ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804

AquaPlus PRINS
Pre insulated System

EPD registration number:	S-P-03735
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ENVIRONMENTAL PRODUCT DECLARATION DETAILS

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PCR Information		
CEN standard EN 15804+A1:2013 serves as the Core Product Category Rules (PCR)		
Product category rules (PCR):	PCR 2012:01, Version 2.34 "Construction Products and Construction Services" UN CPC Ver.2 code 36230 "Tubes, pipes and hoses, and fittings therefore, of plastics"	
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Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification		
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INTERPLAST manufactures plastic pipes and fittings to the very highest specifications, for use in water supply, heating and sewerage systems and covering a broad range of applications in the areas of house construction, technical projects and industrial facilities. The company aims to design, develop and market products and integrated solutions that cover the needs of modern construction and improve quality of life, by building a relationship of trust between the technical world and the consumer public.		
Product-related or management system-related certifications:	• TUV Germany for the Quality Management System DIN EN ISO 9001: 2015. ELOT EN ISO14001:2015 and ELOT EN ISO50001:2018 by IQNET • EVETAM Greece for the physical and mechanical properties of pipes PE-X, PERT, PP-H, PVC, PP-R and PP-RCT with or without Glass fibres. It involves sizing of pipes and fittings, measuring the degree of networking for PEX pipes, microscopic homogenisation check, impact tests, testing under pressure at various temperatures and checking linear expansion. • SKZ Germany for physical and mechanical properties of pipes PE-X, PE-RT, PP- H and PP-R. Moreover, sewer pipes PP-H feature fireproofing certificate. It involves sizing of pipes and fittings, measuring the degree of networking for PEX pipes, microscopic homogenisation check, impact tests, testing under pressure at various temperatures and checking linear expansion. • SKZ Germany for physical and mechanical properties of PP-R accessories. • AENOR Spain for physical and mechanical properties of PPR pipes and fittings firefighter. • CSA Canada for physical and mechanical properties of pipes PE-X, as for the suitability for drinking water. • GOST Russia for physical and mechanical properties of pipes PE-X, PP-R, PP-R with aluminum and brass fittings, and for suitability for drinking water • SEPRO Ukraine the physical and mechanical properties of pipes PE-X, PP-R, PP-R with aluminum, PP-H and brass components. • ZIK Croatia the physical and mechanical properties of pipes PE-X, PP-R, PP-R aluminum, as for the suitability for drinking water. • MPA-NRW Germany for oxygen permeability of Como-Pex pipes and Como-Floor Oxygen Barrier. • WRAS-NSF Great Britain for suitability of pipes PE, PEX and PP-R in drinking water. • KIWA Nederland for determination of the oxygen permeability of PP-R and PERT pipes.	

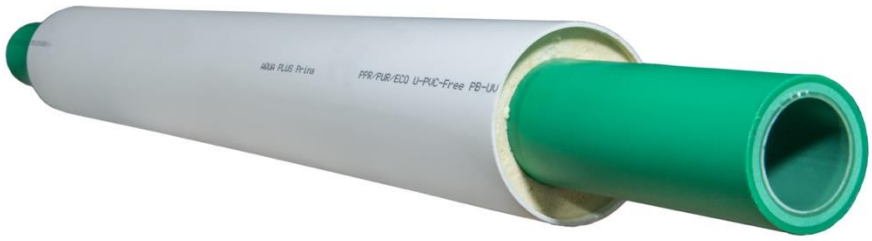
The EPD owner has the sole ownership, liability, and responsibility for the EPD.

PRODUCT INFORMATION

Product Name and Description

The INTERPLAST product declared in this EPD is the “AQUA Plus Prins” pre insulated PP-R system, which improves the AQUA Plus system (PP-R pipe), by manufacturing pre-insulated piping solutions for plumbing networks. The new system, designed for indoor, outdoor and underground installations, offers certified energy savings, durability over time, remaining unaffected by the mechanical loads, unaffected by the humidity and the sun radiation (UV). The new system exceeds the conventional insulation requirements and offers smaller linear expansion. The analyzed product system includes:

- AQUA Plus inner pipe.
- Insulation of hard closed-cell polyurethane.
- High quality U-PVC & HDPE pipe.



