ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	hpg plastics gmbh
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-HPG-20250688-IBC1-EN
Issue date	10.03.2026
Valid to	09.03.2031

Underfloor heating pipes made of PE-RT

hpg plastics gmbh

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ECO PLATFORM EPD VERIFIED

hpgPlastics by HuliotGroup

1. General Information

hpg plastics gmbh

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-HPG-20250688-IBC1-EN

This declaration is based on the product category rules:

Plastic pipe systems for hot and cold water installation in the building, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

10.03.2026

Valid to

09.03.2031

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

Underfloor heating pipes made of PE-RT

Owner of the declaration

hpg plastics gmbh
Anna-Schlinkheider-Str. 3
40878 Ratingen
Germany

Declared product / declared unit

1 kg of 5-layer PE-RT pipes

Scope:

The HPG PLASTICS 5 layer pipes are produced in Germany by the German company hpg Plastics GmbH in Ratingen and are delivered to different countries in Europe (Germany, Holland, Belgium, Nordics, UK) as well as in the USA and far East. The produced datasets for this life cycle assessment are representative to an HPG PLASTICS 5 layer PE-RT pipe. This is an average EPD based on an average, generic product variant.The study covers five-layer solid plastic pipes made of PE-RT for hot and cold water installations in buildings. The trade names for the pipes are FLEXOLEN, MIDI SOFT (PE-RT type 0), MIDI Composite, MIDI Inverse I (PE-RT type 1) and BASELINE, MIDI Composite Plus, MIDI Inverse II (PE-RT type 2). The pipes are produced in various sizes in white, silver, red, green, blue, purple, and orange. The smallest has a diameter of 8 mm and a wall thickness of 1.0 mm, while the largest has a diameter of 32 mm and a wall thickness of 3.0 mm.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Dr.-Ing. Nikolay Minkov,
(Independent verifier)

2. Product

2.1 Product description/Product definition

The HPG PLASTICS 5 layer pipes are made of PE-RT (Polyethylene of Raised Temperature resistance), EVOH (Ethylene-vinyl-alcohol copolymer) as oxygen barrier function layer and polyolefin based grafted co-polymer as adhesive function layers. Most of the pipes are colored white, silver, red, green, blue, violet, or orange, hence they also contain a small amount of coloring agent. HPG PLASTICS 5-layer PE-RT pipes are produced by hpg plastics GmbH in Germany according to the respective standards: *DIN EN ISO 22391, ISO 24033, DIN EN ISO 21003* and the national guidelines *BRL 5602, BRL 5607* and *HR 3.16*. The HPG PLASTICS 5 layer pipes are specifically developed pointing on customer demand for high flexibility coupled to a distinguished long term stability. They hold several performance approvals like *SKZ, KIWA/KOMO, DINCERTCO* and *CE-ETA*. The oxygen barrier properties of the MIDI 5 layer pipes is controlled according *ISO 17455* and complies to *DIN 4726, BRL 5602, BRL 5607 and DIN EN 1264* design standards.

2.2 Application

The HPG PLASTICS 5-layer PE-RT pipes are intended to be used for the surface heating or cooling applications, like for example, underfloor heating systems (UFH), wall heating systems, ceiling cooling systems, concrete core activation, geothermal systems and radiator connection.

2.3 Technical Data

The HPG PLASTICS 5-layer PE-RT pipes are designed for a lifetime of 50 years, according to an operating temperature profile defined by the *ISO 10508* classification for classes 4 & 5 and an allowable operating pressure of maximum 6 to 10 bar depending on application class and pipe dimension. The values given in the following table apply to PE-RT pipes in all pipe sizes.

Constructional data

Technical Data / Physical Properties

Name	Value	Unit
Permissible operating pressure PN of the pipe system depending on application class and pipe dimension max.	10	bar
Mean density of the material according to EN ISO 1183-1, or -2	934	kg/m^3
Pipe OD	8 - 26	mm
Pipe wall thickness	1 - 3	mm
Thermal Conductivity ISO 52612	0.4	W/(mK)
Thermal Expansion Coefficient ISO 52328	0.195	mm / mK
Oxygen diffusion rate @ 40°C ISO 4726 / ISO 17455	< 0.32	$mg/(m^2d)$
Oxygen diffusion rate @ 80°C ISO 4726 / ISO 17455	≤ 3.60	$mg/(m^2d)$
PE-RT material density ISO 1133	0.929-0.941	kg/m^3
Flexural modulus ISO 178	400 - 660	MPa

The performance data of the products with respect to their essential characteristics are in accordance to *ETA No 16/003 V.2* / 09.01.2024 'Plastics piping kits for the transport system of hot and cold water, made of Polyethylene Raised Temperature Resistance Type 0, I and II'.

2.4 Delivery status

The HPG PLASTICS 5-layer pipes are delivered in an outer dimension range of 8-32 mm and a pipe wall thickness range of 1-3 mm.
Furthermore they are delivered on pallet quantities in a range of 300 meters up to 3,000 meters on each pallet.

