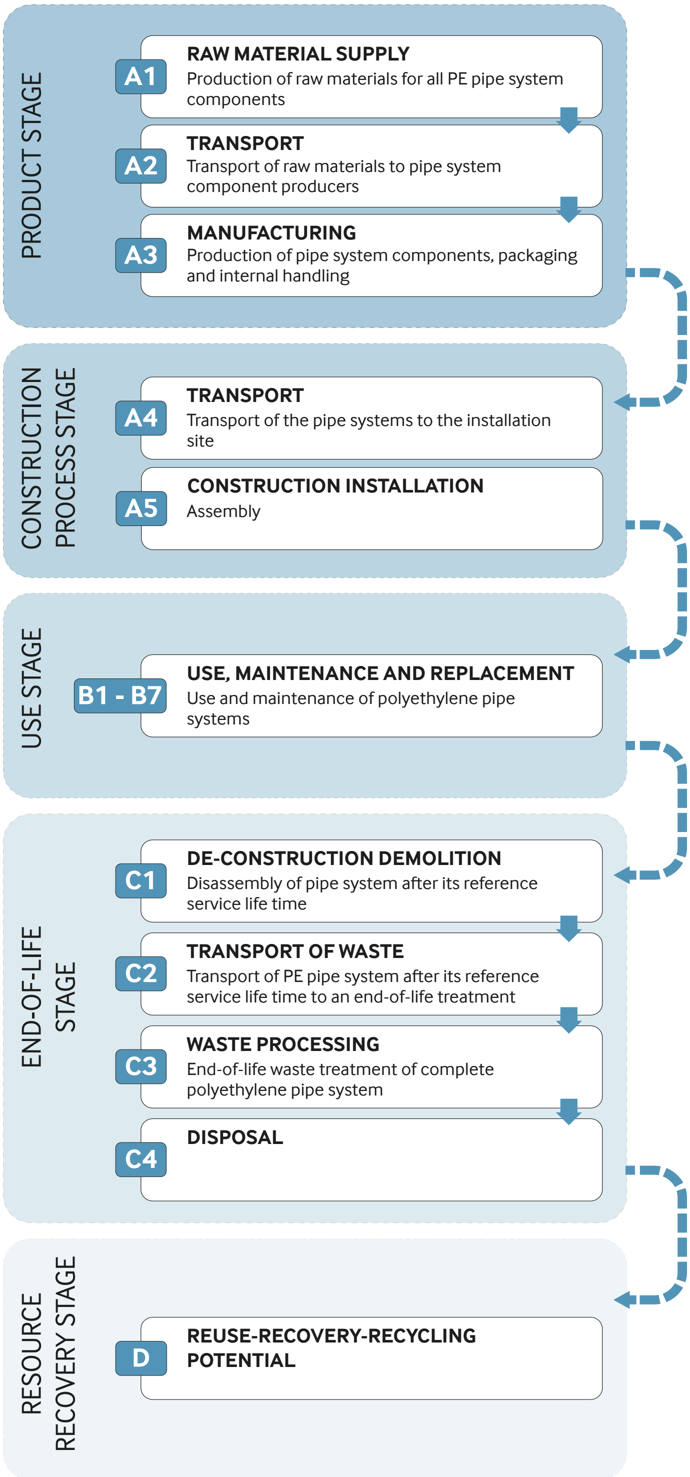
After passing the quality control tests, the raw materials are pneumatically conveyed from the silos at the plants to the pipe extruders by a vacuum pressure transfer system. This equipment is made up of a rotating screw, whose main function is to produce a homogeneous mixture which is forced in a forward direction to the die, while the material is subjected to heat, pressure and shear. The die distributes the melt around a solid mandrel, thus producing the annular shape for solid wall pipe.

Pipe dimensions are set during the sizing and cooling steps, this process being accomplished by drawing the hot material from the die through a sleeve into a vacuum cooling tank: the outer surface of the pipe is held against the sizing sleeve and simultaneously refrigerated to maintain proper dimensions. After exiting this tank, the pipes are moved through a series of spray or immersion cooling tanks, depending on the pipe size (annealing zones between the cooling tanks are used to minimise the internal pipe wall stresses), to bring the material to ambient temperature.

A puller is necessary to provide the force to pull the pipes through the cooling area and keep the required pipe wall thickness by a constant pulling rate (the combination of the extruder screw speed and the pulling rate is determinant for the wall thickness of the pipe).

According to standards and specifications, pipes are marked at fixed intervals either with ink jet or indent printing with identification data for trademark, size, type, application, class and batch for traceability.

Finally, pipes are cut into specific lengths for storage (typically 6 and 12 m, longer for customised requests) and bundled or, alternatively, they can be coiled up to DN160 for handling, storage and delivery. Pipe packaging is made of plastic end caps, strapping bands, stretch films and wooden slats.
Throughout the production process, the pipes are subjected to in-line quality controls (special devices are able to detect any deviation from the required sizes or imperfections) and once they have been produced, they undergo a number of quality assurance tests for the verification of the set of requirements in the appropriate standards or technical specifications.