The strict specifications followed by INTERPLAST in the production of pipes and fittings are certified in company owned laboratories, with tests laid down by European norms EN ISO 15874, 15875, 4427, ISO 15876 and German DIN 8077, 8078, 16892, 16893, 8075, 16833, 17081 so, 16968, 1988 and 16962, Spanish UNE EN ISO and the United States ASTM standards.

Some of the proven advantages of AQUA Plus Prins include:

- Polyurethane density greater than 60 kg /m^3, according to EN 253.
- No liquefaction and air trapping effects, due to universal filling of all surfaces.
- Use of high quality U-PVC & HDPE pipe, free of lead, with stabilization to sunlight (UV protection), self-extinguishing and smoke suppressant, categorized in B1 specifications.
- Lower linear expansions from copper (α=0,016 mm/m/C).
- Lower linear thermal expansion by 40% compared to PP-R reinforced with fiberglass pipe.
- Use of polyurethane as insulation (λ=0,021 W/mK), thus reducing thermal losses and increasing energy savings by 41-58% compared to an insulation with standard properties (λ=0,04 W/mK).
- No maintenance required; stable λ (lamda) over the years; long lifetime; use of waterproof material; unaffected by insects, rodents and weather conditions.

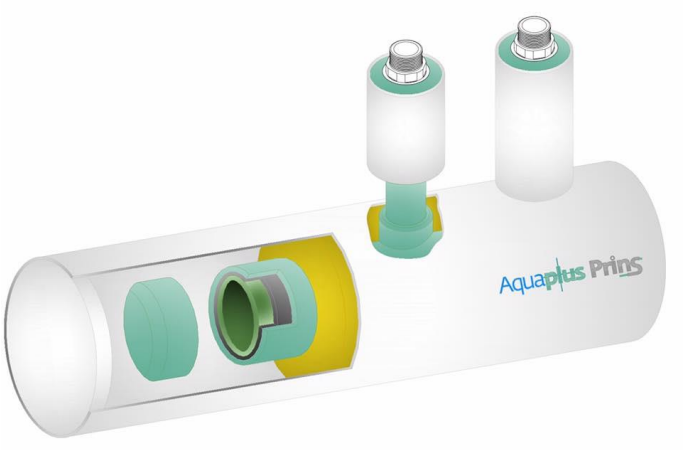
LCA INFORMATION

This EPD outlines the various environmental aspects which accompany the AQUA Plus Prins PP-R system of INTERPLAST, from the primary extraction of raw materials up to the manufacturing of the final product. Due to the scope of the LCA (cradle- to-gate), reference service life is not applicable in the study.

Declared Unit

With a cradle-to-gate system boundary and in accordance to the guiding PCR the declared unit being evaluated, is:

1m of piping system with a 25 mm inner pipe diameter



The reference flow of the declared unit is 1.24 kg per 1 m length of AQUA Plus Prins PP-R system. Please note that EPDs of construction products may not be comparable if they do not comply with the CEN TC 350 (EN15804 and EN15942) standards.

Database and LCA software used

The LCA model was created using the **SimaPro 9.3** Software system for life cycle engineering, developed by PRé Sustainability. The **EcoInvent** database (v3.8) provides the life cycle inventory data for all the raw and process materials obtained from the background system. This LCA database was compiled in November 2021, while the date of all background data used lies between 2012 and 2021.

System Boundaries

Boundary for the LCA has been set accordingly to the PCR requirements, in a **cradle-to-gate** approach, thus only Modules A1-A3 have been considered. According to the EN 15804+A1:2013 standard on the sustainability of construction works, these modules are: Raw Material Production, inbound Transport, and Manufacturing, which are categorized as A1, A2, and A3, respectively. Transport to the construction site and impacts from installation, use, and end-of-life are excluded due to lack of available data and wide variation in these phases globally. Thus, life cycle modules A4 and after are excluded from the study. The product does not contain materials or substances that can adversely affect human health and the environment in all stages of the life cycle.