2.5 Base materials/Ancillary materials

Product Composition

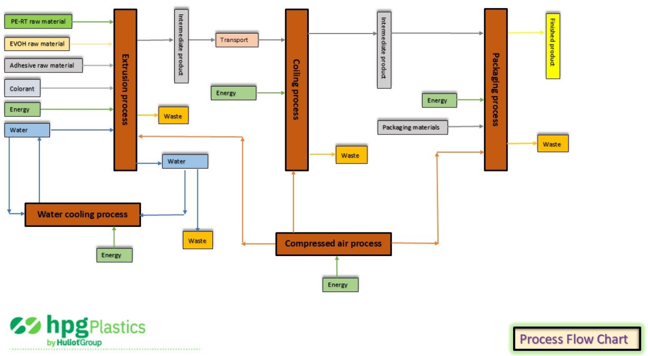
Name	Value	Unit
PE-RT Polyethylen	90-94	%
Oxygen barrier EVOH	2-4	%
Adhesive MA-PE g-copo	3-5	%
Colorant	0-1	%

The product does not contain substances listed in the '*Candidate list of Substances of Very High Concern for Authorization*' (SVHC, date: 01.10.2025).

1. This product/article/at least one partial article contains substances listed in the *candidate list* (01.10.2025) exceeding 0.1 percentage by mass: **no**
2. This product/article/at least one partial article contains other CMR substances in categories 1A or 1B which are not on the *candidate list,* exceeding 0.1 percentage by mass: **no**
3. Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): **no**

2.6 Manufacture

The manufacturing process starts with the thorough inspection of every incoming batch of raw material. The materials must fall within the claimed specifications and should pass all the required tests to ensure the product compliance to the standards.
Once materials pass the tests, they are released by QA for use in the production. They are then transported to the feeding zones of the extrusion machines. During extrusion process, the raw materials are heat treated and melt. The melt is then guided to the extruder's 5-layer head and through the applied vacuum is shaped to a pipe. The calibration stage follows and conveys the appropriate dimension to the product. The formed pipe runs through a water tank for cooling down and allowing further processing. During the cooling process the pipe dimension is continuously monitored by ultrasonic scanners throughout its complete cross-section to assure the specified tolerances.
The intermediate cooled down product is then stored on large size drums and after the respective printing has taken place on the pipe.
The intermediate product is then directed first to the coiling machines, where also a last visual and manual product control applies, and then to the packaging section for being prepared according to the customer demand.
The pipes, before released for delivery, have to undergo and pass all necessary lab controls to ensure their compliance with all necessary standards and certifications.



2.7 Environment and health during manufacturing
At hpg Plastics, we take our responsibility towards the environment and its resources very seriously and are constantly working to optimize our production, processes and products with regard to sustainability. Our commitment is supported by the "*Going Green Program*" by Huliot Group, our parent company, which consistently develops sustainable measures in all business areas.

In our production, we continuously strive to implement sustainable processes, such as: using silos to store our raw materials, maximum pallet utilization, closed-loop water cooling systems on our machines.

At hpg Plastics we are in process of implementing and operating Environmental and Health & Safety Management Systems (acc. to *ISO 14001-2015 & ISO 45001-2018*).

2.8 Product processing/Installation
The HPG PLASTICS 5-layer pipes must be transported, stored and handled in such a way that
they are protected from any accidental damage.
The pipes must not be exposed to direct sunlight. In case of unavoidable exposure to sunlight, the HPG PLASTICS pipes should be protected in cardboard boxes or minimum by a black foil.
When visually inspected without magnification, the inner and outer surfaces of the pipes shall be smooth, clean and free from surface defects.
The minimum permissible bending radius of 5 or 8 times the outer diameter of the pipe, respectively to the OD, should be respected during installation. In case of violation of the minimum bending radius and consequent breaking of the pipe, the faulty part should be cut and replaced. The temperature affects the allowable bending radius.
Shortly before covering the installed UFH system a pressure test should be conducted according to *DIN EN 1264-4*.
An installed UFH system must not remain with water inside the piping when ambient temperature is likely to drop lower than 0°C. If piping is needed to remain with water inside then suitable anti-freezing agent should be used.

2.9 Packaging
The coils of HPG PLASTICS 5-layer pipes are packed and delivered in PE foil, cardboard boxes and wooden one-way drums. They are transported to the buyers being placed on wooden pallets.

2.10 Condition of use
The material composition of HPG PLASTICS 5-layer pipes does not change during the specified service life of 50 years.

2.11 Environment and health during use
HPG PLASTCICS 5-layer pipes don't contain any harmful substances and do not produce any emissions when used for their designed purpose.

2.12 Reference service life
The reference service life (RSL) in accordance with *ISO 15686* is not relevant to the LCA calculation and is therefore not determined. According to HPG Plastics, the pipes are designed for a service life of 50 years in accordance with the *DIN EN ISO 22391* standard.
It is expected that the HPG PLASTICS pipes will obtain a yellowish color after a certain period of the heating system operation. This is due to the plastic material aging in continuous heating treatment.

2.13 Extraordinary effects
Fire
The HPG PLASTICS 5-layer pipes are classified according to *DIN 4102* as B2 class of building materials and according to *ISO EN 13501:1* as E class building products.

Name	Value	Unit
Building material class acc. to DIN 4102	B2	-
Building products class acc. to ISO EN 13501	E	-

Water
When HPG PLASTICS 5-layer pipes are installed and operated in compliance to the *EN ISO 1264-4* the risk flooding is minimized and remains only to the accidental level.

