

Statement of Recognition

BREG EPD No.: R00047

Issue 02

The attached

Environmental Product Declaration

provided by:

VM BUILDING SOLUTIONS

is Recognised by BRE Global as being in accordance with the requirements of:

EN 15804:2012+A1:2013

as verified and issued by: IBU

Reference number: EPD-VMZ-20180088-IBD1-EN

This declaration is for:

1 kg of textured and mattified rolled zinc - AZENGAR® from VMZINC

Company Address

Les Mercuriales – Tour du Ponant, 40 Rue Jean Jaurès, 93170 Bagnolet, France



Signed for BRE Global Ltd

Emma Baker

Operator

25 March 2024

Date of this Issue

15 November 2018

Date of First Issue

14 November 2024

Expiry Date



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EPD Verified and issued by IBU



ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804+A1

| | |
|--------------------------|--|
| Owner of the Declaration | VM Building Solutions Deutschland GmbH |
| Publisher | Institut Bauen und Umwelt e.V. (IBU) |
| Programme holder | Institut Bauen und Umwelt e.V. (IBU) |
| Declaration number | EPD-VMZ-20180088-IBD1-EN |
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VMZinc - Textured and mattified rolled zinc VM BUILDING SOLUTIONS

www.ibu-epd.com | <https://epd-online.com>



ECO PLATFORM

EPD
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1. General Information

VM BUILDING SOLUTIONS

Programme holder

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

Declaration number

EPD-VMZ-20180088-IBD1-EN

This declaration is based on the product category rules:

Building metals, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

15.11.2018

Valid to

14.11.2024



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



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

VMZinc - Textured and mattified rolled zinc

Owner of the declaration

VM Building Solutions Deutschland GmbH
Gladbecker StraBe 413
45326 ESSEN
Germany

Declared product / declared unit

1 kg of textured and mattified rolled zinc - AZENGAR® from VMZINC

Scope:

This Environmental Product Declaration in accordance with the /EN 15804/ covers the life cycle of 1 kg of textured and mattified rolled zinc – AZENGAR® manufactured in the French production plants located in Aubry and Viviez of the company VM Building Solutions. The textured and mattified rolled zinc from VMZINC covered by this EPD can be used in buildings as roof, façade or rainwater systems.

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+A1. 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 | |
| <input type="checkbox"/> | internally |
| <input checked="" type="checkbox"/> | externally |



Dr. Stefan Diederichs,
(Independent verifier)

2. Product

2.1 Product description/Product definition

The product covered by this EPD is 1 kg of textured and mattified rolled zinc –AZENGAR® in sheets or coils from VMZINC used for building envelope applications (roof, façade or rainwater systems). The textured and mattified rolled zinc from VMZINC is a copper and titanium zinc alloy in accordance with /DIN EN 988/, which has received a surface treatment. This alloy contains mainly very high purity zinc in accordance with /DIN EN 1179/ (Grade Z1: 99,995% of purity) with very few alloy components (copper, titanium and aluminum). It has optimal mechanical and physical properties for applications in construction, in particular regarding mechanical resistance and resistance against creep deformation. From an aesthetical point of view, textured and mattified rolled zinc is the lightest, most matt zinc. It is distinguished by its heterogeneous surface punctuated with asperities.

2.2 Application

The textured and mattified rolled zinc in sheets and coils is used in numerous building applications:

- Roofing,
- Facade applications,
- Flashings and coverings,
- Roof drainage systems,

2.3 Technical Data

The main constructional data is presented in the following table:

Constructional data

| Name | Value | Unit |
|----------------------------------|-------|----------------------------------|
| Coefficient of thermal expansion | 22 | 10 ⁻⁶ K ⁻¹ |
| Tensile strength | 152 | N/mm ² |
| Compressive strength | - | N/mm ² |
| Modulus of elasticity | 9000 | N/mm ² |
| Melting point | 420 | °C |
| Thermal conductivity | 110 | W/(mK) |
| Electrical conductivity at 20°C | 17 | Ω ⁻¹ m ⁻¹ |
| Density | 7200 | kg/m ³ |

Product performance values in line with the /EN 988/.

2.4 Delivery status

Textured and mattified rolled zinc AZENGAR® offer an other surface design than natural rolled zinc. It is produced by engraving and matting the natural rolled zinc (it complies with European standard /EN 988/).