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	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	MNA*		MNA							MNA				MNA

(*) MNA: Module(s) Not Assessed

A1. Raw materials Production

This first module includes the extraction and production of all raw materials required for the manufacturing process and the energy and resource consumption involved on those stages upstream and during the manufacturing process. Specifically, it includes the production of the materials used in the INTERPLAST-produced pipes, as well as other additives used in small quantities. It also includes all processes, electric consumption and materials needed for the manufacturing of pipes and other components at INTERPLAST facility. The module also includes raw materials supplied by external partners (such as insulation) and their manufacturing processes that take place in the relevant supply chain.

A2. Transport

Transport of raw materials and externally supplied components to the production facility of INTERPLAST has been modelled under this module, taking into account the location of the suppliers and average transportation units from EcoInvent database.
Transportation for raw materials takes place by road.

A3. Manufacturing

This module includes the assembly of all components in the final AQUA Plus Prins system.

Time & Geographical coverage and Data Quality

Annual data from 2021 were collected for the pipe manufacturing facilities in Komotini, Greece, and used in the LCA calculations. Regarding the AQUA Plus pipe (the inner pipe in the system), data from the corresponding EPD will be used (see table below). Background data (mainly raw materials, chemicals and fuels) were obtained from the Ecoinvent database, while the electricity data were collected by the Hellenic Electricity Distribution Network Operator (IPTO or ADMIE) for 2021.

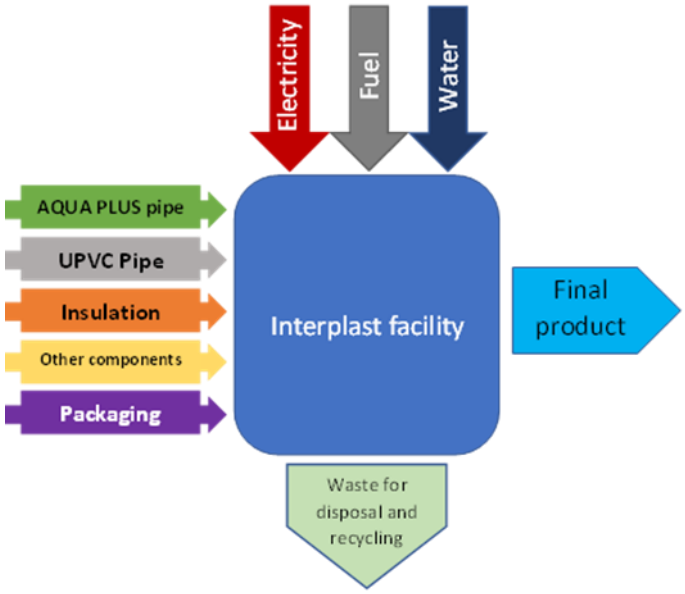
Inner Pipe of AQUA Plus Prins	Product declared	Declaration number	EPD owner	EPD program operator	Valid until
AquaPlus 25mm PP-R Pipe	PP-R Pipe	EPD S-P-02120	INTERPLAST S.A.	The International EPD® System	7/8/2025

The data represent the technology used at the pipe manufacturing plant. The INTERPLAST data used, refers to the production line of the specific product, thus there is no need for multi-output allocation estimations. In this study, site-specific data representative of the technology used in Greece in the reference year 2021 were collected and analysed. In cases when no primary data were available, either estimations provided by the company or calculated data were used.

Cut-off criteria

For the first Product Stage (Raw Materials Supply - A1) no cut off criteria are defined. Regarding Transport (A2), emissions related to transporting the plastic scrap to the recycling facility have been omitted. This impact of transporting the scrap PVC was not considered, due to its minimal contribution (less than 0.2% of the total t*km required – as calculated from tables 3-5 and 3-6). For Manufacturing (A3), all available energy and material flow data occurring at INTERPLAST facilities for the assembly of Aqua Plus Prins PPR system have been included in the model, except the insignificant consumption of the lubricants for the extrusion processes and the PP straps for packaging, since both input flows contribute less than 0.01% in terms of total mass (as seen in tables 3-4 and 3-7). All life cycle inventories have been based on EcoInvent v3.8 and corresponding cut-off criteria reported within the database apply.