Mechanical destruction
The HPG PLASTICS 5-layer pipes should be checked for accidental mechanical damages before installation. Any mechanical damage can potentially produce leakage.

2.14 Re-use phase
The HPG PLASTICS 5-layer pipes are not designed for re-use. The HPG PLASTICS 5-layer pipes can be recycled.

2.15 Disposal
HPG PLASTICS 5-layer pipes can be recycled, thermally recovered, or sent to landfill. They are disposed of in accordance with local regulations governed by the *European Waste Catalogue* (waste code: 07 wastes from organic chemical processes - 07 02 13 waste plastic).

2.16 Further information
Additional information may be available on our web site (hpg-plastics.com) or upon request.

3. LCA: Calculation rules

3.1 Declared Unit
The declared unit is 1 kg of PE-RT pipe at the factory gate. This corresponds to 11.4 meters or 0.99 kg of installed pipe (see information on module A5 in chapter 4). The declared unit refers to the product as it leaves the factory gate.

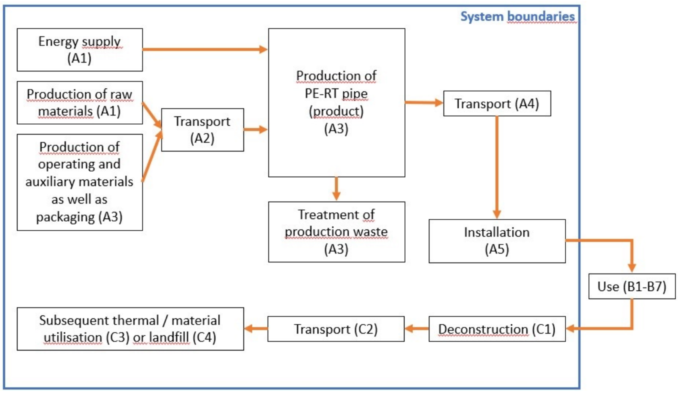
Declared unit

An average product of the PE-RT pipe was calculated. It is based on the production volumes for 2024 and therefore covers all product variants. The mass reference differs depending on the pipe size.

Name	Value	Unit
Declared unit	1	kg
PE-RT type 0 (FLEXOLEN, MIDI SOFT)		
Mass reference 14 x 2.0 mm	0.077	kg/m
Mass reference 16 x 2.0 mm	0.088	kg/m
Mass reference 17 x 2.0 mm	0.930	kg/m
Mass reference 18 x 2.0 mm	0.102	kg/m
Mass reference 20 x 2.0 mm	0.116	kg/m
PE-RT type 1 (MIDI Composite, MIDI inverse I)		
Mass reference 8,0 x 1.0 mm	0.023	kg/m
Mass reference 10 x 1.3 mm	0.038	kg/m
Mass reference 12 x 1.3 mm	0.045	kg/m
Mass reference 12 x 1.5 mm	0.051	kg/m
Mass reference 14 x 2.0 mm	0.076	kg/m
Mass reference 15 x 2.0 mm	0.082	kg/m
Mass reference 16 x 2.0 mm	0.088	kg/m
Mass reference 17 x 2.0 mm	0.096	kg/m
Mass reference 18 x 2.0 mm	0.102	kg/m
Mass reference 20 x 2.0 mm	0.116	kg/m
Mass reference 25 x 2.3 mm	0.164	kg/m
Mass reference 32 x 3.0 mm	0.273	kg/m
PE-RT type 2 (BASELINE, MIDI Composite Plus, MIDI inverse II)		
Mass reference 8,0 x 1.0 mm	0.023	kg/m
Mass reference 10 x 1.3 mm	0.038	kg/m
Mass reference 12 x 1.3 mm	0.046	kg/m
Mass reference 12 x 1.5 mm	0.049	kg/m
Mass reference 14 x 2.0 mm	0.077	kg/m
Mass reference 15 x 2.0 mm	0.083	kg/m
Mass reference 16 x 2.0 mm	0.089	kg/m
Mass reference 17 x 2.0 mm	0.093	kg/m
Mass reference 18 x 2.0 mm	0.103	kg/m
Mass reference 20 x 2.0 mm	0.116	kg/m
Mass reference 25 x 2.3 mm	0.166	kg/m
Mass reference 26 x 3.0 mm	0.218	kg/m
Mass reference 32 x 3.0 mm	0.275	kg/m
Raw density (mean value)	934	kg/m^3

3.2 System boundary

The EPD covers the life cycle from cradle to factory gate with options, modules C1-C4, and module D (A1-A3 + A4-A5 + C + D). The life cycle is designed modularly according to *DIN EN 15804*.



