

Environmental Product Declaration

as per ISO 14025 and EN 15804

Owner of the declaration: RIVA Thy Marcinelle S.A.

Publisher: Kiwa-Ecobility Experts

Programme operator: Kiwa- Ecobility Experts

Registration number: EPD-RIVA Thy Marcinelle-300-EN

Issue date: 20.03.2023

Valid to: 20.03.2028



Meshes

This EPD is based on the LCA of Meshes from RIVA Thy Marcinelle S.A., which is produced in the steel mill and welding machines of the plant location Charleroi.

1. General information

RIVA Thy Marcinelle S.A.

Program operator

Kiwa-Ecobility Experts
Voltastr. 5
13355 Berlin
Germany

Registration number

EPD-RIVA Thy Marcinelle-300-EN

Issue date

20.03.2023

Scope

This EPD is based on the LCA of the meshes from RIVA Thy Marcinelle S.A., which is produced in the steel mill and the welding machines of the plant location Charleroi.

The type of the EPD is “from cradle to gate with options”, regarding the moduls C1 to C4 and modul D.

The owner of the declaration shall be liable for the underlying information and evidence. Kiwa-Ecobility Experts shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.



Frank Huppertz
(Head of Kiwa – Ecobility Experts)



Prof. Dr. Frank Heimbecher
(Chairman of the independent expert committee Kiwa-Ecobility Experts)

Meshes

Owner of the declaration

RIVA Thy Marcinelle S.A.
Rue de L'Acier 1
B-6000 Charleroi
Belgium

Declared product / declared unit

1 kg Meshes

Valid to

20.03.2028

Product category rules

PCR B for construction steel products (construction steel products; draft; 2020-03-13).

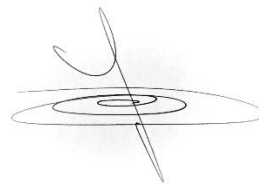
Verification

The European standard EN15804:2012+A2:2019 serves as the core PCR.

Independent verification of the declaration and data according to ISO 14025:2006

internal

external



Anne Kees Jeeninga - Advieslab V.o.f.
(Third party verifier)

2. Product

2.1 Product description

The product to be declared is an average product for meshes with a range of diameters from 5mm to 12mm. The product to be declared is Meshes from RIVA Thy Marcinelle S.A., which is produced in the steel mill and the welding machines of the plant location “Carleroi” located at Rue de L'Acier 1, B-6000 Charleroi, Belgium.

2.2 Application

The Meshes are used for the reinforcement of concrete.

2.3 Technical data

The following technical data was provided by RIVA Thy S.A..

Table 1: Technical data

| Parameter | Value |
|--------------------|---|
| Steel Grade | B500A |
| Yield strength | 500 to 550 MPa |
| Ratio R_m/R_e | at least 1.05 |
| Way of production | EAF |
| Standard/Norm | EN 10080 + all national standards for each European country |
| Range of diameters | 5mm to 12mm |

2.4 Manufacturing

Steel billets are semi-finished products with a square cross-section and rounded edges produced by continuous casting. They serve as starting material for the hot rolling process or are processed directly into forgings.

Wire rods are produced by hot rolling steel billets on special continuous rolling mills, it is a long product formed into coils and serves as semi-finished product.

Welded mesh panels consist of longitudinal and transverse bars of the same or different nominal diameter and length, technically at right angles to each other, which are joined at all crossing points by automatic machines in the factory by electric resistance spot welding.

2.5 Raw materials

Table 2 lists the raw materials for the steel billets from which the meshes is made, with the average shares in mass percent. To respect the commercial secrets, the values are given in intervals that represents the distribution of the shares of the raw materials.

Table 2: Raw materials and shares in mass percent

| Material | Share in m% |
|--------------------------------|-------------|
| Ferrosilicon | 0-2 |
| Limestone | 2-4 |
| Manganese for Siliconmanganese | 0-2 |
| Anthracite | 1-3 |
| Scrap | 93-96 |
| Silicon for Silicomanganese | 0-2 |

There is no biogenic carbon in the products. The product does not contain substances from the “Candidate list of substances of very high concern for authorisation” (SVHC).

2.6 Reference service life

Since the service life of wire rods is not considered, there is no need to specify a reference service life.

3. LCA: Calculation rules

3.1 Declared unit

According to PCR B for construction steel products (draft; 2020-03-13), the declared unit is 1 kg Meshes.

Table 3: Declared unit

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

For the calculation of potential environmental impacts, process-specific data were collected for the product under consideration. All the energy and materials required for the production process were determined, as were the data for calculating the auxiliary materials and co-products.