System Diagram



Content Declaration

The INTERPLAST AQUA Plus Prins PP-R system includes:

- PP-R inner pipe (INTERPLAST Aqua Plus PP-R pipe)
- Polyurethane Insulation
- External PVC & HDPE pipe
- Inner pipe supporting and centering components.

No hazardous substances or listed under ECHA's SVHC list (Substances of Very High Concern) are included in the formulation of the product. The table below shows the reference flow for the declare unit.
The following tables show the total materials, resources, components and transport inputs required to meet the declared unit of 1m of piping system, 25mm inner and 63 mm external diameter

AQUA PLUS Prins PP-R system (Ø25 internal - 63mm overall diameter) - 1m length

Weight contributions (kg)		
Layers		
Inner pipe	AQUA Plus pipe 25 mm diameter	0.235 kg
Insulation	Polyurethane (PUR)	0.22 kg
External pipe	PVC pipe 63 mm diameter	0.585 kg
Inner pipe supporting components	PP-R	0.2 kg
	Total	1.24 kg

At the INTERPLAST facility, raw material is extruded for the pipes (both the inner and external), while the supporting components are also manufactured in-house. All raw materials and other components of the AQUA PLUS Prins system are transported from suppliers (A2) and delivered to INTERPLAST facility where the final product manufacturing (A3) takes place.
Plastic PVC scrap was assumed to be sold to external recyclers. Nevertheless, according to the EPD Programme guidelines, no recycling credits or burdens should be considered. The emissions of transportation of plastic scrap to the external recycler were not considered, due to its minimal transportation contribution (less than 0.2% of the total t*km required – as calculated from tables showing transportation distances). As regard the waste treatment of the excess PUR, the dataset used assumes the disposal mix for 1 kg of waste polyurethane in Greece using country-specific data.

Material composition of 1m PVC pipe Ø63 - the casing of AQUA Plus Prins Pipe System

Material	
PVC resin	0.3 kg
Pigments (White colour)	0.045 kg
EVOH (Oxygen barrier)	0.01 kg
Flame retardant	0.12 kg
$CaCO_3$	0.05 kg
PVC stabilizer	0.06 kg

Material composition of the supporting components used for 1m of Aqua plus Prins pipe Ø25

Material	
PP resin	0.2 kg

*Input and output from PVC pipe manufacturing process (Ø63 external pipe) - 1m length.*Input flow "Lubricants" not considered in calculations.*

Type	Flow	Value	Unit
Inputs	Electricity	0.32	kWh
	Natural Gas	0.0005	Nm3
	Lubricants*	0.00001	kg
	Water	0.0025	m3
Outputs	Final Product (Pipe)	0.585	kg
	Plastic Scrap for recycling (PVC)	0.05	kg

Transportation of PVC pipe raw materials to INTERPLAST facility

Flow	Location of production	Distance (km)	Transportation mode
PVC resin	France	2700	Truck (to INTERPLAST facility – Komotini)
Pigment	Greece	500	
EVOH (Oxygen barrier)	Germany	1800	
Flame Retardant	Germany	1800	
$CaCO_3$	Greece	500	
PVC Stabilizer	Greece	500	
PP resin	Austria	1500	

Transportation of externally supplied components from suppliers to INTERPLAST facility

Component	Location of production	Distance (km)	Transportation mode
Insulation	Greece	800	Truck (to INTERPLAST facility – Komotini)
Packaging – Wood pallets	Greece	10	
Packaging – PP strap	Greece	10	

*Inputs and Outputs for Aqua Plus Prins Ø25 manufacturing at INTERPLAST facility. *Input flow "Lubricants" and "PP strap" not considered in calculations.*

Type	Flow	Value	Unit
Inputs	Electricity	0.48	kWh
	Natural Gas	0.001	Nm^3
	Lubricants*	0.000015	kg
	AquaPlus 25mm PP-R Pipe	1	m
	PVC Pipe 63 mm	1	m
	Insulation (PUR)	0.27	kg
	Inner pipe supporting components	0.2	kg
	Water	0.004	m^3
	Wood pallets	0.03125	p
	PP strap*	0.0001	kg
Outputs	Final Product (Aqua Plus Prins+ Packaging)	1.87	kg
	Waste PUR	0.05	kg