Modules A1, A2, and A3 are treated as an aggregated module A1-A3.
The following life cycle stages are considered:

Module A1: The system boundaries comprise raw material extraction and supply as well as Energy supply from cradle to factory gate and is represented through generic background data sets. Approximately 0,53 kWh electricity are required for the production of 1 kg HPG PLASTICS PE-RT pipe. This data was provided by HPG PLASTICS GmbH.
Module A2: The transport of the raw materials from the factory gate to the point of manufacturing is represented through generic background data sets. The transportation distances have been provided by the manufacturer.
Module A3: The manufacturing includes manufacturer-specific material data which are represented through generic data sets. Machinery as well as buildings are neglected. This module also includes the product packaging (plastic film, cardboard, wooden Pallets).
Module A4: The transport of the PE-RT pipes from the factory gate to the site of assembly is represented through generic background data. The transport distances are based on average transport distances data provided by the manufacturer.
Module A5: Installation can be carried out using standard electrical tools. An electricity consumption of 0.062 kWh is assumed for the installation of 1 kg of PE-RT pipe. Incineration is assumed for packaging material in this module.
Modules B1-B7: Not declared.
Modules C1-C4: The modeling of the end-of-life phase includes dismantling of the installed pipe using electrical tools (module C1), transport to waste treatment or landfill (module C2), waste treatment in the form of recycling (module C3) respectively thermal recovery (module C3/1) or landfill (module C4).
Module D: This module describes potential impacts and benefits from energy recovery. In the EoL base scenario and scenario 1, effects arise from the recovery of energy during waste incineration. In the EoL base scenario, advantages from the reuse of secondary materials are also taken into account.

For the environmental impact, the use of green electricity was calculated taking into account the residual electricity mix for the remaining electricity. The proportion of the electricity demand for the production of the pipes covered by green electricity in the total electricity demand is 53.3%. A certificate for the proportion of green electricity used, with a corresponding note on its origin, can be found as an appendix to this EPD. The energy requirements for manufacturing (modules A1-A3) result in a **total GWP of 0.436 kg CO2-eq./kWh**.

3.3 Estimates and assumptions

In addition to transport to the production facility, return transport over the same distance was assumed for reusable packaging. Statistical background data from Ecoinvent "Background data for transport," 2019 was used for the transportation of product packaging materials to the production site, non-plastic waste for recycling and the product to the construction site.
EVOH production was estimated based on polyvinyl alcohol and LLD-PE production.
The production of the bonding agent was approximated by the production of LLD-PE and maleic anhydride, as well as heat input.

3.4 Cut-off criteria

The production of reusable packaging was neglected. Due to their low mass (<0.005%), the proportions of polyethylene bags used as raw material packaging for colour masterbatch/LLDPE and aluminium inliners in the octabins were assumed to be negligible.
Due to their low proportion of <0.01% of the total mass, the inorganic pigments and stabilisers in the colour masterbatch were simplified and approximated as TiO_2.

3.5 Background data

The LCA model underlying this EPD was created in *LCA for Experts* developed by Sphera. The *Managed LCA content* database from Sphera was used.

3.6 Data quality

The data collected by HPG PLASTICS for the production year 2024 was used to model pipe production. All relevant information and data for modeling the pipes are available. The life cycle inventory for the PE-RT pipes is therefore based on an internal assessment of manufacturing and environmental data, assessment of LCA-relevant data for the supply chain and energy measurement within the factors. The data quality complies with EN 15941:2024 in terms of temporal, geographical, and technical representativeness and has also been assessed for plausibility, completeness, consistency, and data sources.
The quality of the background data used can be assessed as good to very good. The background data used is not older than 4 years. Datasets from Sphera's MLC database are assumed to have a high quality.

3.7 Period under review

The production data refers to the average of the year 2024.

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: EU-27 Member States

3.9 Allocation

No co-product allocation is necessary for the foreground processes, as no co-products are generated during the production (modules A1-A3) of PE-RT pipes.
Co-products are generated in the upstream chain of energy generation and raw material production, so allocations are available in the background data sets. The same applies to downstream processes, such as incineration processes in waste recycling.
The end-of-life waste to be recycled loses its waste status when processed into regrind, as regrind has economic value. Up to and including the grinding process, the emissions and impacts are attributed to the initial product.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. The *Managed LCA content* database from Sphera was used.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product and its product packaging when it leaves the factory gate. According to the Sphera background data set, the wooden product packaging has approx. 47.7 % biogenic carbon per kg of wood. The amount of biogenic carbon in the product is 0.

Information on describing the biogenic carbon content at factory gate

Name	Value	Unit
Biogenic carbon content in product	-	kg C
Biogenic carbon content in accompanying packaging	0.021	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

The following technical scenario information serves as a basis for the declared modules. All values refer to the declared unit of 1 kg PE-RT pipe.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0.003	l/100km
Transport distance	434	km

Assembly (A5)

Name	Value	Unit
Water consumption	0.018	m^3
Electricity consumption	0.062	kWh
Material loss	0.01	kg
Output substances following waste treatment on site	0.004	kg

The amount of packaging material to be disposed of per declared unit is 0.004 kg. This does not include the reusable wooden pallet, which weighs 0.046 kg.

End of life (C1-C4)

The PE-RT pipe is uninstalled using electric tools. An energy consumption of 0.061 kWh per 0.99 kg of pipe is used for this (C1). The removed pipe is then transported 218 km for recycling (C2) respectively 77 km for waste incineration (C2/1) and landfilling (C2/2).

Name	Value	Unit
Recycling (C3)	0.99	kg
Energy recovery from waste incineration (C3/1)	0.99	kg
Landfilling (C3/2)	0.99	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Module D includes the credits of the incineration processes from module A5 (packaging waste) and C3, C3/1 at a waste incineration plant.
PE regrind obtained from deconstructed pipes leaves the product system. After regranulation, it can replace virgin material at an assumed substitution factor of 0.5 (D).