This is an EPD for Meshes, which were produced at the plant location Charleroi. The range of diameters is from 5mm to 12mm.

3.2 System boundary

In this life cycle assessment according to EN 15804+A2, the following phases of the product life cycle are considered:

A1: Extraction and processing of raw materials and processing of secondary materials used as input (e.g. recycling processes)

A2: Transport to Manufacturing

A3: Manufacturing

C1: Demolition

C2: Transport to waste treatment

C3: Waste treatment for reuse, recovery and/or recycling

C4: Disposal

D: Reuse-, Recovery-, Recycling- potentials, indicated as net flows and benefits

Therefore, the type of this average EPD is “from cradle to gate with options”.

For the declared life cycle phases, all inputs (raw materials, precursors, energy and auxiliary materials) as well as the waste generated were considered.

Figure 1 shows the simplified process flow diagram for the regarded steel product Meshes which are produced at the plant location Charleroi of RIVA Thy Marcinelle S.A..

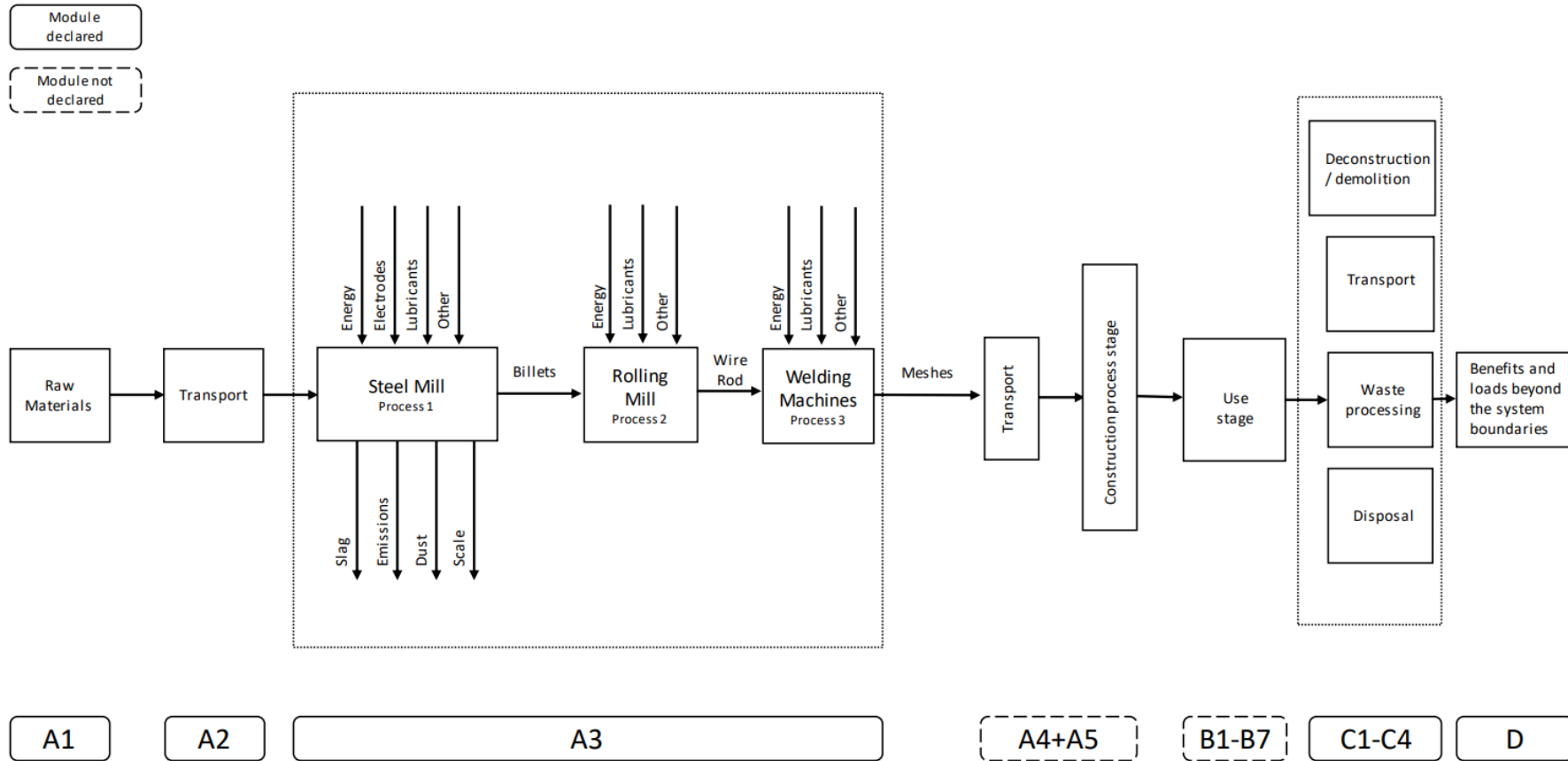


Figure 1: Simplified process flow diagram

3.3 Estimates and assumptions

The waste scenarios for production and the waste scenarios for the end-of-life phase were created on the basis of a detailed query. The background data for modelling the fall scenarios were provided by RIVA Thy Marcinelle S.A. and are explained and presented in the background report.

3.4 Period under review

All product- and process-specific data were collected for the 2021 operating year and are thus up-to-date.

3.5 Cut-off criteria

For the process modules A1 to A3, all process-specific data were collected. Potential environmental impacts were assigned to the material flows based on the Ecoinvent database V3.6 of 2019. All flows contributing to more than 1 percent of the total mass, energy, or environmental impacts of the system were considered in the LCA. It can be assumed that the neglected processes would have contributed less than 5 percent to the considered impact categories.

3.6 Data quality

To ensure the comparability of the results, only consistent background data from the Ecoinvent database V3.6 of 2019 were used in the LCA (e.g. data sets on energy, transports, auxiliary and operating materials). The database is regularly checked and thus complies with the requirements of EN 15804 (background data not older than 10 years). Almost all consistent data sets contained in the Ecoinvent database V3.6 of 2019 are documented and can be viewed in the online documentation. The data refer to the annual average of inputs (energy, inputs, etc.) consumed during the operating phase 01/2021 - 12/2021 and were converted to reference flows (input / output per declared unit).