Ø Dimensions Panels: 1000 x 2000 mm, 1000 x 2500, 1000 x 3000 mm;

Ø Coils with following blanks: 200 mm / 250 mm / 280 mm / 333 mm / 400 mm / 500 mm / 600 mm / 670 mm / 1000 mm

Ø Thickness [mm]: 0.5 mm to 1.5 mm

Ø Weight: 3.6 kg/m² (t=0.5 mm) to 10.8 kg/m² (t=1.5mm)

2.5 Base materials/Ancillary materials

Composition of textured and mattified (Azengar)

| Name | Value | Unit |
|---|--------------|------|
| Copper | 0.08 to 0.2 | % |
| Primary zinc (very high purity zinc of 99.995% with limited lead and cadmium contents: grade Z1 according to /DIN EN 1179/) | > 99.835 | % |
| Titanium | 0.07 to 0.12 | % |
| Aluminium | < 0.015 | % |

2.6 Manufacture

The manufacturing of the textured and mattified rolled VMZINC (AZENGAR) takes place in 7 stages:

1. Pre-alloying: An alloy comprising copper, titanium and aluminium is prepared at 650°C in an alloy furnace. This master alloy is put in a second smelting furnace with the refined zinc.

2. Smelting: Refined zinc cathodes and ingots are smelted in the first induction furnace at 500°C and then are put in a second smelting furnace with the master alloy. The finished alloy is fed into the casting furnace. This loads the continuous casting machine at 500°C.

3. Casting and cooling: The molten metal is transferred into a continuous casting machine to harden there into the form of an approx. 12-millimetre-thick and one-meter wide continuous cast strand. The controlled cooling process in the system guarantees a fine, homogenous grain size.

4. Rolling: The cast strand is rolled into the desired thickness in three to five rolling operations. In the course of this process the temperature, rolling speed and degree of reduction are constantly monitored and adapted to achieve the desired mechanical properties and dimensions.

5. Engraving: This step is performed on Aubry (North) site. It aims to provide aesthetic differentiation by texturing the surface of the rolled zinc.

6. Matting: This stage is carried out on the site of Vivez (Aveyron); it aims to mattified the texture obtained during the engraving step.

7. Stretching and cutting: The final stages include stretching and cutting the rolled zinc into sheets and coils into the desired dimensions and weights.

The production plant of Vivez and Aubry are certified /ISO 9001/ (Quality management control).

2.7 Environment and health during manufacturing

All production sites for VM Building Solution construction products are certified in accordance with /ISO 14001/.

2.8 Product processing/Installation

General principles:

Rolled zinc from VMZINC® must be stored in a dry and ventilated place. This also applies to building site storage as well as for parts stored temporarily at the installation site. Coils are to be stored on pallets, so that moisture cannot penetrate into them (later water stains). Transport may only be carried out by enclosed vehicles. If the surfaces of natural rolled VMZINC are covered with films, make sure that the surfaces are well

ventilated. Wet covering films may not come into direct contact with the titanium zinc surfaces to be covered. Rolled zinc from VMZINC which is wet from water may also not be directly covered.

The material is to be processed without tension.

Take into account the expansion coefficient for the installation of the product.

If for compelling reason the rolled zinc from VMZINC work is carried out during the cold time of year, special measures are required with folding which incur additional costs. This must be in accordance with the construction management. With metal temperatures below 10°C and rapid deformation, whole batches have to be warmed up to prevent cracks forming. This particularly applies to connections, for example crimp folds and 180° handling.

Assembly of the rolled zinc from VMZINC with other metals:

Electrolytic corrosion can occur when assembling together with different metals if metal (-part) of the higher potential is arranged above it in the water's flow direction.

With the presence of damp or moisture, damage can occur if the VMZINC system comes into contact with copper or unprotected (no galvanized) steel due to an electrochemical reaction. The direct proximate assembly of copper and rolled zinc from VMZINC components is always to be avoided.

Assembly of rolled zinc from VMZINC with other building materials:

If VMZINC systems are to come into contact with precipitation water from unprotected bituminous roofing, these should be provided with protective coatings, as otherwise you can reckon with so-called "bitumen corrosion".

Detailed processing information as for example types of fixings, deformation and joining techniques can be found in the corresponding information material from VM Building Solutions.