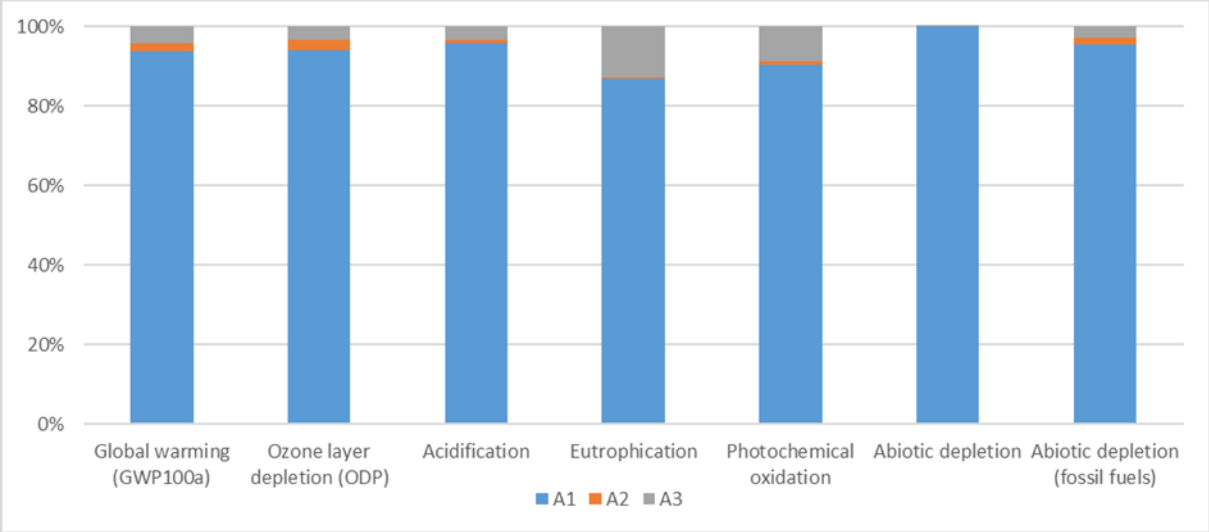
ENVIRONMENTAL PERFORMANCE

The environmental performance of the INTERPLAST AQUA PLUS Prins PP-R system will be examined for each one of the three modules mentioned before and the impact assessment categories, which are shown in the following table. The selection of impact categories conforms with the relevant PCR specifications. As also dictated by the PCR, the corresponding characterization factors used refer to the latest version of the impact assessment method adopted by EN15804+A1:2013, which is the CML-IA baseline version 3.07 (December 2021).

Impact Category	Description	EN15804+A1:2013
Global Warming (GWP_{100})	A measure of greenhouse gas emissions, such as CO2 and CH4	kg CO2 equivalent
Eutrophication	Eutrophication covers all potential impacts of excessively high levels of macronutrients, the most important of which nitrogen (N) and phosphorus (P).	kg $(PO_4)^{-3}$ equivalent
Acidification for soil and water	A measure of emissions that cause acidifying effects to the environment.	kg SO_2 equivalent
Photochemical Ozone Creation	A measure of emissions of precursors that contribute to ground level smog formation (mainly ozone O3).	kg C_2H_4 equivalent
Ozone Depletion	A measure of air emissions that contribute to the depletion of the stratospheric ozone layer.	kg CFC-11 equivalent
Depletion of abiotic resources – elements	A measure of the depletion of nonliving (abiotic) resources such as minerals and metals	kg Sb equivalent
Depletion of abiotic resources – fossil fuels	A measure of the depletion of nonliving (abiotic) resources such as fossil fuels	MJ

LCA Results

The overall cradle-to-gate results are presented broadly into three categories: Raw Material, Transport, and Manufacturing. For overall results using the EN 15804+A1:2013 life cycle modules as required by the guiding PCR, refer to the declared results in the EPD. that the impact contribution of raw materials dominates the cradle-to-gate results. The production of the PVC casing, alongside with the corresponding raw material supply chains contribute most of the impact in all categories. The PUR insulation layer has an important contribution, followed by the inner PP-R pipe. Nevertheless, the inner pipe has a considerable impact share which rises in larger product sizes. If the contribution of the PP supports is added to the aforementioned components, more than 85% of the total impact is summed for all categories. The electric consumption, the wood pellets used for packing and the truck transportation show notable, however minor contributions.