APPLIED METHODOLOGY

The environmental performance was evaluated in compliance with the requirements of the International EPD® System and the PCR 2019:14 Version 1.1 Construction Products.
The methodology used for the quantification of environmental performance is the Life Cycle Assessment (LCA) according to standards ISO 14040 and 14044.
The scope of the LCA related to the production of PE pipes is to evaluate the environmental impact, covering all significant stages over the full product lifecycle.
Specific data were collected on the production sites of Castelnuovo di Garfagnana (LU) and Castelvecchio Pascoli/ Barga (LU) and refer to the year 2019. The contribution of proxy data is less than 10%.
The declared functional unit is 1 kg of PE pipe.
The French style of the international system of units (comma as decimal separator) is used in this document.
According to the reference PCR and EN 15804 the range of variability of the results related to the potential greenhouse effect is indicated in the following data.
For power consumption, the Italian residual mix was applied with an emission factor of 0,52 kg CO_2 eq/kWh.

CALCULATIONS AND DESCRIPTION OF SYSTEM BOUNDARIES

The study conducted is of the "cradle-to-gate with options" type, as defined by EN 15804 standard. The system boundaries have been set considering modules A1 to A3, modules C1-C4, module D, and in addition the optional modules A4 and B1-B7.

Furthermore, the intent of the study is to cover all significant environmental impacts over the full product life cycle in two representative scenarios: STANDARD installation and NO DIG installation. In these two scenarios («DN160 SDR11 – STANDARD installation» and «DN160 SDR11 – NO DIG installation») the reported study is of the "cradle-to-grave" type and system boundaries have been set considering modules A1 to A3, module A4, modules B1-B7, modules C1-C4, module D, and in addition module A5.

All Use stage, B1 to B7 modules, were deemed not relevant (of negligible impact) for the following reasons:

- **Module B1** refers to the "use" of the installed product. When using plastic piping systems, it is assumed that there are no impacts.
- **Module B2-B3-B4-B5** refer to the "maintenance", "repair", "replacement" and "refurbishment" of the piping system. In the useful lifetime of the piping system, maintenance interventions were not considered since failures cases generally involve the replacement of the pipe. The impacts related to the replacement would therefore be attributed to the life cycle of a new product. It is therefore assumed that there are no impacts referred to modules B2 to B5.
- **Modules B6** "Operational energy use" and **B7** "Operational water use" include the energy and water consumed for the operation of the system. When using plastic piping systems, it is assumed that there are no impacts referred to modules B6-B7.

Due to the fact that the energy consumption necessary to prepare for the disposal of the piping system is to be referred to the installation of a new piping system, module C1 that considers the decommissioning phase was deemed not relevant (of negligible impact).

Modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishement	Operational energy use	Operational water use	De-cosnstrucion demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling potential
Modules	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	×	×	×	×	-	×	×	×	×	×	×	×	×	×	×	×	×
Geographic representativeness	IT	IT	IT	GLO	-	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO
Specific data	> 90%					-	-	-	-	-	-	-	-	-	-	-	-
Range of variability of the products	< 10%					-	-	-	-	-	-	-	-	-	-	-	-
Range of variability of the industrial plants	< 10%					-	-	-	-	-	-	-	-	-	-	-	-

ENVIRONMENTAL IMPACT OF POLYETHYLENE PIPES

The environmental impact of PE pipes is assessed against several criteria throughout the complete life cycle.

Global Warming Potential (GWP100) Global warming of the atmosphere, due to greenhouse gas (GHG) emissions into the atmosphere such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), etc.	UNIT **kg CO_2 eq**
Acidification Potential (AP) Drop in pH of soils, lakes, forests, due to air emissions of acidifying compounds, with harmful effects on living organisms, e.g. "acid rains". The indicator is expressed in kg SO_2 eq (sulfur dioxide) and in mol H^+ eq (moles of hydrogen).	UNIT **kg SO_2 eq** **mol H^+ eq**
Eutrophication (EP) Reduction of oxygen present in water bodies and necessary for ecosystems due to the excessive intake of nutrients such as nitrogen and phosphorus. The indicator is expressed in kg PO_4^{3-} eq (phosphate), kg N eq (nitrogen) and mol N eq (moles of nitrogen).	UNIT **kg PO_4^{3-} eq** **kg N eq** **mol N eq**
Ozone Depletion (ODP) Degradation and reduction, caused by chlorofluorocarbons (CFC) or chlorofluoromethanes (CFM), of the ozone layer present in the stratosphere to filter the ultraviolet component of the sun's rays thanks to its particularly reactive compounds.	UNIT **kg CFC-11 eq**
Photochemical Oxidant Formation (POFP) Ozone formation on earth surface due to the emission of unburnt hydrocarbons and nitrogen oxides into the atmosphere in the presence of solar radiation. This phenomenon is harmful to living organisms and is often present in large urban centers. The indicator is expressed in kg NMVOC eq (Non-Methane Volatile Organic Compounds).	UNIT **kg NMVOC eq** Non Methane Volatile Organic Compounds
Abiotic Depletion Potential – Elements Over-extraction of minerals and other non-renewable elements, leading to exhaustion of natural resources.	UNIT **kg Sb eq**
Abiotic Depletion Potential – Fossil Fuels Over-extraction of fossil fuels, leading to exhaustion of natural resources.	UNIT **MJ** net calorific value
Water Scarsity (WSI) Indicator that represents the equivalent volume of water consumed proportionate to the water availability of single countries.	UNIT **m^3 eq**

AVERAGE PRODUCT

Use of resources

The data refer to the declared unit.