Industrial safety, health and environmental protection measures:

With the processing/installation of VMZINC® products no other health protection measures are required beyond the usual industrial safety measures (like e.g. protective gloves). No significant environmental pollution is triggered by the processing/assembly of the named products. No special measures need to be taken to protect the environment.

Residual materials and packaging:

Any VMZINC® residual materials and packaging on the building site must be collected separately.

Rolled zinc products are 100% recyclable. In Europe there is an extensive network which takes back zinc waste from building sites and recycles this for a huge variety of applications.

2.9 Packaging

The packaging materials used are wooden pallets (transport), cardboard and plastics (films and wires).

All packaging can be recycled if the wastes generated in the building site are well managed.

The /waste keys/ for the main packaging are:

-corrugated board - 15 01 01,

-wood pallets - 15 01 03.

2.10 Condition of use

The behaviour of textured mattified rolled zinc exposed to the atmosphere is the same than those of natural rolled zinc: a protective layer called patina occurs naturally. This protective layer ensures absolutely maintenance free of the surfaces of the rolled zinc from VMZINC and is responsible for the rolled zinc from VMZINC's high resistance to corrosion.

In the first stage zinc oxide is formed on the zinc surface. Zinc hydroxide then forms under the influence of moisture (rain). Under the influence of CO₂ from the atmosphere basic zinc carbonate is then formed, which is then the dense, adhesive and water-insoluble protective layer. This very dense and if injured, "self-healing" layer gives lifetime protection and keeps natural wear very low.

2.11 Environment and health during use

Environment

Generally, zinc runoff coming from rolled zinc applications used in building does not create a risk to the environment.

Indeed, zinc is naturally present in the environment and has always been used by living organisms in their growth and development making zinc the third trace elements and the most important for human beings.

Furthermore, when zinc is released into the environment, a large amount reacts mainly by adsorption with the other components of the environment such as organic matters or oxides (we speak about speciation) leaving a small amount available to living organisms (we speak about bioavailability). Generally, in soil, more than 90% of zinc emitted binds to soil particles, leaving only 10% of the zinc available for living organisms; in water, 70% of zinc emissions are captured into sediments (1).

This scientific knowledge about zinc behaviour in the environment (speciation and bioavailability) was incorporated into the risk assessment methods used for European regulations.

In all cases, whatever the type of products used in the building, where it is proposed to evacuate rainwater directly into the environment, an environmental impact assessment must be carried out.

Parameters influencing zinc runoff from building products are:

- Sulfur dioxide - SO₂ atmospheric content (the more there is sulfur dioxide the more is zinc runoff rate).

-Chlorides - Cl²⁻ atmospheric content (the more there are chlorides, the more is the runoff rate).

-Slope of the constructive element (the more the slope is high, the less is the zinc runoff rate).

-Surface aspect of rolled zinc.

Zinc concentration into rainwaters, which have passed on building products in rolled zinc:

Corrosion and runoff mechanisms of rolled zinc used in building applications are very well documented. This knowledge allows modelling accurately zinc emissions, which may be obtained as a function of a number of parameters (atmospheric levels of sulfur dioxide and chloride, slope and orientation of the building elements and rolled zinc surface aspect).

Generally speaking, in average after 5 years of exposure under yearly precipitation of rain between 470 and 790 mm/year:

- zinc concentration of rainwater, which has passed on natural rolled zinc roof is around 4 mg/L (2),

The zinc concentration may be even lower if the rainwater has passed on coated rolled zinc such as PIGMENTO®, then zinc concentration is reduced by 95% (3).

So generally, in all cases, zinc concentration is lower than the drinkable threshold equal to 5 mg/L when this regulatory threshold exists (4) because in numerous countries, there is not drinkable threshold for zinc like at the European level (because zinc is not an issue).

Ground seepage:

Due to seepage there can be locally restricted slightly increased zinc concentrations in the ground/ in technical infiltration, like troughs, rigolen systems and absorbing wells. There is no risk of an excess supply of zinc for the soil/plants/animals.

Health

The use stage of the rolled zinc from VMZINC, used in the envelope applications in the building, cannot have impacts on the health of the users.

Zinc is an essential element that means it is absolutely necessary for all living organisms.

For human beings, zinc is the 3rd most important.

