ENVIROMENTAL PROFILE OF THE PB PIPE SYSTEM FOR HOT AND COLD WATER (CRADLE-TO-GRAVE) IN ABSOLUTE FIGURES PER FUNCTIONAL UNIT

IMPACT CATEGORY	Abiotic dep. (non fossil)	Abiotic dep. (fossil)	Acidification	Eutrophication	Climate Change	Ozone depletion	Photochemical oxidation
Life cycle phases	kg Sb eq	MJ, net cal	kg SO2 eq	kg PO4 - eq	kg CO2 eq	kg CFC-11 eq	kg C2H4
PRODUCT STAGE							
Production raw materials for PB-1 pipes	4.43E-08	9.55E+00	9.41E-04	8.92E-04	2.60E-01	8.07E-09	5.23E-05
Transportation of raw materials for pipes to converter	3.31E-08	1.69E-01	4.34E-05	8.87E-06	1.06E-02	1.81E-09	1.45E-06
Extrusion PB-1 pipes	1.12E-07	1.55E+00	3.53E-04	5.46E-05	7.99E-02	4.53E-09	1.58E-05
Production raw materials for PB-1 part fittings	4.88E-09	1.05E+00	1.04E-04	9.82E-06	2.87E-02	8.89E-10	5.76E-06
Transport of raw materialsfor PB-1 part fitting to converter	2.64E-09	1.35E-02	3.47E-06	7.09E-07	8.48E-04	1.44E-10	1.16E-07
Injection mouldingPB-1 part fittings	2.68E-08	3.09E-01	8.06E-05	1.07E-05	1.72E-02	8.34E-10	3.35E-06
Production other plastic part fittings	4.36E-07	5.65E-01	1.09E-04	6.38E-05	2.57E-02	9.78E-09	3.07E-05
Production PVDF parts fittings	2.60E-07	1.82E+00	8.82E-04	5.04E-05	1.50E-01	1.35E-08	4.10E-05
Production PPSU parts fittings	4.13E-07	5.34E-01	1.03E-04	6.03E-05	2.43E-02	9.25E-09	2.90E-05
Production PA-GF parts fittings	3.12E-07	1.87E+00	5.33E-04	8.64E-05	1.22E-01	5.37E-11	2.41E-05
Production stainless steel inserts for fittings	1.42E-07	6.68E-02	2.27E-05	2.29E-06	4.08E-03	2.28E-10	1.36E-06
Production brass inserts for fittings	1.68E-05	1.23E+00	2.04E-03	8.76E-04	9.64E-02	7.38E-09	7.74E-05
Production alloy (heating wire) part fittings	3.80E-06	1.07E-01	4.69E-04	2.21E-04	7.29E-03	5.89E-10	1.75E-05
CONSTRUCTION PROCESS STAGE							
Transportation of complete PB-1 pipe system to building site	4.07E-08	2.27E-01	5.98E-05	1.18E-05	1.52E-02	2.29E-09	5.02E-06
Installation of PB-1 pipe system	1.36E-07	1.33E+00	3.01E-04	4.45E-05	1.02E-01	4.09E-09	3.51E-05
USE STAGE							
Operational use of PB-1 hot & cold system	0	0	0	0	0	0	0
Maintenance of PB-1 hot& cold system	0	0	0	0	0	0	0
END OF LIFE STAGE							
Disassembly of PB-1 pipe system	6.95E-08	2.42E-01	5.98E-05	1.20E-05	1.61E-02	2.52E-09	2.10E-06
Transport of PB-1 pipe system to EoL	-5.39E-08	-4.95E-01	-1.10E-04	-9.59E-06	4.92E-02	-1.43E-09	-5.65E-06
EoL treatment PB-1 pipe system							
Total	**2.25E-05**	**2.01E+01**	**5.99E-03**	**1.59E-03**	**1.01E+00**	**6.46E-08**	**3.36E-04**

A: contribution > 50%: most important, significant influence

B: 25% < contribution ≤ 50%: very important, relevant influence

B: 10% < contribution ≤ 25%: fairly important, some influence

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The European Plastic Pipes and Fittings Association
Channelling Performance

The European Plastic Pipes and Fittings Association (TEPPFA) is the trade association representing manufacturers and national associations of plastic pipe systems in Europe. We are actively involved in the promotion of plastic pipe systems for all applications. We want to raise awareness of the value that plastic pipe systems offer for a sustainable future.