Parameter		Unit	A1 A3	A4	B1 B7	C1	C2	C3	C4	Total A1 A4 + B + C	D
Primary energy resources Renewable	Use as energy carrier	MJ, net calorific value	0,946	0,003	-	-	0,002	< 0,001	< 0,001	0,950	- 0,810
	Use as raw material	MJ, net calorific value	0,011	0,001	-	-	0,001	< 0,001	< 0,001	0,013	- 0,001
	TOTAL	MJ, net calorific value	0,957	0,004	-	-	0,002	< 0,001	< 0,001	0,963	- 0,810
Primary energy resources Non-renewable	Use as energy carrier	MJ, net calorific value	0,946	1,049	-	-	0,613	0,015	< 0,001	10,100	- 4,390
	Use as raw material	MJ, net calorific value	71,507	< 0,001	-	-	< 0,001	< 0,001	< 0,001	71,507	- 64,349
	TOTAL	MJ, net calorific value	79,930	1.049	-	-	0,613	0,015	< 0,001	81,607	- 68,740
Secondary meterial		kg	-	-	-	-	-	-	-	-	-
Renewable secondary fuels		MJ	-	-	-	-	-	-	-	-	-
Non-renewable secondary fuels		MJ	-	-	-	-	-	-	-	-	-
Net use of fresh water		m^3	0,014	< 0,001	-	-	< 0,001	< 0,001	< 0,001	0,014	- 0,012

Environmental impacts

The data refer to the declared unit.

Parameter		Unit	A1 A3	A4	B1 B7	C1	C2	C3	C4	Total A1 A4 + B + C	D
Global warming potential (GWP)	Fossil	kg CO_2 eq	2,141	0,068	-	-	0,040	0,151	0,006	2,405	- 1,796
	Biogenic	kg CO_2 eq	0,017	< 0,001	-	-	< 0,001	< 0,001	< 0,001	0,017	- 0,003
	Land use	kg CO_2 eq	5,56E-05	1,50E-06	-	-	8,73E-07	1,18E-07	2,19E-08	5,81E-05	4,40E-06
	TOTAL	kg CO_2 eq	2,158	0,068	-	-	0,040	0,151	0,006	2,422	- 1,800
GWP-GHC Total (without CO_2 biogenic)		kg CO_2 eq	2,145	0,068	-	-	0,040	0,151	0,006	2,409	- 1,800
Acidification potential (AP)		kg SO_2 eq	0,007	< 0,001	-	-	< 0,001	< 0,001	< 0,001	0,008	- 0,006
Acidification potential (AP)		mol H^+ eq	0,009	< 0,001	-	-	< 0,001	< 0,001	< 0,001	0,009	- 0,007
Eutrophication aquatic freshwater (EP-freshwater)		kg PO_4^{3-} eq	0,001	< 0,001	-	-	< 0,001	< 0,001	< 0,001	0,001	0,000
Eutrophication aquatic marine (EP-marine)		kg N eq	0,002	< 0,001	-	-	< 0,001	< 0,001	< 0,001	0,002	- 0,001
Eutrophication terrestrial (EP)		mol N eq	0,017	0,001	-	-	< 0,001	< 0,001	< 0,001	0,019	- 0,012
Ozone depletion (ODP)		kg CFC-11 eq	4,21E-08	1,27E-08	-	-	7,45E-09	1,31E-10	1,06E-12	6,42E-08	- 9,44E-10
Photochemical oxidant formation (POFP)		kg NMVOC eq	0,009	< 0,001	-	-	< 0,001	< 0,001	< 0,001	0,010	- 0,008
Abiotic depletion potential - Elements		kg Sb eq	3,78E-08	2,15E-10	-	-	1,26E-10	3,43E-10	9,43E-13	3,58E-08	- 3,27E-08
Abiotic depletion potential - Fossil fuels		MJ, net calorific value	69,536	0,983	-	-	0,575	0,013	< 0,001	71,106	-59,674
Water scarcity potential		m^3 eq	0,597	0,002	-	-	0,001	0,001	< 0,001	0,601	- 0,445