Oligo-element after magnesium and iron and the WHO recommends daily zinc intakes of 15 mg/day for men and 12 mg/day for women.

2.12 Reference service life

The long experience, which has shown so numerous very old buildings with rolled zinc products still efficient and the deep theoretical knowledge about the behavior of the rolled zinc exposed to the atmosphere lead to announce a service life of 100 years; the standard /ISO 15686/ has not been considered.

2.13 Extraordinary effects

Fire

Fire protection

Fire performance:

The textured and mattified rolled zinc VMZINC® meet the requirements of the building material class A2 s1 d0 "M1" in accordance with the standard /EN 13501-1/.

| Name | Value |
|-------------------------|-------|
| Building material class | A2 |
| Burning droplets | d0 |
| Smoke gas development | s1 |

Water

The effect of floods on zinc coils and sheets does not lead to product change or any other negative consequences for the environment.

Mechanical destruction

None

2.14 Re-use phase

Scrap of 'new' rolled zinc: rolled zinc scrap, from the VMZINC manufacturing process can be fed back completely into the melting in the VMZINC manufacturing process.

Old rolled zinc: the old rolled zinc, dismantled at its end of life during demolition or renovation works in the building site, can be collected to be sold either directly to secondary smelting works or via a scrap metal dealer.

Indeed, due to its high residual value (60 to 75% of the zinc content is remunerated in value) and to a recycling market very well structured, the recycling rate of the rolled zinc products at its end of life is at least 96% in Western Europe.

The old rolled zinc can be recycled to be reused in different applications such as steel galvanizing or zinc oxides manufacturing.

The use of recycled material instead of zinc ore has a positive influence on the sustainability of the natural resources and also on the energy use (significant energy savings from 50 to 90%).

2.15 Disposal

Because of the very high and efficient recycling rate of the rolled zinc products, only 4% of the old rolled zinc from roofing, facade or rainwater systems goes to landfill.

Nevertheless, the /waste key/ for zinc is: 17 04 04.

2.16 Further information

For further information: vmzinc.com

3. LCA: Calculation rules

3.1 Declared Unit

This declaration refers to one kilogramme of textured and mattified rolled zinc from VMZINC under the trademark AZENGAR®.

Declared unit

| Name | Value | Unit |
|---------------|-------|------|
| Declared unit | 1 | kg |

3.2 System boundary

This declaration is a 'Cradle to Gate' with options. It covers modules A1 to A3, modules C3, C4 and D.

The aggregated module A1-A3 includes:

The module C3 includes pre-treatment before recycling.

The module C4 corresponds to landfill.

- The manufacturing and transport of raw materials (Ti, Cu, Zn etc.),
- The manufacturing of the textured and mattified rolled zinc (AZENGAR®),
- The manufacturing of the energy resources (electricity, thermal energy, auxiliaries),
- The manufacturing, the transport and the end of life of the packaging (including loads and benefits for electricity and thermal energy),
- The end of life of the process wastes.

Module D includes re-melting and avoided impacts due to recycling of old rolled zinc.

3.3 Estimates and assumptions

No major estimates or assumptions were necessary for this LCA excepted for recycling rate which has been assumed at 96% (European recycling rate for rolled zinc).

3.4 Cut-off criteria

All the data from the operating data survey, all direct production wastes, all emission measurements available and all transport distances were taken into consideration.

Material and energy flows with a share of less than 1 percent were also taken into consideration.

Only machines, facilities and LPG (liquid petroleum gas) for engines required at the production plant are neglected.

It can be assumed that the sum of ignored processes may not exceed 5% of the impact categories.

3.5 Background data

The /GaBi 8/ software system on comprehensive analysis developed by Thinkstep used for modelling the life cycle for the manufacturing and recycling of the textured and mattified rolled zinc. All relevant background data records for the manufacturing of zinc are taken from the GaBi 8 software database, specific data related to the production of textured and mattified rolled zinc were collected in Viviez and Auby VM Building Solutions production plant.

3.6 Data quality

Consistency of the process data and used background data (GaBi) more particularly data related to the production of primary zinc /IZA – SHG LCA/ with the best geographical coverage (worldwide), temporal coverage (2012) and technological (electro-metallurgical and pyro-metallurgical).

3.7 Period under review

The life cycle assessment is based on data collection from Auby and Viviez production plants of VM BUILDING SOLUTIONS made in 2012. We considered the data over the complete year 2012 (nothing has changed since 2012).