Name	Value	Unit
PE granulate (D)	0.447	kg
Electric recovery from waste incineration (D)	0.729	MJ
Thermal recovery from waste incineration (D)	1.29	MJ
Electric recovery from waste incineration (D/1)	6.69	MJ
Thermal recovery from waste incineration (D/1)	12.0	MJ
Electric recovery from waste incineration (D/2)	0.084	MJ
Thermal recovery from waste incineration (D/2)	0.150	MJ

5. LCA: Results

The results of the impact assessment refer to 1 kg of PE-RT pipe. The life cycle impact assessment method is based on *EN 15804*.
The scenarios considered include the following modules:
Base scenario - Recycling/material recovery (modules C3, C4, D)
Scenario 1 - Thermal recovery (modules C3/1, C4/1, D/1)
Scenario 2 – Landfill (Modules C3/2, C4/2, D/2)

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	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	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 kg PE-RT pipe

Parameter	Unit	A1-A3	A4	A5	C1	C2	C2/1	C2/2	C3	C3/1	C3/2	C4	C4/1	C4/2	D	D/1	D/2
GWP-total	kg CO_2 eq	2.5E+00	4.18E-02	1.09E-01	4.83E-02	1.98E-02	6.99E-03	6.99E-03	2.69E-01	3.1E+00	0	0	0	3E-02	-9.5E-01	-1.41E+00	-1.77E-02
GWP-fossil	kg CO_2 eq	2.48E+00	4.13E-02	9.77E-02	4.83E-02	1.95E-02	6.9E-03	6.9E-03	2.69E-01	3.1E+00	0	0	0	2.99E-02	-9.44E-01	-1.4E+00	-1.76E-02
GWP-biogenic	kg CO_2 eq	1.51E-02	7.72E-05	1.16E-02	1.03E-05	3.66E-05	1.29E-05	1.29E-05	4.66E-05	9.32E-05	0	0	0	0	-5.04E-03	-7.12E-03	-8.94E-05
GWP-luluc	kg CO_2 eq	1.65E-03	4.34E-04	3.78E-05	3.5E-06	2.06E-04	7.26E-05	7.26E-05	1.21E-05	2.62E-05	0	0	0	8.19E-05	-7.38E-04	-1.89E-03	-2.37E-05
ODP	kg CFC11 eq	1.9E-11	7E-15	2.74E-13	1.97E-13	3.31E-15	1.17E-15	1.17E-15	4.74E-13	1.73E-13	0	0	0	1.02E-13	-4.67E-12	-1.29E-11	-1.62E-13
AP	mol H^+ eq	3.89E-03	7.04E-05	9.66E-05	6.54E-05	3.33E-05	1.18E-05	1.18E-05	1.71E-04	3.12E-04	0	0	0	1.78E-04	-2.31E-03	-1.63E-03	-2.05E-05
EP-freshwater	kg P eq	4.48E-06	1.14E-07	1.13E-05	2.52E-09	5.38E-08	1.9E-08	1.9E-08	2.47E-08	2.11E-08	0	0	0	1.67E-05	-1.56E-06	-1.26E-06	-1.58E-08
EP-marine	kg N eq	9.85E-04	2.92E-05	6.88E-05	1.73E-05	1.38E-05	4.89E-06	4.89E-06	4.45E-05	6.7E-05	0	0	0	3.86E-05	-6.27E-04	-4.74E-04	-5.95E-06
EP-terrestrial	mol N eq	1.06E-02	3.12E-04	2.97E-04	1.89E-04	1.48E-04	5.22E-05	5.22E-05	5.21E-04	1.48E-03	0	0	0	4.21E-04	-6.78E-03	-5.29E-03	-6.64E-05
POCP	kg NMVOC eq	4.55E-03	6.36E-05	7.32E-05	4.92E-05	3.01E-05	1.06E-05	1.06E-05	1.26E-04	1.99E-04	0	0	0	1.22E-04	-2.63E-03	-1.29E-03	-1.62E-05
ADPE	kg Sb eq	3.09E-07	2.8E-09	2.15E-09	1.37E-09	1.33E-09	4.69E-10	4.69E-10	3.36E-09	1.95E-09	0	0	0	2.03E-09	-1.06E-07	-1.36E-07	-1.71E-09
ADPF	MJ	7.62E+01	5.4E-01	7.31E-01	5.97E-01	2.56E-01	9.04E-02	9.04E-02	1.43E+00	3.64E-01	0	0	0	4.95E-01	-3.53E+01	-2.47E+01	-3.1E-01
WDP	m^3 world eq deprived	7.84E-02	1.93E-04	1.07E-02	3.21E-03	9.13E-05	3.23E-05	3.23E-05	8.57E-02	2.86E-01	0	0	0	3.68E-03	-1.78E-01	-1.4E-01	-1.76E-03