AVERAGE PRODUCT

Waste production

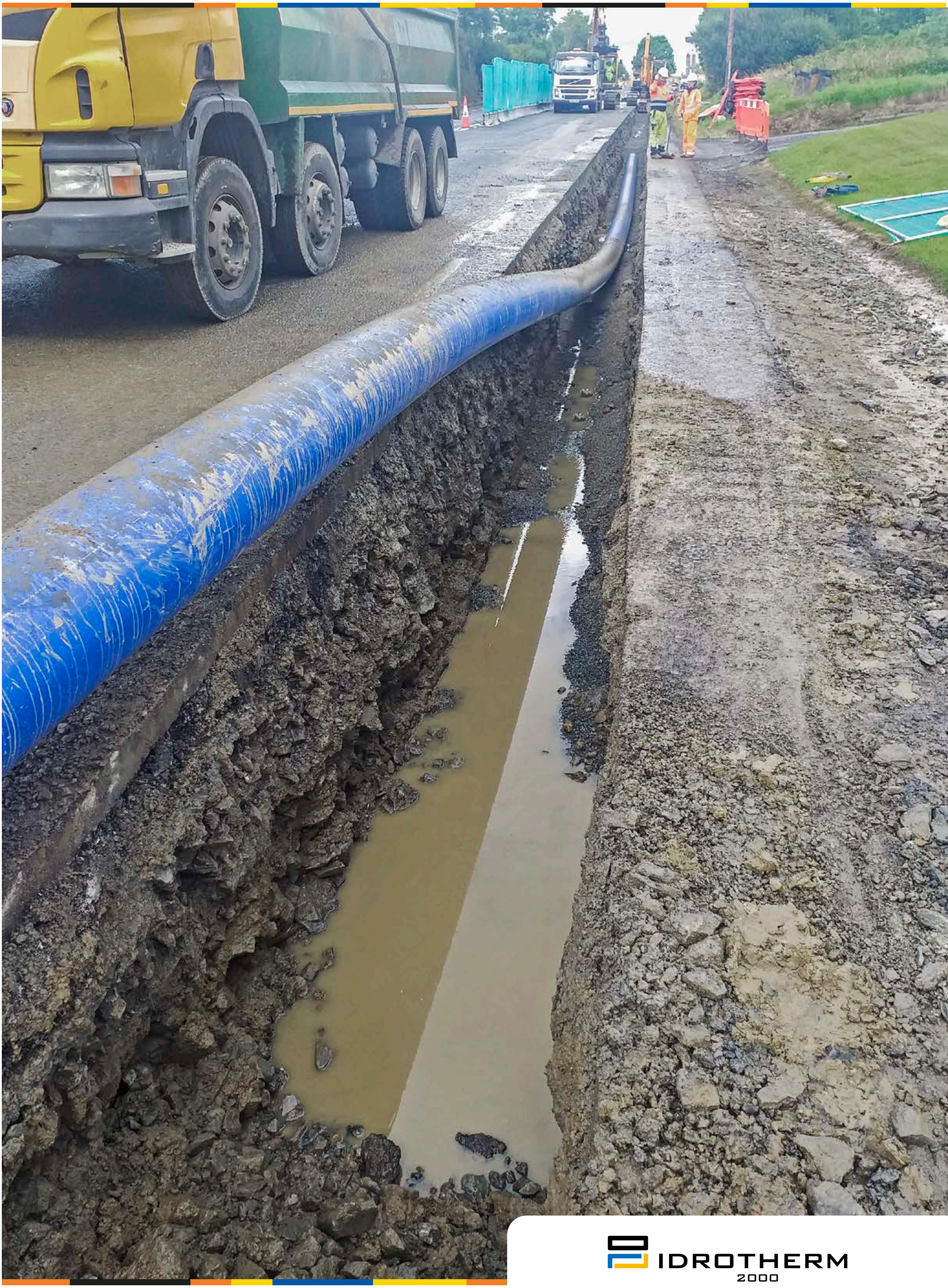
The data refer to declared unit.

Parameter	Unit	A1 A3	A4	B1 B7	C1	C2	C3	C4	Total A1 A4 + B + C	D
Hazardous waste disposed	kg	< 0,001	< 0,001	-	-	< 0,001	< 0,001	< 0,001	< 0,001	- 0,000
Non-hazardous waste disposed	kg	< 0,001	< 0,001	-	-	< 0,001	< 0,001	0,050	0,050	- 0,000
Radioactive waste disposed	kg	< 0,001	< 0,001	-	-	< 0,001	< 0,001	< 0,001	< 0,001	- 0,000

Output flows

The data refer to declared unit.

Parameter	Unit	A1 A3	A4	B1 B7	C1	C2	C3	C4	Total A1 A4 + B + C	D
Components for reuse	kg	-	-	-	-	-	-	-	-	-
Material for recycling	kg	0,008	-	-	-	-	0,900	-	0,908	-
Materials for energy recovery	kg	-	-	-	-	-	0,050	-	0,050	-
Exported energy, electricity	MJ	-	-	-	-	-	-	-	-	-
Exported energy, thermal	MJ	-	-	-	-	-	-	-	-	-