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: France

3.9 Allocation

Allocation was avoided as much as possible as required by EN 15804 but allocations had to be done for:

- Production residues and packaging wastes (module A3). Some of the production wastes are fed into incineration processes, landfills or recycling processes. For recycled waste, we chose a conservative approach that does not take into account the benefits and loads.

- Recycling of old rolled zinc at its end of life (module D).

The loads and benefits for the zinc obtained from remelting is calculated on the basis of the data record of primary zinc manufacturing.

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 data base used involves GaBi data base, version 8.5 and also the IZA 2014 Primary Zinc dataset Thinkstep /IZA – SHG LCA/

4. LCA: Scenarios and additional technical information

Modules A4-A5, B1-B7, and C1-C2 are not considered in this study. The possible loads and benefits given in Module D are based on the recyclability of zinc products. After collection, zinc scrap is re-melted and converted to secondary zinc (third parties). The possible loads and benefits for zinc gained through re-melting is calculated using the dataset of primary zinc production.

Packaging materials for 1 kg of Natural rolled zinc: wood pallets = 0,039kg, kraft paper = 0,006kg, polyethylene film = 0,001kg, polypropylene and steel wire rod = 0,0003kg.

Module A1-A3 have a GWP biogenic carbon = 0,137 kg CO₂ eq.

Module A5 (not declared) contains the end of life of the product packaging. The global warming potential is mainly due to the burning of wooden pallets with GWP biogenic carbon = 0,02522 kg CO₂ eq. for this step.

The modules C3 includes the mechanical selection of the old rolled zinc.

The modules C4 includes the landfill of the slight part of the old rolled zinc which is not recovered for being recycled (4%).

After the collection takes place, recycling loads and credits are both addressed in the module D.

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE 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 | MND | MND | MND | MND | MNR | MNR | MNR | MND | MND | MND | MND | X | X | X |

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 kg of textured and mattified rolled zinc

| Parameter | Unit | A1-A3 | C3 | C4 | D |
|---|------------------------------------|-----------|----------|----------|-----------|
| Global warming potential (GWP) | kg CO ₂ eq | 3.36E+00 | 3.74E-03 | 1.95E-03 | -2.25E+00 |
| Depletion potential of the stratospheric ozone layer (ODP) | kg CFC11 eq | -1.05E-08 | 2.06E-13 | 4.71E-15 | 9.87E-09 |
| Acidification potential of land and water (AP) | kg SO ₂ eq | 1.74E-02 | 1.44E-05 | 5.49E-06 | -1.34E-02 |
| Eutrophication potential (EP) | kg PO ₄ ³ eq | 2.76E-03 | 1.72E-06 | 6.71E-07 | -2.16E-03 |
| Formation potential of tropospheric ozone photochemical oxidants (POCP) | kg Ethen eq | 9.77E-04 | 1.17E-06 | 5.22E-07 | -7.04E-04 |
| Abiotic depletion potential for non fossil resources (ADPE) | kg Sb eq | 4.28E-04 | 4.34E-09 | 1.74E-10 | -3.85E-04 |
| Abiotic depletion potential for fossil resources (ADPF) | MJ | 3E+01 | 1.01E-01 | 2.8E-02 | -1.56E+01 |

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A1: 1 kg of textured and mattified rolled zinc

| Parameter | Unit | A1-A3 | C3 | C4 | D |
|---|----------------|----------|----------|----------|-----------|
| Renewable primary energy as energy carrier (PERE) | MJ | 1.21E+01 | 5.38E-02 | 2.11E-03 | -8.94E+00 |
| Renewable primary energy resources as material utilization (PERM) | MJ | 0 | 0 | 0 | 0 |
| Total use of renewable primary energy resources (PERT) | MJ | 1.21E+01 | 5.38E-02 | 2.11E-03 | -8.94E+00 |
| Non renewable primary energy as energy carrier (PENRE) | MJ | 4.36E+01 | 4.26E-01 | 2.91E-02 | -2.09E+01 |
| Non renewable primary energy as material utilization (PENRM) | MJ | 0 | 0 | 0 | 0 |
| Total use of non renewable primary energy resources (PENRT) | MJ | 4.36E+01 | 4.26E-01 | 2.91E-02 | -2.09E+01 |
| Use of secondary material (SM) | kg | 2.38E-03 | 0 | 0 | 9.6E-01 |
| Use of renewable secondary fuels (RSF) | MJ | 0 | 0 | 0 | 0 |
| Use of non renewable secondary fuels (NRSF) | MJ | 0 | 0 | 0 | 0 |
| Use of net fresh water (FW) | m ³ | 7.04E-01 | 1.63E-04 | 1.23E-07 | -6.34E-01 |