The general rule was followed that specific data from specific production processes or average data derived from specific processes must have priority in the calculation of an LCA. Data for processes over which the manufacturer has no control were assigned generic data.

The calculation of the LCA was performed using the online EPD tool "R<THiNK" from Nibe.

3.7 Allocation

The allocation regarding production waste is explained in the project report of this EPD. There are no multi-functional processes to be considered. Specific information on allocations within the background data can be found in the Ecoinvent database V3.6 document of 2019.

3.8 Comparability

In principle, a comparison or assessment of the environmental impacts of different products is only possible if they have been prepared in accordance with EN 15804. For the evaluation of the comparability, the following aspects have to be considered in particular: PCR used, functional or declared unit, geographical reference, definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs and general program instructions of different EPDs programs may differ. A comparability needs to be evaluated. For further guidance see EN 15804+A2 (5.3 Comparability of EPD for construction products) and ISO 14025 (6.7.2 Requirements for comparability). Reference Service Life (RSL)

The lifetime of monopiles will be limited by the service life of the construction. Under these circumstances, no RSL according to the relevant ISO standards and EN 15804 can be declared.

3.9 Data collection

For the data collection, ISO 14044 section 4.3.2 was considered.

The data collection was implemented by using an Excel data collection template provided by Kiwa GmbH. The data collected was checked by Kiwa GmbH, for example by checking the extent to which the data for the different production processes matched to each other. In this way, some errors (e.g. unit errors, language barriers) could still be corrected in cooperation with RIVA Thy Marcinelle S.A.. The annual input and output values (raw materials and energy, auxiliary materials, components of waste etc.) were related to the declared unit of one kilogram of steel product with the aid of corresponding calculations.

3.10 Calculation methods

The calculation procedures described in ISO 14044 Section 4.3.3 were used for the life cycle assessment. The evaluation is based on the phases according to the system boundaries and the processes contained.

4. LCA: Scenarios and additional technical information

The assigned waste scenarios are based on the "Natio-nale Milieudatabase" (NMD), the national environmental database of the Netherlands. This is due to the fact that the used online EPD tool "R<THiNK" was developed by Nibe in the Netherlands. The waste scenario used for reinforcing steel has the NMD ID 72. Further informarmation about the waste scenarios are presented in the backround report.