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PE PIPES INSTALLATION

PE pipes are usually installed below or above ground according to the applications and the existing national regulations.
For underground installations an open trench is mostly used and its width at the springline of the pipe should not be greater than necessary to provide adequate room for jointing the pipe in the trench and compacting the pipe zone backfill.
As for the depth, it should be a minimum of 600 mm, especially for pipes passing under traffic areas, although shallower depths may be chosen to prevent the conveyed fluids from being affected by frost.
Pipes require uniform support, this being provided by the bedding layer, which should in average have a minimum thickness of 100 mm and be constituted by granular materials, such as gravel, sand or crushed rock.
Junctions of PE pipes are generally accomplished either with butt-welding and electrofusion techniques or with mechanical fittings.
The growing demand for faster and more economic installation methods with less environmental disturbance has led to modern techniques, which include sandless bedding in open trench and no dig installations, among which horizontal directional drilling (HDD) is the most used.
Due to their aggressive impacts on pipes, these methods have only been made possible through innovative plastic pipe developments: if laid in rocky or sandless bedding conditions, standard PE pipes would be subjected to external damage and high stresses. Over time this could lead to crack development and ultimate pipe failure.
The last generation of polyethylene, named as PE100 RC (raised crack resistance), has been specifically designed for pipes subjected to elevated stresses and a high level of risk of surface damage caused by modern trenchless or sandless installations: this way, they provide the most robust solution for pressure applications currently available in the market with reduced environmental impact.

Environmental impacts based on
STANDARD INSTALLATION - DN160 SDR11

Use of resources

The data refer to 100 m of pipes (674 kg), installed with standard installation.

Parameter		Unit	A1 A3	A4	A5	B1 B7	C1	C2	C3	C4	Total A+B+C	D
Primary energy resources. Renewable	Use as energy carrier	MJ, net calorific value	637,463	1,787	111,460	-	-	1,048	0,104	0,022	751,884	- 545,686
	Use as raw material	MJ, net calorific value	7,720	0,640	25,259	-	-	0,377	0,028	0,005	34,029	- 0,452
	TOTAL	MJ, net calorific value	**645,182**	**2,428**	**136,719**	**-**	**-**	**1,425**	**0,132**	**0,026**	**785,913**	**- 546,138**
Primary energy resources. Non-renewable	Use as energy carrier	MJ, net calorific value	5.677,145	706,855	3.808,987	-	-	413.234	10,172	0,133	10.616,527	- 2.959,040
	Use as raw material	MJ, net calorific value	48.195,874	0,001	633,018	-	-	< 0,001	< 0,001	< 0,001	48.828,893	- 43.371,524
	TOTAL	MJ, net calorific value	**53.873,019**	**706,856**	**4.442,005**	**-**	**-**	**413,234**	**10,173**	**0,133**	**59.445,420**	**- 46.330,564**
Secondary material		kg	-	-	-	-	-	-	-	-	-	-
Renewable secondary fuels		MJ	-	-	-	-	-	-	-	-	-	-
Non-renewable secondary fuels		MJ	-	-	-	-	-	-	-	-	-	-
Net use of fresh water		m³	9,635	0,069	19,127	-	-	0,040	0,007	< 0,001	28,878	- 8,222

STANDARD INSTALLATION - DN160 SDR11

Environmental impacts

The data refer to 100 m of pipes (674 kg), installed with standard installation.

Parameter		Unit	A1 A3	A4	A5	B1 B7	C1	C2	C3	C4	Total A+B+C	D
Global warming potential (GWP)	Fossil	kg CO_2 eq	1.442,956	45,528	244,830	-	-	26,922	101,768	3,921	**1.865,957**	- 1.210,720
	Biogenic	kg CO_2 eq	11,294	0,002	3,047	-	-	0,001	< 0,001	0,001	**14,346**	- 2,244
	Land use	kg CO_2 eq	0,037	0,001	0,133	-	-	0,001	< 0,001	< 0,001	**0,171**	- 0,003
	TOTAL	kg CO_2 eq	**1.454,288**	**45,531**	**248,011**	**-**	**-**	**26,924**	**107,799**	**3,922**	**1.880,475**	**- 1.212,949**
GWP-GHC Total (without CO_2 biogenic)		kg CO_2 eq	**1.445,545**	**45,531**	**245,179**	**-**	**-**	**26,924**	**107,799**	**3,922**	**1.868,901**	**- 1.212,949**
Acidification potential (AP)		kg SO_2 eq	4,911	0,201	2,131	-	-	0,103	0,012	< 0,001	**7,358**	- 3,898
Acidification potential (AP)		mol H^+ eq	5,911	0,226	2,457	-	-	0,116	0,012	< 0,001	**8,722**	- 4,713
Eutrophication aquatic freshwater (EP-freshwater)		kg PO_4^{3-} eq	0,397	0,031	0,372	-	-	0,016	0,003	< 0,001	**0,819**	- 0,262
Eutrophication aquatic marine (EP-marine)		kg N eq	1,087	0,081	0,731	-	-	0,042	0,006	0,001	**1,948**	- 0,768
Eutrophication terrestrial (EP)		mol N eq	11,405	0,889	8,111	-	-	0,457	0,066	< 0,001	**20,928**	- 8,395
Ozone depletion (ODP)		kg CFC-11 eq	2,84E-05	8,59E-06	4,09E-05	-	-	5,02E-06	8,84E-08	7,16E-10	**8,30E-05**	- 6,36E-07
Photochemical oxidant formation (POFP)		kg NMVOC eq	6,382	0,230	2,370	-	-	0,119	0,015	0,001	**9,117**	- 5,239
Abiotic depletion potential Elements		kg Sb eq	< 0,001	< 0,001	0,006	-	-	< 0,001	< 0,001	< 0,001	**0,006**	- 0,000
Abiotic depletion potential Fossil fuels		MJ, potere calorifico netto	46.867,024	622,,374	3.935,935	-	-	387,220	9,062	0,069	**51.861,683**	- 40.220,215
Water scarcity potential		m^3 eq	402,101	1,332	799,530	-	-	0,770	0,607	0,002	**1.204,342**	- 300,261