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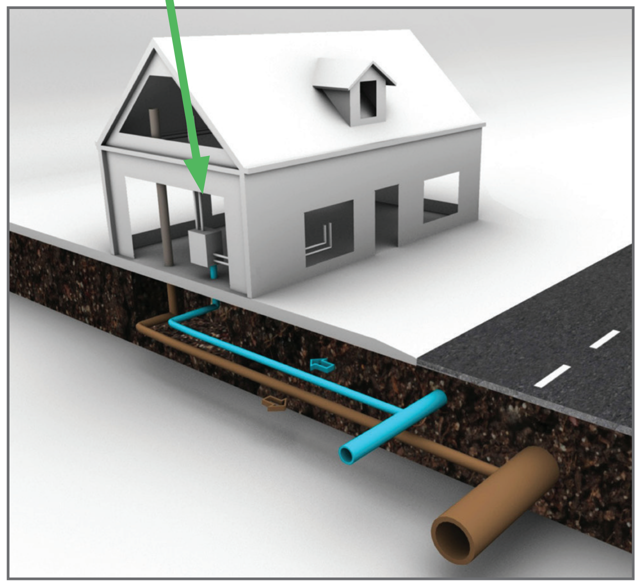
Polybutylene (PB) vs copper environmental impact comparison

An independent study following ISO 14040 and 14044 methodology by the respected Flemish institute for Technological Research (VITO), and validated by the Denkstatt sustainable development institute in Austria, is conclusive in its findings that systems made from Polybutylene for plumbing hot and cold solid wall applications have a lower environmental impact than those made from copper.

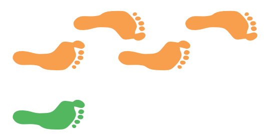
hot and cold plumbing



RELATIVE SIZE OF ENVIRONMENTAL FOOTPRINT

COPPER

POLYBUTYLENE



To make a fair comparison between these two different materials and determine the enviromental impacts of both, each stage of their lifecycle was analysed.
"Environmental footprints" can be either adverse or beneficial. Adverse effects such as omitting greenhouse gases may arise in either the product's production or disposal process; beneficial effects help to reduce greenhouse gas emissions by saving energy whilst the product is in use.

DETERMINING A PRODUCT'S ENVIRONMENTAL FOOTPRINT

A scientifically-based full Life Cycle Assessment (LCA) is the standardised method for fairly comparing the enviromental impacts of different products or services. This type of assessment involves systematically collecting and evaluating quantiative data on the inputs and outputs of material. energy and waste flows associated with a product over its entire life cycle. Therefore a whole range of processes need to be assessed to calculate overall impacts, beginning with the manufacturing of raw materials, to transforming them into products; continuing through the product's transportation and installation, the product's lifetime of use, and ultimately, the product's disposal or re-processing at the end of life.

The findings of LCA assessments are typically published in the forms of Environmental Product Declarations (EPDs) to help communicate a product's overall environmental impact.
The VITO study involved collectiong data on plastic pipe systems from companies covering more than 50% of the European market. Data for copper was based on publicly available information.

ENVIRONMENTAL IMPACT CRITERIA

The environmental impact of each pipe material was assessed against seven different criteria across its full life cycle.

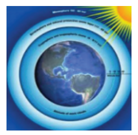
'Abiotic-depletion' non-fossil: the over-extraction of minerals and other non-living, non-renewable materials that can lead to exhaustion of natural ressource.

'Abiotic-depletion' fossil: The over-extraction of fossil fuels including all fossil resources.

'Acidification' potential: emissions, such as sulphur dioxide and nitrogen oxides, from manufacturing processes, result in acid rain which harms soil, water supplies, human and animal organisms, and the ecosystem.

'Eutrophication' potential: which arises from of the over-fertilisation of water and soil by nutrients (such as nitrogen and phosphorous). This speeds up plant growth and kills off animal life in lakes and waterways.

'Global warming' potential (its carbon footprint): the insulating effect of greenhouse gases - CO_2 and methane - in the atmosphere is a major contributor to global warming, affecting both human health and that of the ecosystem in which we live.