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 kg PE-RT pipe

Parameter	Unit	A1-A3	A4	A5	C1	C2	C2/1	C2/2	C3	C3/1	C3/2	C4	C4/1	C4/2	D	D/1	D/2
PERE	MJ	7.86E+00	4.07E-02	9.9E-02	3.56E-02	1.93E-02	6.81E-03	6.81E-03	8.95E-02	9.99E-02	0	0	0	8.26E-02	-2.91E+00	-7.87E+00	-9.88E-02
PERM	MJ	1.87E-02	0	-1.87E-02	0	0	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	7.88E+00	4.07E-02	8.03E-02	3.56E-02	1.93E-02	6.81E-03	6.81E-03	8.95E-02	9.99E-02	0	0	0	8.26E-02	-2.91E+00	-7.87E+00	-1.67E-10
PENRE	MJ	7.65E+01	5.4E-01	1.25E+00	5.97E-01	2.56E-01	9.04E-02	9.04E-02	3.56E+00	4.3E+01	0	0	0	4.95E-01	-3.53E+01	-2.47E+01	-3.1E-01
PENRM	MJ	4.36E+01	0	-5.22E-01	0	0	0	0	-4.49E+01	-4.27E+01	0	0	0	0	0	0	0
PENRT	MJ	1.2E+02	5.4E-01	7.31E-01	5.97E-01	2.56E-01	9.04E-02	9.04E-02	-4.14E+01	3.64E-01	0	0	0	4.95E-01	-3.53E+01	-2.47E+01	-3.1E-01
SM	kg	2.51E-03	0	0	0	0	0	0	0	0	0	0	0	0	8.93E-01	0	0
RSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NRSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FW	m^3	1E-02	2.01E-05	2.74E-04	8.19E-05	9.53E-06	3.37E-06	3.37E-06	2.02E-03	6.7E-03	0	0	0	1.08E-04	-5.21E-03	-6.11E-03	-7.66E-05

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

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 kg PE-RT pipe

Parameter	Unit	A1-A3	A4	A5	C1	C2	C2/1	C2/2	C3	C3/1	C3/2	C4	C4/1	C4/2	D	D/1	D/2
HWD	kg	4.14E-07	2.17E-11	1.06E-10	2.15E-11	1.03E-11	3.63E-12	3.63E-12	6.15E-11	1.98E-10	0	0	0	1.11E-10	-6.37E-09	-1.52E-08	-1.91E-10
NHWD	kg	2.29E-02	7.54E-05	1.78E-02	1.88E-04	3.57E-05	1.26E-05	1.26E-05	1.48E-03	1.23E-02	0	0	0	9.86E-01	-8.93E-03	-1.22E-02	-1.53E-04
RWD	kg	3.52E-04	1.02E-06	3.86E-05	2.96E-05	4.83E-07	1.71E-07	1.71E-07	7.1E-05	2.09E-05	0	0	0	7.13E-06	-6.47E-04	-1.81E-03	-2.27E-05
CRU	kg	1.36E-01	0	4.63E-02	0	0	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	4.46E-02	0	0	0	0	0	0	9.9E-01	0	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	3.11E-03	0	8.4E-02	0	0	0	0	3.31E-01	6.61E+00	0	0	0	0	3.14E-01	0	0
EET	MJ	7.17E-03	0	1.5E-01	0	0	0	0	5.88E-01	1.18E+01	0	0	0	0	5.59E-01	0	0

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 kg PE-RT pipe

Parameter	Unit	A1-A3	A4	A5	C1	C2	C2/1	C2/2	C3	C3/1	C3/2	C4	C4/1	C4/2	D	D/1	D/2
PM	Disease incidence	4.05E-08	6.95E-10	9.22E-10	6.04E-10	3.29E-10	1.16E-10	1.16E-10	1.53E-09	1.82E-09	0	0	0	1.83E-09	-2.04E-08	-1.33E-08	-1.67E-10
IR	kBq U235 eq	3.6E-02	1.46E-04	4.13E-03	2.72E-03	6.94E-05	2.45E-05	2.45E-05	6.6E-03	3.34E-03	0	0	0	9.57E-04	-1.07E-01	-2.98E-01	-3.74E-03
ETP-fw	CTUe	4.98E+01	7.02E-01	5.57E-01	1.03E-01	3.33E-01	1.18E-01	1.18E-01	2.54E-01	1.34E-01	0	0	0	1.13E+00	-2.16E+01	-2.14E+00	-2.69E-02
HTP-c	CTUh	1.25E-09	9.47E-12	5.54E-11	2.58E-12	4.49E-12	1.58E-12	1.58E-12	7.22E-12	1.97E-11	0	0	0	1.56E-11	-4.28E-10	-2.5E-10	-3.13E-12
HTP-nc	CTUh	1.63E-08	5.3E-10	5.3E-09	9.94E-11	2.51E-10	8.86E-11	8.86E-11	2.49E-10	9.1E-11	0	0	0	2.77E-10	-6.77E-09	-4.1E-09	-5.14E-11
SQP	SQP	5.28E+00	2.39E-01	4.52E-02	4.85E-03	1.13E-01	4E-02	4E-02	1.86E-02	1.13E-01	0	0	0	7.65E-02	-1.72E+00	-4.64E+00	-5.82E-02