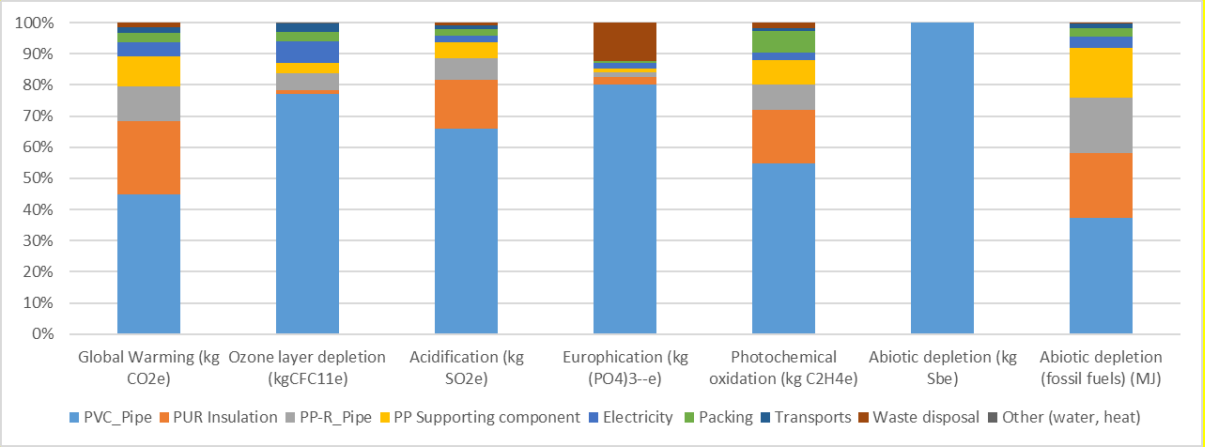
Impact contribution of life cycle stages of construction products according to EN 15804+A1:2013 standard

The absolute equivalent values of impacts are summarized in the following table.

Impact Assessment results of INTERPLAST AQUA PLUS Prins (per declared unit of 1m of piping system - Ø25mm inner pipe)

Type	Unit	Total	Raw Material (A1)	Transport (A2)	Manufacturing (A3)
Global Warming (GWP_{100})	kg CO_2 eq	5.84	5.47	0.111	0.255
Eutrophication	kg $(PO_4)^{-3}$ eq	5.34E-02	4.65E-02	7.99E-05	6.87E-03
Acidification for soil and water	kg SO_2 eq	3.63E-02	3.47E-02	3.47E-04	1.21E-03
Photochemical Ozone Creation	kg C_2H_4 eq	1.62E-03	1.46E-03	1.47E-05	1.41E-04
Ozone Depletion	kg CFC-11 eq	7.51E-07	7.06E-07	2.00E-08	2.52E-08
Depletion of abiotic resources – elements	kg Sb eq	0.136	0.136	5.10E-07	1.68E-06
Depletion of abiotic resources – fossil fuels	MJ	104	99.5	1.63	3.10

Impact contribution of flows considered for the INTERPLAST AQUA Plus Prins Ø25 (per declared unit of 1m of system)



Resource use, waste categories and output flow parameters of INTERPLAST AQUA PLUS Prins (per declared unit of 1m of piping system - Ø25mm inner pipe)