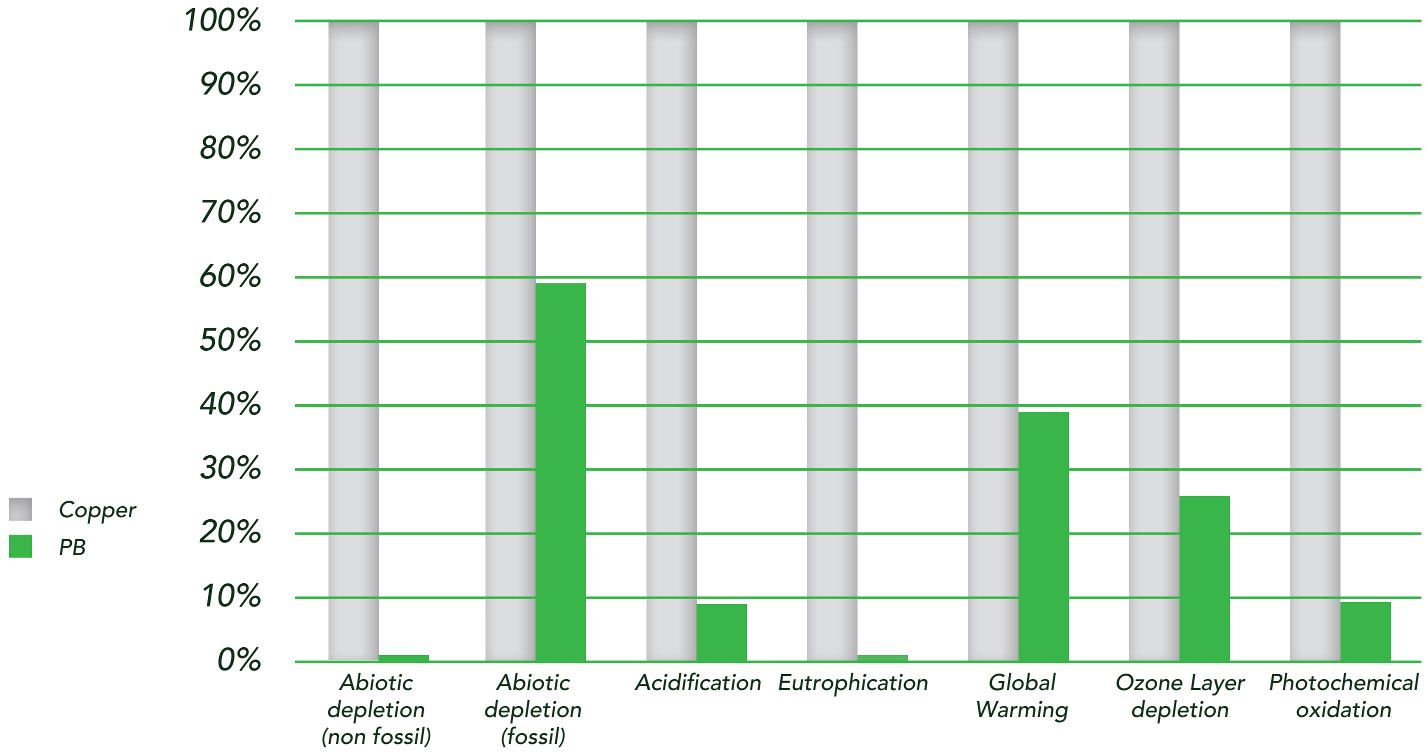
'Ozone-depletion' potential: depletion of the ozone layer in the atmosphere caused by the emission of chemical foaming and cleaning agents allows the passage of greater levels of UV from the sun, causing skin cancer and reducing crop yields.

'Photochemical-oxidation' potential: where the photochemical reaction of sunlight with primary air pollutants such as volatile organic compounds nd nitrogen oxides leads to chemical smogs that affect human health, food crops and the ecosystem in general.