RESULTS OF THE LCA - WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A1: 1 kg of textured and mattified rolled zinc

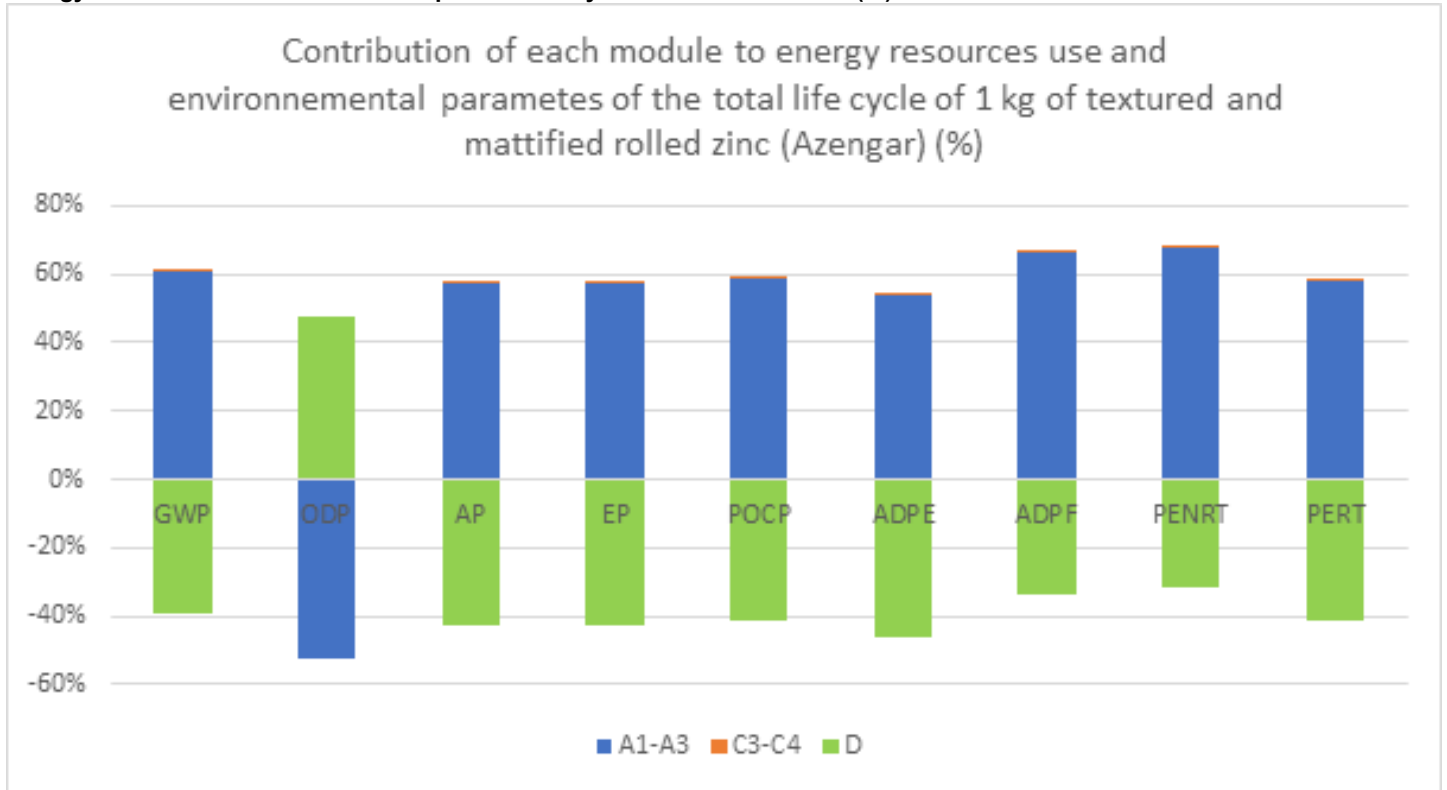
| Parameter | Unit | A1-A3 | C3 | C4 | D |
|-------------------------------------|------|----------|----------|----------|----------|
| Hazardous waste disposed (HWD) | kg | 5.37E-04 | 3.44E-09 | 3.58E-09 | 9.72E-03 |
| Non hazardous waste disposed (NHWD) | kg | 3.88E-01 | 9.23E-05 | 4.02E-02 | -1.9E-01 |
| Radioactive waste disposed (RWD) | kg | 5.36E-03 | 1.28E-04 | 1.28E-04 | -2.1E-03 |
| Components for re-use (CRU) | kg | 0 | 0 | 0 | 0 |
| Materials for recycling (MFR) | kg | 0 | 9.6E-01 | 0 | 0 |
| Materials for energy recovery (MER) | kg | 0 | 0 | 0 | 0 |
| Exported electrical energy (EEE) | MJ | 0 | 0 | 0 | 0 |
| Exported thermal energy (EET) | MJ | 0 | 0 | 0 | 0 |