Waste production

The data refer to 100 m of pipes (674 kg), installed with standard installation.

Parameter	Unit	A1 A3	A4	A5	B1 B7	C1	C2	C3	C4	Total A+B+C	D
Hazardous waste disposed	kg	0,001	< 0,001	0,005	-	-	< 0,001	< 0,001	< 0,001	0,006	- 0,000
Non-hazardous waste disposed	kg	0,086	< 0,001	0,020	-	-	< 0,001	< 0,001	33,700	33,806	- 0,000
Radioactive waste disposed	kg	0,016	0,005	0,022	-	-	0,003	< 0,001	< 0,001	0,046	- 0,000

Output flows

The data refer to 100 m of pipes (674 kg), installed with standard installation.

Parameter	Unit	A1 A3	A4	A5	B1 B7	C1	C2	C3	C4	Total A+B+C	D
Components for reuse	kg	-	-		-	-	-	-	-	-	-
Material for recycling	kg	5,701	-		-	-	-	606,600	-	612,301	-
Materials for energy recovery	kg	-	-		-	-	-	33,700	-	33,700	-
Exported energy, electricity	MJ	-	-		-	-	-	-	-	-	-
Exported energy, thermal	MJ	-	-		-	-	-	-	-	-	-

Environmental impacts based on NO-DIG INSTALLATION* - DN160 SDR11





Use of resources

The data refer to 100 m of pipes (674 kg), installed with no-dig installation.

Parameter		Unit	A1 A3	A4	A5	B1 B7	C1	C2	C3	C4	Total A+B+C	D
Primary energy resources. Renewable	Use as energy carrier	MJ, net calorific value	637,463	1,787	67,345	-	-	1,048	0,104	0,022	707,769	- 545,686
	Use as raw material	MJ, net calorific value	7,720	0,640	19,754	-	-	0,377	0,028	0,005	28,523	- v0,452
	TOTAL	MJ, net calorific value	**645,182**	**2,428**	**87,099**	**-**	**-**	**1,425**	**0,132**	**0,026**	**736,293**	**- 546,138**
Primary energy resources. Non-renewable	Use as energy carrier	MJ, net calorific value	5.677,145	706,855	834,013	-	-	413.234	10,172	0,133	7.641,552	- 2.959,040
	Use as raw material	MJ, net calorific value	48.195,874	0,001	633,538	-	-	< 0,001	< 0,001	< 0,001	48.828,413	- 43.371,524
	TOTAL	MJ, net calorific value	**53.873,019**	**706,856**	**1.466,551**	**-**	**-**	**413,234**	**10,173**	**0,133**	**56.469,966**	**- 46.330,564**
Secondary material		kg	-	-	-	-	-	-	-	-	-	-
Renewable secondary fuels		MJ	-	-	-	-	-	-	-	-	-	-
Non-renewable secondary fuels		MJ	-	-	-	-	-	-	-	-	-	-
Net use of fresh water		m^3	9,635	0,069	19,127	-	-	0,040	0,007	< 0,001	10,730	- 8,222

* Horizontal Directional Drilling

NO-DIG INSTALLATION* - DN160 SDR11

Environmental impacts

The data refer to 100 m of pipes (674 kg), installed with no-dig installation.