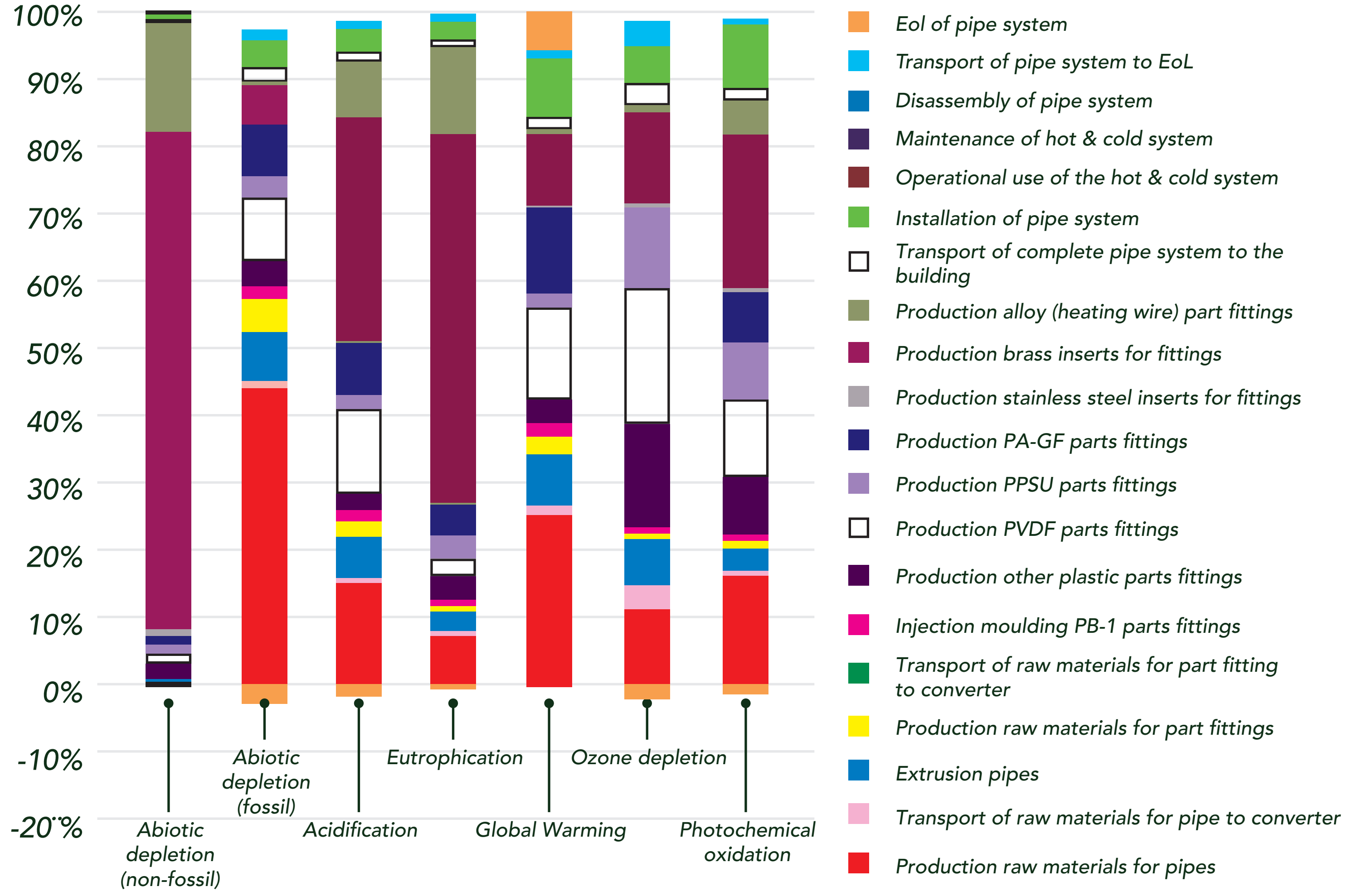
COMPARISON BASED ON IDENTICAL FUNCTIONAL UNITS

For the purpose of a direct fair comparison between alternative materials the following identical functional unit was used in the LCA study for plumbing hot and cold solid wall systems:
- The pressure supply and transport of hot and cold drinking water from entrance of an apartment of 100m² to the tap.
- a 50 year lifetime has been assumed which aligns with the normal lifetime expectancy of a building

COMPARISON OF PB TO COPPER FOR THE 6 ENVIRONMENTAL IMPACT CRITERIA



ENVIRONMENTAL PROFILE OF THE PB PIPE SYSTEM FOR HOT AND COLD WATER IN THE BUILDING FROM CRADLE-TO-GRAVE PER FUNCTIONAL UNIT



Note: Negative values shown represent energy recovery credits