Table 5: C2 – Transport End of Life

| Waste Scenario | Waste Treatment | Transport Profile | Transport dittance in km |
|----------------------------------|-----------------|--------------------------------------|--------------------------|
| Steel, reinforcement (NMD ID 74) | Landfill | Lorry (Truck), unspecified (default) | 100 |
| | Incineration | Lorry (Truck), unspecified (default) | 150 |
| | Recycling | Lorry (Truck), unspecified (default) | 50 |

Table 6: C– Shares of waste treatment

| Waste Scenario | Shares of waste treatment [%] | | |
|----------------------------------|-------------------------------|-----------|--------------|
| | Landfill | Recycling | Incineration |
| Steel, reinforcement (NMD ID 74) | 5 | 95 | - |

Table 7: D – Used Environmental Profile for benefits

| Waste Scenario | Used Environmental Profile for benefits | | |
|----------------------------------|---|---|--------------|
| | Landfill | Recycling | Incineration |
| Steel, reinforcement (NMD ID 74) | - | Benefits module D World Steel method (Steel production, electric, low-alloyed - Steel production, converter, unalloyed) | - |

5. LCA: Results

The following tables show the results of the life cycle assessment, more precisely for the environmental impact indicators, resource consumption, output flows and waste categories. The results presented refer to the declared unit of 1 kg of Meshes.

The results of the environmental impact indicators ETP fw, HTP-c, HTP-nc, SQP, ADP-f, ADP-mm and WDP must be used with caution, as the uncertainties in these results are high or as there is limited experience with the indicator.

Disclaimer on IR: This impact category mainly addresses the potential effect of low dose ionizing radiation on human health in the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents and occupational exposures, nor does it consider radioactive waste disposal in underground facilities. Potential ionizing radiation from soil, radon, and some building materials is also not measured by this indicator.

Table 8: Overview of the considered information modules showing all phases of the building life cycle according to DIN EN 15804 (X = module declared)

| Description of the system boundary (X = module declared; MND = module not declared) | | | | | | | | | | | | | | |
|---|-----------|---------------|---|-----------------------------------|-----------|-------------|--------|-------------|--------------|------------------------------|-----------|------------------|----------|---|
| 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 manufacturer to place of use | Construction-installation process | Use | Maintenance | Repair | Replacement | Refurbishmen | De-construction / demolition | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-potential |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | C1 | C2 | C3 | C4 | D |
| X | X | X | MND | MND | MND | MND | MND | MND | MND | X | X | X | X | X |

Table 9: Results of the LCA – Environmental impact categories

| Results of the LCA – Environmental impact categories | | | | | | | | | |
|--|---------------------------|----------|----------|----------|----------|----------|----------|----------|-----------|
| Impact category | Unit | A1 | A2 | A3 | C1 | C2 | C3 | C4 | D |
| AP | mol H+ eqv. | 4,89E-04 | 9,01E-05 | 6,87E-04 | 0,00E+00 | 4,96E-05 | 0,00E+00 | 4,93E-06 | 2,41E-04 |
| GWP-total | kg CO2 eqv. | 1,05E-01 | 1,24E-02 | 2,55E-01 | 0,00E+00 | 8,56E-03 | 0,00E+00 | 5,32E-04 | 6,19E-02 |
| GWP-b | kg CO2 eqv. | 1,97E-03 | 8,66E-06 | 1,70E-03 | 0,00E+00 | 3,95E-06 | 0,00E+00 | 2,13E-06 | -6,51E-04 |
| GWP-f | kg CO2 eqv. | 1,02E-01 | 1,24E-02 | 2,52E-01 | 0,00E+00 | 8,55E-03 | 0,00E+00 | 5,30E-04 | 6,26E-02 |
| GWP-luluc | kg CO2 eqv. | 1,33E-04 | 1,33E-05 | 1,20E-03 | 0,00E+00 | 3,13E-06 | 0,00E+00 | 1,42E-07 | -4,62E-05 |
| ETP-fw | CTUe | 2,39E+00 | 1,58E-01 | 3,46E+00 | 0,00E+00 | 1,15E-01 | 0,00E+00 | 2,64E-01 | 2,10E+00 |
| PM | disease incidence | 2,33E-08 | 8,18E-10 | 9,00E-09 | 0,00E+00 | 7,69E-10 | 0,00E+00 | 9,47E-11 | 3,62E-09 |
| EP-m | kg N eqv. | 1,05E-04 | 3,51E-05 | 1,90E-04 | 0,00E+00 | 1,75E-05 | 0,00E+00 | 1,69E-06 | 4,48E-05 |
| EP-fw | kg PO4 eqv. | 6,06E-06 | 1,30E-07 | 6,10E-06 | 0,00E+00 | 8,63E-08 | 0,00E+00 | 2,46E-08 | 2,21E-06 |
| EP-T | mol N eqv. | 1,20E-03 | 3,86E-04 | 2,17E-03 | 0,00E+00 | 1,93E-04 | 0,00E+00 | 1,86E-05 | 5,23E-04 |
| HTP-c | CTUh | 1,06E-09 | 5,88E-12 | 3,84E-09 | 0,00E+00 | 3,73E-12 | 0,00E+00 | 2,36E-09 | 8,09E-12 |
| HTP-nc | CTUh | 9,64E-10 | 1,54E-10 | 2,98E-07 | 0,00E+00 | 1,26E-10 | 0,00E+00 | 1,18E-11 | -1,21E-08 |
| IR | kBq U235 eqv. | 5,89E-03 | 7,35E-04 | 8,91E-02 | 0,00E+00 | 5,40E-04 | 0,00E+00 | 7,27E-05 | -1,07E-03 |
| SQP | Pt | 5,44E-01 | 1,49E-01 | 2,43E+00 | 0,00E+00 | 1,12E-01 | 0,00E+00 | 5,34E-02 | 9,66E-02 |
| ODP | kg CFC 11 eqv. | 5,87E-09 | 2,53E-09 | 5,10E-08 | 0,00E+00 | 1,89E-09 | 0,00E+00 | 2,55E-10 | 1,53E-09 |
| POCP | kg NMVOC eqv. | 3,75E-04 | 1,05E-04 | 1,17E-03 | 0,00E+00 | 5,50E-05 | 0,00E+00 | 5,44E-06 | 3,56E-04 |
| ADP-f | MJ | 1,47E+00 | 1,75E-01 | 9,16E+00 | 0,00E+00 | 1,29E-01 | 0,00E+00 | 1,73E-02 | 4,37E-01 |
| ADP-mm | kg Sb-eqv. | 6,46E-07 | 2,38E-07 | 1,74E-06 | 0,00E+00 | 2,17E-07 | 0,00E+00 | 5,36E-09 | 4,23E-08 |
| WDP | m ³ world eqv. | 1,45E-02 | 7,00E-04 | 1,14E-01 | 0,00E+00 | 4,61E-04 | 0,00E+00 | 4,06E-04 | 1,19E-02 |