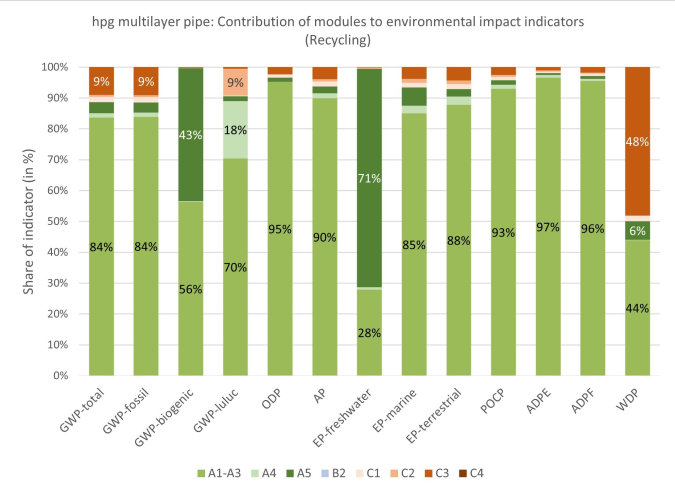
PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

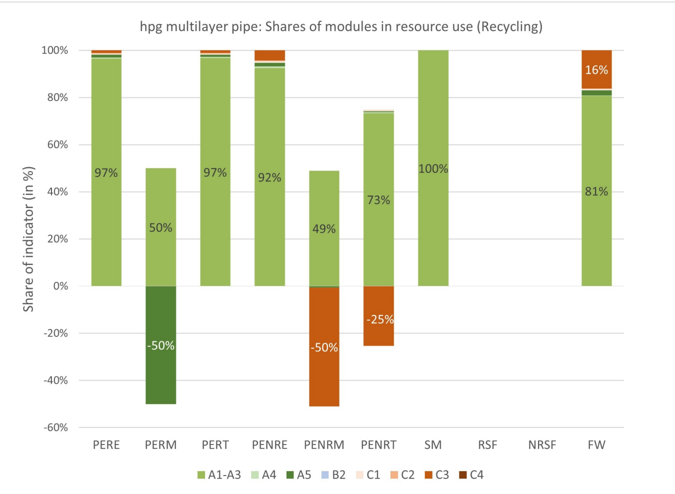
Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

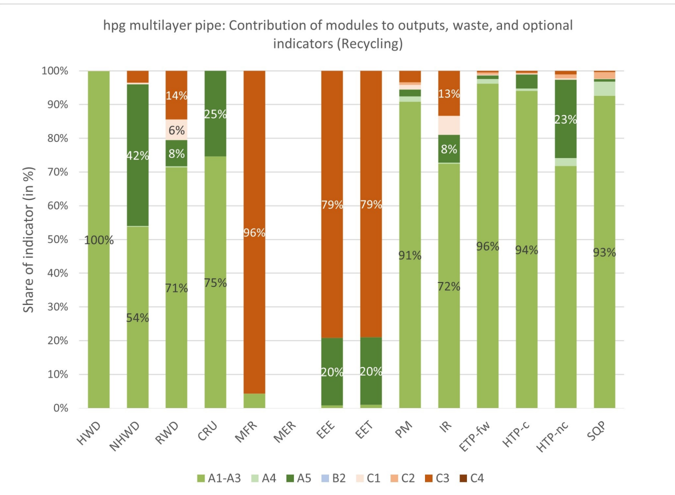
Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high as there is limited experience with the indicators.

6. LCA: Interpretation

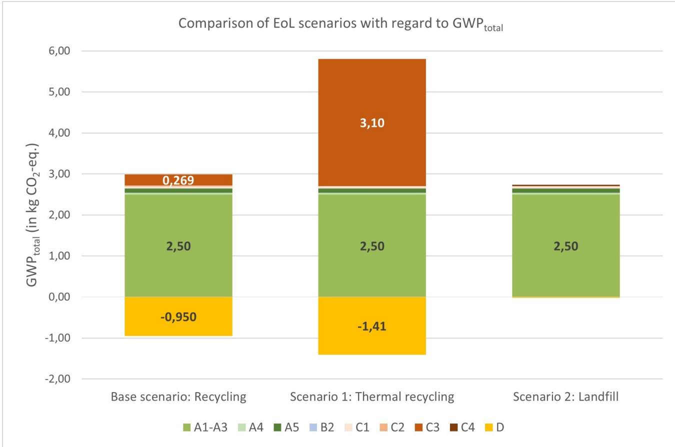
Many of the indicators on environmental impacts and resource consumption are dominated by the production phase (modules A1-A3). In the base scenario and in scenario 1, waste treatment (modules C3, C3/1) also plays a significant role in the indicators. In scenario 2, disposal (module C4/2) in particular plays a greater role for some indicators. Transportation to the construction site (Module A4) and assembly (Module A5) only play a major role for a few indicators in all scenarios.







In the base scenario and in Scenario 1, the impacts within the system boundaries can be partially compensated for by recycling potentials outside the system boundaries as well as energy recovery (Module D, D/1, not shown in the graphs). The following figure shows the life cycle assessment results for the indicator 'GWP total' (global warming potential). The graph shows the absolute values (kg CO_2-eq).