Parameter		Unit	Total	Raw Material (A1)	Transport (A2)	Manufactu-ring (A3)
Primary energy resources – Renewable	**Use as energy carrier**	MJ, net calorific value	26.6	10.1	2.82E-02	1.54E-03
	Used as raw materials	MJ, net calorific value	0	0	0	16.4
	TOTAL	MJ, net calorific value	26.6	10.1	2.82E-02	16.5
Primary energy resources – Non-renewable	**Use as energy carrier**	MJ, net calorific value	125	119	1.77	3.71
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	125	119	1.77	3.71
Secondary material		kg	0	0	0	0
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m^3	0.122	0.116	3.10E-04	5.72E-03
Hazardous waste disposed		kg	0	0	0	0
Non hazardous waste disposed		kg	5.00E-02	0	0	5.00E-02
Radioactive waste disposed		kg	0	0	0	0
Components for re use		kg	0	0	0	0
Materials for recycling		kg	5.00E-02	5.00E-02	0	0
Materials for energy recovery		kg	0	0	0	0
Exported energy		MJ per energy carrier	0	0	0	0

In order to facilitate the estimation of the corresponding impact of larger product sizes, two alternative system sizes were also assessed. The additional sizes examined refer to a medium (Aquaplus Prins 90mm diameter - 160mm outer diameter) and a large (Aquaplus Prins 315mm diameter - 450mm outer diameter) product size. The impact of in-between system pipe sizes may be estimated through interpolation, according to the inner pipe diameter.

Impact Assessment results of additional INTERPLAST AQUA Plus Prins sizes (per declared unit of 1m of system)

Type	Unit	Aquaplus Prins 25mm (63mm_out)	Aquaplus Prins 90mm (160mm_out)	Aquaplus Prins 315mm (450mm_out)
Global Warming (GWP_{100})	kg CO_2 eq	5.84	38.6	186
Eutrophication	kg $(PO_4)^{-3}$ eq	5.34E-02	0.168	1.00
Acidification for soil and water	kg SO_2 eq	3.63E-02	0.195	1.01
Photochemical Ozone Creation	kg C_2H_4 eq	1.62E-03	8.95E-03	4.47E-02
Ozone Depletion	kg CFC-11 eq	7.51E-07	2.58E-06	1.55E-05
Depletion of abiotic resources – elements	kg Sb eq	0.136	0.406	2.67
Depletion of abiotic resources – fossil fuels	MJ	104	713	3532

Interpretation of LCA Results

Raw materials used in the AQUA Plus Prins components (incorporating all manufacturing and transport processes for their production) were by far the highest impact grouping in the cradle-to-gate analysis, featuring a corresponding contribution more than 85% for all impact categories. Main contributors in all impact categories were mainly the PVC casing, followed by insulation (PUR) and the contribution of the inner PP-R pipe. Transportation of components to INTERPLAST facility and electricity required for assembly related processes for the AQUA Plus Prins were of lower significance.

It was found that the impact contribution of raw materials dominates the cradle-to-gate results. The production of the PVC casing, alongside with the corresponding raw material supply chains contribute most of the impact in all categories. The PUR insulation layer has an important contribution, followed by the inner PP-R pipe. Nevertheless, the inner pipe has a considerable impact share which rises in larger product sizes. If the contribution of the PP supports is added to the aforementioned components, more than 85% of the total impact is summed for all categories. The electric consumption, the wood pellets used for packing and the truck transportation show notable, however minor contributions. Overall, the manufacturing stage provides less than 10% of the total impact, which can be further decreased if a recycling option is adopted for the waste PUR.

Two alternative system sizes were also assessed, in order to facilitate the estimation of the corresponding impact of larger product sizes. The environmental impact values for the larger sizes show an approximate linear growth, according to the increase of the inner pipe diameter.

This study identifies the main drivers of impact for INTERPLAST; significant contributors are analyzed at the cradle-to-gate level as well as at the individual material input level. This granular level of reporting will support INTERPLAST to make environmentally informed choices about the rest components that are provided by suppliers.

REFERENCES

General Programme Instructions of the International EPD® System. Version 3.01.

PCR Construction Products and Construction Services (2012:01), version 2.34

EN 15804+A1:2013: Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

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JRC. (2010). ILCD Handbook: General guide for Life Cycle Assessment – Detailed guidance. EUR 24708 EN (1st ed.). Luxembourg: Joint Research Centre.

IPTO (ADMIE) S.A. (Hellenic Independent Power Transmission Operator S.A.) https://www.admie.gr/en/market-statistics/montlhy-energy-balance/

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