Parameter		Unit	A1 A3	A4	A5	B1 B7	C1	C2	C3	C4	Total A+B+C	D
Global warming potential (GWP)	Fossil	kg CO_2 eq	1.442,956	45,528	49,473	-	-	26,922	101,768	3,921	**1.670,599**	- 1.210,720
	Biogenic	kg CO_2 eq	11,294	0,002	2,028	-	-	0,001	< 0,001	0,001	**13,327**	- 2,244
	Land use	kg CO_2 eq	0,037	0,001	0,081	-	-	0,001	< 0,001	< 0,001	**0,120**	- 0,003
	TOTAL	kg CO_2 eq	**1.454,288**	**45,531**	**51,582**	**-**	**-**	**26,924**	**107,799**	**3,922**	**1.684,046**	**- 1.212,949**
GWP-GHC Total (without CO_2 biogenic)		kg CO_2 eq	**1.445,545**	**45,531**	**49,691**	**-**	**-**	**26,924**	**107,799**	**3,922**	**1.673,413**	**- 1.212,949**
Acidification potential (AP)		kg SO_2 eq	4,911	0,201	0,536	-	-	0,103	0,012	< 0,001	**5,762**	- 3,898
Acidification potential (AP)		mol H+ eq	5,911	0,226	0,673	-	-	0,116	0,012	< 0,001	**6,939**	- 4,713
Eutrophication aquatic freshwater (EP-freshwater)		kg PO_4^{3-} eq	0,397	0,031	0,130	-	-	0,016	0,003	< 0,001	**0,577**	- 0,262
Eutrophication aquatic marine (EP-marine)		kg N eq	1,087	0,081	0,068	-	-	0,042	0,006	0,001	**1,285**	- 0,768
Eutrophication terrestrial (EP)		mol N eq	11,405	0,889	0,816	-	-	0,457	0,066	< 0,001	**13,633**	- 8,395
Ozone depletion (ODP)		kg CFC-11 eq	2,84E-05	8,59E-06	8,58E-06	-	-	5,02E-06	8,84E-08	7,16E-10	**5,06E-05**	- 6,36E-07
Photochemical oxidant formation (POFP)		kg NMVOC eq	6,382	0,230	0,371	-	-	0,119	0,015	0,001	**7,118**	- 5,239
Abiotic depletion potential Elements		kg Sb eq	< 0,001	< 0,001	0,006	-	-	< 0,001	< 0,001	< 0,001	**0,006**	- 0,000
Abiotic depletion potential Fossil fuels		MJ, potere calorifico netto	46.867,024	622,,374	1.210,409	-	-	387,220	9,062	0,069	**49.136,157**	- 40.220,215
Water scarcity potential		m^3 eq	402,101	1,332	35,709	-	-	0,770	0,607	0,002	**440,521**	- 300,261

Waste production

The data refer to 100 m of pipes (674 kg), installed with no-dig installation.

Parameter	Unit	A1 A3	A4	A5	B1 B7	C1	C2	C3	C4	Total A+B+C	D
Hazardous waste disposed	kg	0,001	< 0,001	0,005	-	-	< 0,001	< 0,001	< 0,001	0,006	- 0,000
Non-hazardous waste disposed	kg	0,086	< 0,001	0,020	-	-	< 0,001	< 0,001	33,700	33,806	- 0,000
Radioactive waste disposed	kg	0,016	0,005	0,022	-	-	0,003	< 0,001	< 0,001	0,046	- 0,000

Output flows

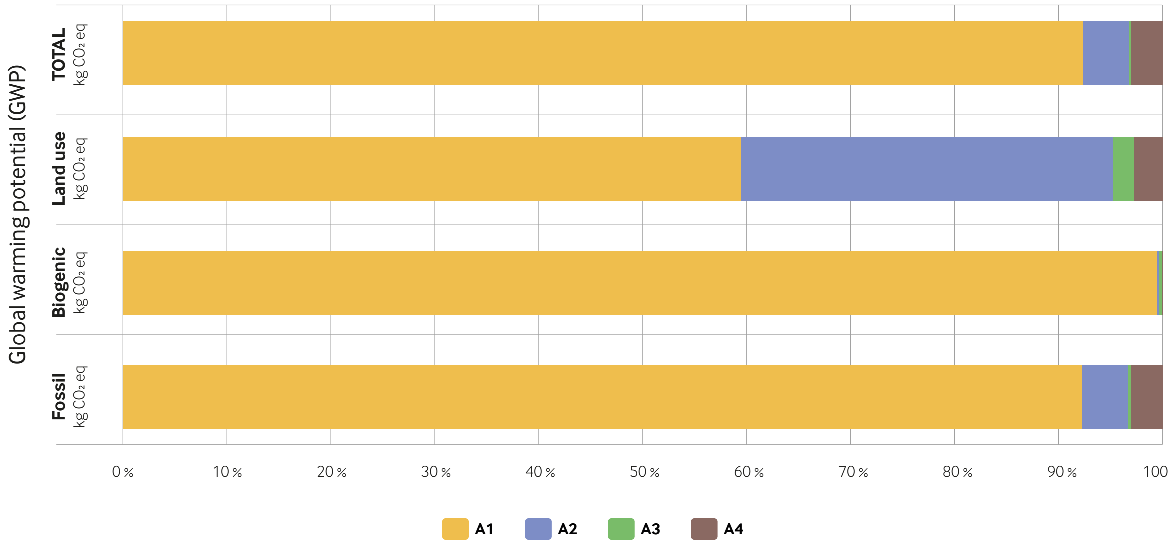
The data refer to 100 m of pipes (674 kg), installed with no-dig installation.