All scenarios are dominated by the production phase (modules a1-A3). The production phase is identical in all scenarios.
In the base scenario (100 % mechanical recycling), the influence of module C3 on "GWP total" is low. The effects within the system boundaries can be partially offset by recovery potentials outside the system boundaries (Module D).
In scenario 1, waste treatment in the form of product incineration plays a major role. This also results in higher energy recoveries for module D.
In scenario 3 (100% landfill), the influence of module C3 disappears completely. Instead, disposal (module C4) plays a limited role.
A sensitivity analysis was performed on the main indicators for modules A1-A3 with regard to the influence of pipe size. The compositions of the smallest (8 x 1 mm) and largest dimensions (32 x 3 mm) were compared with the balanced average product, in each case based on the declared unit of 1 kg of pipe. Apart from water consumption (WDP), the deviations for all indicators do not exceed 4%. For the WDP indicator, the deviation from the declared product is a maximum of 13%. Due to these minor differences in the impact assessments, the calculated average composition can be considered representative of all pipes considered.

7. Requisite evidence

The PE-RT pipes included in this EPD meet the requirements of standard *EN ISO 22391*, and corresponding certificates are available from HPG PLASTICS upon request.

8. References

Standards

EN 15804
EN 15804:2012+A2:2019+AC:2021, Nachhaltigkeit von Bauwerken – Umweltproduktdeklarationen – Grundregeln für die Produktkategorie Bauprodukte.

ISO 14025
EN ISO 14025:2011, Umweltkennzeichnungen und -deklarationen – Typ III Umweltdeklarationen – Grundsätze und Verfahren.

EN ISO 22391
DIN EN ISO 22391-2:2021-03, Kunststoff-Rohrleitungssysteme für die Warm- und Kaltwasserinstallation - Polyethylen erhöhter Temperaturbeständigkeit (PE-RT) - Teil 2: Rohre

ISO 24033
ISO 24033:2025, Polyethylene of raised temperature resistance (PE-RT) pipes — Effect of time and temperature on the expected strength

ISO 17455
ISO 17455:2005, Plastics piping systems — Multilayer pipes — Determination of the oxygen permeability of the barrier pipe

ISO 10508
ISO 10508:2006, Plastics piping systems for hot and cold water installations — Guidance for classification and design

ISO 15686
ISO 15686-1:2011, Buildings and constructed assets — Service life planning — Part 1: General principles and framework

ISO 14001
ISO 14001:2015, Environmental management systems — Requirements with guidance for use

ISO 45001
ISO 45001:2018, Occupational health and safety management systems — Requirements with guidance for use

DIN EN ISO 21003
DIN EN ISO 21003-3:2022-05, Multilayer piping systems for hot and cold water installations inside buildings – Part 3: Fittings (ISO 21003-3:2008 + Amd 1:2021)

DIN 4726
DIN 4726:2024-12, Warmwasser-Flächenheizungen und Heizkörperanbindungen – Kunststoff- und Verbundrohrleitungssysteme

DIN EN 1264
DIN EN 1264, Raumflächenintegrierte Heiz- und Kühlsysteme mit Wasserdurchströmung (Water based surface embedded heating and cooling systems)

EN 13501
EN 13501-1:2018, Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire Tests

EN ISO 1264
EN ISO 1264-4:2021-08, Water based surface embedded heating and cooling systems – Part 4: Installation

DIN 4102
DIN 4102, Brandverhalten von Baustoffen und Bauteilen

BRL 5602
BRL 5602, Plastics piping systems of PE-RT intended for floor heating (2016-10-25), KIWA

BRL 5607
BRL 5607, Plastics piping systems of PE-RT intended for heating installations: radiator connections (2022-02-01), KIWA

HR 3.16
HR 3.16, Heating Pipes made of Polyethylene of Raised Temperature Resistance PE-RT Type I and Type II, Prüfnorm SKZ HR 3.16

Further literature

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Institut Bauen und Umwelt e.V.: Allgemeine Anleitung für das EPD-Programm des Institut Bauen und Umwelt e.V., Version 2.1, Berlin: Institut Bauen und Umwelt e.V., 2022, http://www.ibu-epd.com

PCR Part A
Institut Bauen und Umwelt e.V.: Produktkategorieregeln für gebäudebezogene Produkte und Dienstleistungen. Teil A: Rechenregeln für die Ökobilanz und Anforderungen an den Projektbericht nach EN15804+A2:2019, Version 1.4, 2024

PCR Part B
Institut Bauen und Umwelt e.V.: PCR Guidance-Texts for Building-Related Products and Services. Part B: Requirements on the EPD for Plastic pipe systems for hot and cold water installation in the building, Version 1, 01.08.2024

European Waste Catalog
Regulation on the European Waste Catalog (Abfallverzeichnis-Verordnung - AVV), 10.12.2001

ETA Nr. 16/0033
ETA Nr. 16/0033, Kunststoffrohr-Bausätze für Heizungsanlagen, hergestellt aus PE-RT Typ 0 oder PE-RT Typ I oder PE-RT Typ II mit einer Sauerstoffsperrschicht, 09.01.2024

SVHC
'Candidate list of substances of very high concern for authorization' (SVHC), https://www.echa.europa.eu/de/candidate-list-table, abgerufen am 26.02.2026

Going Green Program
Huliot Group, "Going Green Program", https://www.huliot.de/drives_us/umwelt-nachhaltigkeit/, abgerufen am 26.02.2026

Title of the software/database

Database
Managed LCA Content, Version 2025.1. Chicago (USA): Sphera Solutions, Inc. (Last access 30.01.2026).

Software
LCA for Experts, Version 10.9.1.19. Chicago (USA): Sphera Solutions, Inc. (Last access 30.01.2026).

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