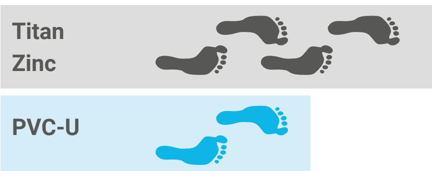
LIFE CYCLE ASSESSMENT • LEAFLET 18

PVC-U vs titan zinc environmental impact comparison

An independent study following ISO 14040 and 14044 methodology by the world-renowned Flemish Institute for Technological Research (VITO), and validated by the Denkstatt sustainable development institute in Austria, is conclusive in its findings that plastic pipe systems made from PVC-U for rain water gutter systems have a lower environmental impact than those made from titan zinc.

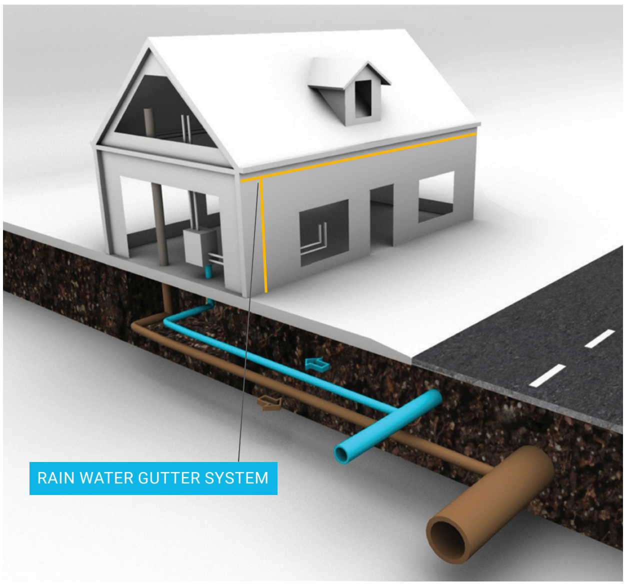
Relative size of environmental footprint

To make a fair comparison between these two different materials and determine the environmental impacts of both, each stage of their lifecycle was analysed. 'Environmental footprints' can be either adverse or beneficial. Adverse effects such as emitting 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 environmental impacts of different products or services. This type of assessment involves systematically collecting and evaluating quantitative 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 form of Environmental Product Declarations (EPDs) to help communicate a product's overall environmental impact.

The VITO study involved collecting data on plastic pipe systems from companies covering more than 50% of the European market. Data for titan zinc 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 Resources Depletion (non-fossil) ADPn: the over-extraction of minerals, fossil fuels and other non-living, non-renewable materials which can lead to exhaustion of natural resources.

Abiotic Resources Depletion (fossil) ADPf: the over-extraction of fossil fuels including all fossil resources.

Acidification Potential AD: 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 EP: increased concentrations of nitrates and phosphates can encourage excessive growth of algae and reduce oxygen levels. This increases mortality in aquatic fauna and flora, leads to loss of species dependent on low-nutrient environments, reduces biodiversity and has knock-on effects on non-aquatic animals and humans.

Global Warming Potential GWP: the insulating effect of greenhouse gases (GHG) - CO_2 and methane - in the atmosphere preventing the earth losing heat gained from the sun. As global temperature rises, it is expected to cause climatic disturbance, desertification, rising sea levels and spread of disease.

Ozone Depletion Potential ODP: depletion of the ozone layer (O_3) 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, damage to the immune system and reducing crop yields.