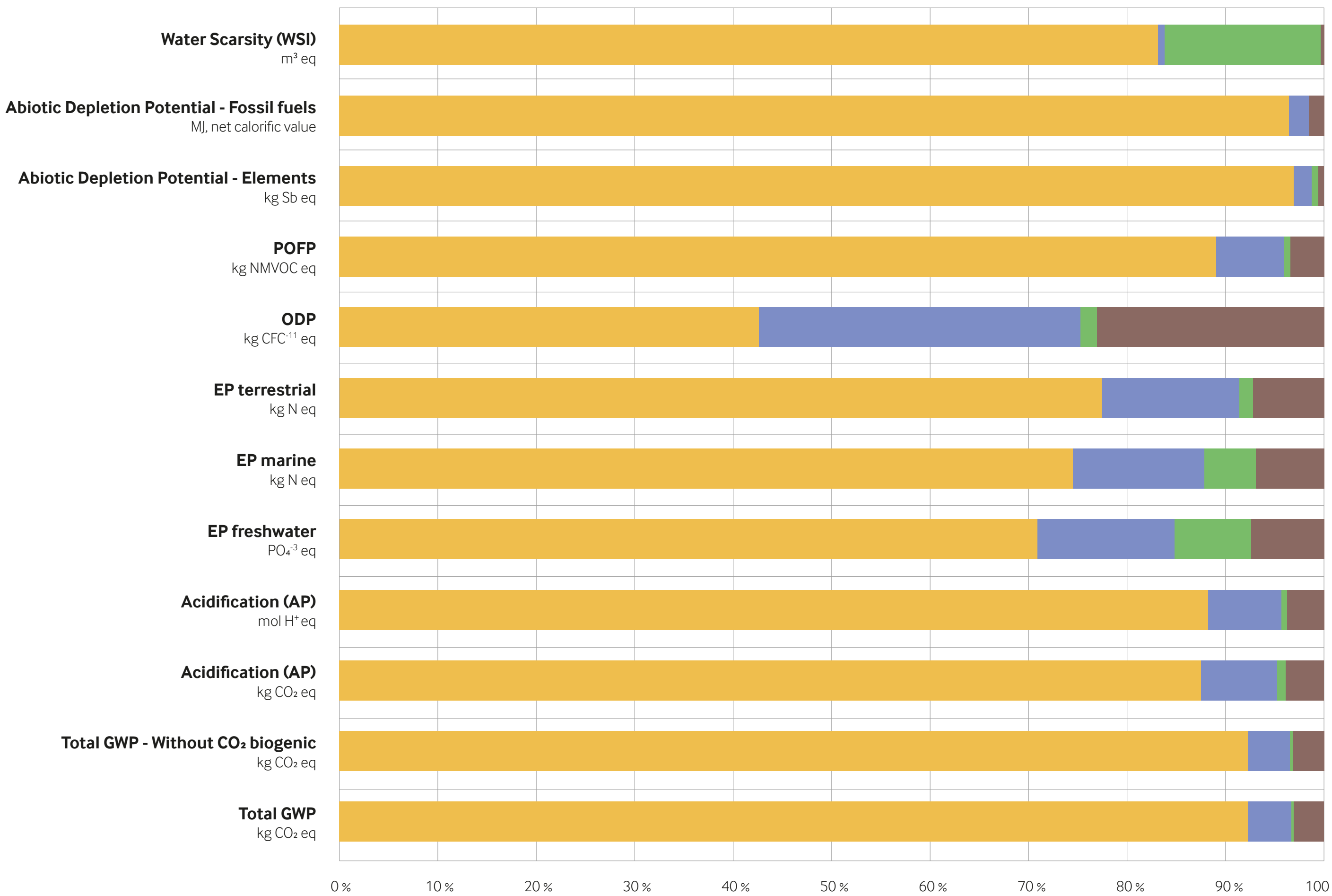
Parameter	Unit	A1 A3	A4	A5	B1 B7	C1	C2	C3	C4	Total A+B+C	D
Components for reuse	kg	-	-		-	-	-	-	-	-	-
Material for recycling	kg	5,701	-		-	-	-	606,600	-	612,301	-
Materials for energy recovery	kg	-	-		-	-	-	33,700	-	33,700	-
Exported energy, electricity	MJ	-	-		-	-	-	-	-	-	-
Exported energy, thermal	MJ	-	-		-	-	-	-	-	-	-

* Horizontal Directional Drilling

INTERPRETATION OF RESULTS

As an example, the detailed contribution of the various phases of the life cycle with respect to the global warming potential (GWP) and a general view of all the impacts are shown in the following graphs, for the modules under the direct control of the company (A1-A4) from the raw material supply up to the transportation from the production gate to the customer.





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- PCR 2019:14 Version 1.1 Construction Products
- EN 15804:2012+A2:2019
- ISO 21930 Environmental declaration of building products. Database Ecoinvent v.3.5 (www.ecoinvent.org).
- LCA study “Tubi in polietilene per trasporto di fluidi e protezione di cavi in ambito industriale e civile
  Rev. 0 – Idrotherm 2000

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TETIS Institute S.R.L. (TEchniques for The Impact on Sustainability)
www.tetisinstitute.org
Prof. Ing. Adriana Del Borghi - E-mail: delborghi@tetisinstitute.it

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IDROTHERM 2000

Via Pio La Torre, 21 - 55032 Castelnuovo Garfagnana (Lu) Italy
Tel. +39 0583 65496 - Fax +39 0583 62033
www.idrotherm2000.com - info@idrotherm2000.com