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 this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

6. LCA: Interpretation

Energy resources and environmental parameters by module (%):



For the energy resources use, the aggregated module A1-A3, the module A1 contributes at 62 % of the total use of non-renewable primary energy resources (**PENRT**) and the module A3 contributes at 37.4 %.

The main module of the aggregated module A1-A3 contributing to the environmental indicators is the module A1 with a contribution of 68 to 99.7 %.

The module A1 is dominated by the production of primary zinc (SHG zinc) contributing between 98% and 99% of the energy resources use and environmental indicators.

'Melting to rolling' step is one of the main contributor to the environmental indicator of the module A3 at :

- 70.6% of the Abiotic depletion potential for fossil resources,
- 62.4% of the global warming potential,
- 43.5% of the Eutrophication potential,

- 53.5% acidification potential

One of the other step contributing more particularly to environmental indicators of module A3 is the 'Matting' step; it contributes at:

- 97.4% of the Abiotic depletion potential for non fossil resources,
- 52.4% of the Ozone Depletion Potential,
- 41% of the Eutrophication potential
- 24.9% of the global warming potential.

The negative value of the **ODP** (Ozone depletion potential) is due to the Special high-grade zinc IZA (IZA dataset). In this dataset, the scope of the Life Cycle Inventory of primary zinc production extends to the costs and benefits associated with the generation of co-products such as sulfuric acid and more specifically silver and incineration with energy recovery of certain wastes (in line with the principle of extending the system boundaries). This is why the "ozone depletion" indicator has negative values in the aggregated A1-A3 module.

Regarding module D, it is interesting to note the significant environmental benefits due to the recycling of the old rolled zinc at its end of life.

7. Requisite evidence

Runoff rate evidences:

Experimental setup: Duration 1 year (June 1998 to June 1999), in Stockholm, Sweden, titanium zinc sheet 0.7 mm thick in surface qualities VMZINC® bright-rolled and pre-weathered QUARTZ-ZINC® and ANTHRA-ZINC®, inclination of roof = 45°, roof surface direction south facing.

Measuring agency: Royal Institute of Technology, Department of Materials Science and Engineering, Division of Corrosion Science – Stockholm in Sweden

Report of results: 'Atmospheric corrosion of zinc-based materials: runoff rates, chemical speciation and ecotoxicity

effects' – I.Odenevall Wallinder, C.Leygraf, C.Karlen, D.Heijerick and C.R.Janssen – Corrosion Science n°43 – pp 809-816 - 2001

Result:

As part of this study annual runoff rates were taken from bright-rolled VMZINC® and pre-weathered QUARTZ-ZINC® and ANTHRA-ZINC® (other zinc-based construction materials were part of this study).

The average annual SO₂ concentration at the measuring agency was 3 µg/m³, the total amount of precipitation during the experiment was 540 mm.

The runoff rates of bright-rolled VMZINC® is the following: 2.3

g/m²/year.

8. References

/DIN EN ISO 14001/

2009-11, Environmental Management Systems - Requirements and Instructions for Application (ISO 14001:2004 + Cor. 1:2009); German and English version EN ISO 14001:2004 + AC:2009

/ISO 9001/

ISO 9001:2015, Quality management

/waste keys/

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