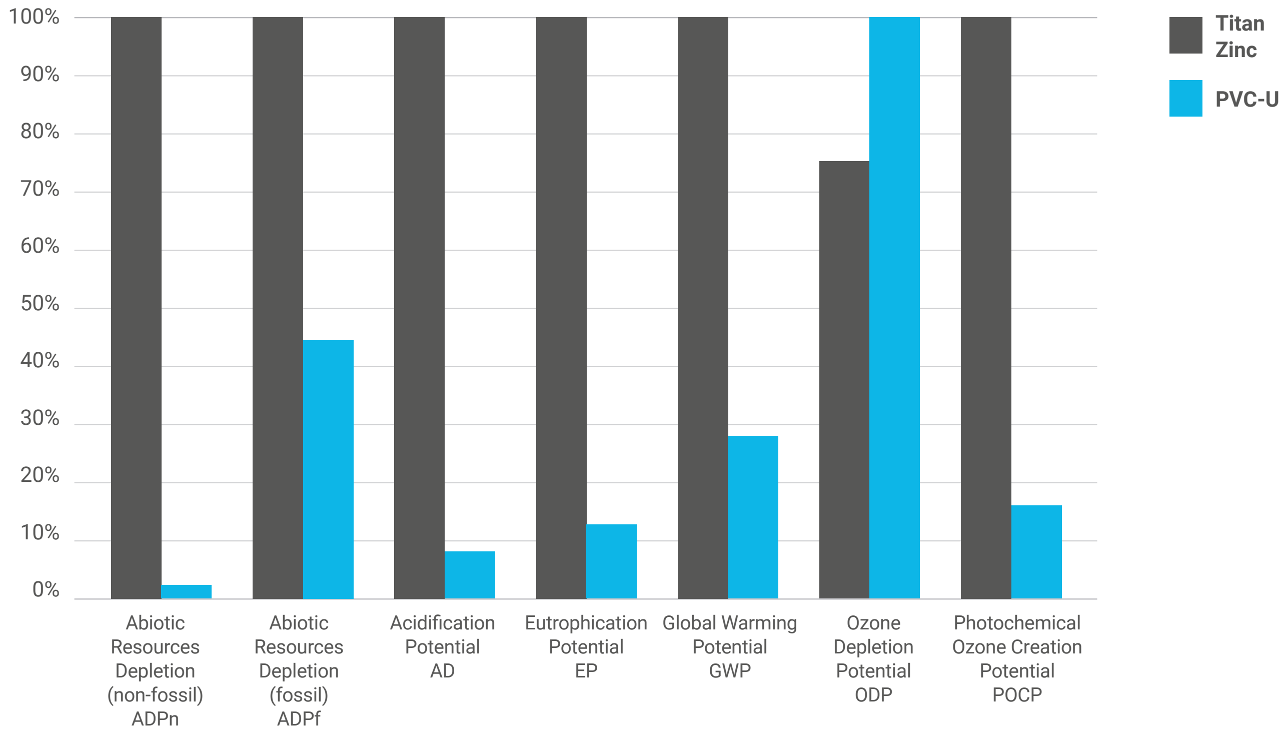
Photochemical Ozone Creation Potential POCP: creation of ozone in the presence of sunlight, nitrogen oxides and volatile organic compounds. Ozone leads to chemical smogs that affect human health, food crops and the ecosystem in general. The effects vary according to geography and climate and are especially problematic in heavily urbanised areas with existing pollution.

Comparison based on identical functional units

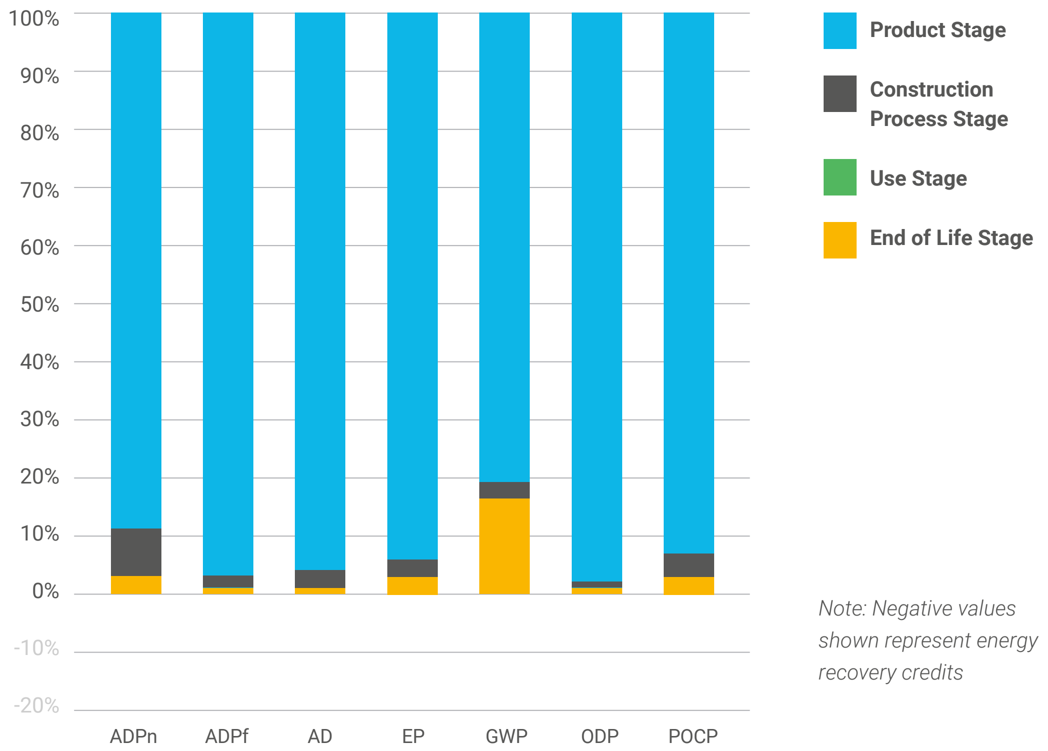
For the purpose of a direct fair comparison between alternative material the following identical functional unit was used in the LCA study for rain gutter systems:

- The collection and gravity withdrawal of rainwater from a typical gable roof of a two storey 100 m^2 family house (2 X 5 m X 10 m) by a half-round gutter system of an average 120 mm opening with two diameter 80 mm downpipes.
- A service life time of 50 years has been assumed.

Comparison of PVC-U to titan zinc of the 7 environmental impact criteria



Environmental profile of the PVC-U rain gutter system (cradle-to-grave) per functional unit



Note: Negative values shown represent energy recovery credits

Environmental profile of the PVC-U rain gutter system (cradle-to-grave) in absolute figures per functional unit

IMPACT CATEGORY	Abiotic Resources Depletion (non-fossil) ADPn	Abiotic Resources Depletion (fossil) ADPf	Acidification Potential AD	Eutrophication Potential EP	Global Warming Potential GWP	Ozone Depletion Potential ODP	Photochemical Ozone Creation Potential POCP
Life cycle phases	kg Sb eq	MJ	kg SO2 eq	kg PO4--- eq	kg CO2 eq	kg CFC-11 eq	kg C2H4 eq
Product Stage	6.39E-06	2.76E+01	3.61E-03	6.17E-04	1.24E+00	4.40E-07	3.64E-04
Construction Process Stage	5.64E-07	5.86E-01	1.23E-04	1.66E-05	5.24E-02	3.58E-09	1.74E-05
Use Stage	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
End of Life Stage	2.14E-07	1.58E-01	3.90E-05	2.28E-05	2.40E-01	4.28E-09	1.16E-05
TOTAL	**7.16E-06**	**2.83E+01**	**3.78E-03**	**6.57E-04**	**1.53E+00**	**4.48E-07**	**3.93E-04**

More detailed information about this material comparison can be obtained via www.teppfa.eu or by contacting TEPPFA at: info@teppfa.eu.

TEPPFA Environmental Product Declarations

The TEPPFA EPDs are aimed at demonstrating the value that plastic pipe systems offer for a sustainable future. We commissioned an independent study by the Flemish Institute for Technological Research (VITO) to measure the environmental footprint of various plastic pipe systems based on life-cycle assessment. The work was validated by the Denkstatt sustainability consultancy in Austria.

An important objective was to provide transparency about the impact of plastic pipe systems on our environment. It was also an important step in the development of the Environmental Product Declarations for plastic pipes.

Data for the plastic systems is provided by the TEPPFA member companies using the Life Cycle Assessment (LCA) method. Data for the non-polymer alternative materials (ductile iron, copper, concrete) is based on the publicly available figures.

Contributors to this study consist of numerous companies, institutes and associations, which among others include PlasticsEurope, TNO and PVC4Pipes. Data was collected from 60% of companies within the European pipe industry.

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The European Plastic Pipes and Fittings Association (TEPPFA) is the leading voice of plastic pipe and fittings manufacturers in Europe. Being a trade association, we are actively involved in the promotion of plastic pipe systems for all applications. Through our work, TEPPFA wants to raise awareness of the value that plastic pipe systems offer for a sustainable future.

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