AP = Acidification; GWP-total = Global warming potential; GWP-b = Global warming potential – Biogenic; GWP-f = Global warming potential – Fossil; GWP-luluc = Global warming potential - Land use and land use change; ETP-fw = Ecotoxicity, freshwater; PM = Particulate Matter; EP-m = Eutrophication marine; EP-fw = Eutrophication, freshwater; EP-T = Eutrophication, terrestrial; HTP-c = Human toxicity, cancer; HTP-nc = Human toxicity, non-cancer; IR = Ionising radiation, human health; SQP = Land use; ODP = Ozone depletion; POCP = Photochemical ozone formation - human health; ADP-f = Resource use, fossils; ADP-mm = Resource use, minerals and metals; WDP = Water use

Table 10: Results of the LCA – Environmental parameters

| Results of the LCA – Environmental parameters | | | | | | | | | |
|---|----------------|-----------|----------|----------|----------|----------|----------|----------|-----------|
| Parameter | Unit | A1 | A2 | A3 | C1 | C2 | C3 | C4 | D |
| PERE | MJ | -3,16E-01 | 2,67E-03 | 8,56E-01 | 0,00E+00 | 1,61E-03 | 0,00E+00 | 2,46E-04 | -1,27E-02 |
| PERM | MJ | 5,26E-01 | 0,00E+00 | 6,49E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PERT | MJ | 2,09E-01 | 2,67E-03 | 9,20E-01 | 0,00E+00 | 1,61E-03 | 0,00E+00 | 2,46E-04 | -1,27E-02 |
| PENRE | MJ | 1,13E+00 | 1,86E-01 | 9,24E+00 | 0,00E+00 | 1,37E-01 | 0,00E+00 | 1,84E-02 | 4,53E-01 |
| PENRM | MJ | 4,13E-01 | 0,00E+00 | 2,83E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PENRT | MJ | 1,54E+00 | 1,86E-01 | 9,52E+00 | 0,00E+00 | 1,37E-01 | 0,00E+00 | 1,84E-02 | 4,53E-01 |
| SM | kg | 1,16E+00 | 0,00E+00 | 1,62E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| RSF | MJ | 0,00E+00 | 0,00E+00 | 5,66E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| NRSF | MJ | 0,00E+00 | 0,00E+00 | 1,89E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| FW | m ³ | 6,49E-04 | 2,50E-05 | 3,07E-03 | 0,00E+00 | 1,57E-05 | 0,00E+00 | 2,06E-05 | 2,26E-04 |
| HWD | kg | 6,11E-07 | 4,53E-07 | 6,71E-06 | 0,00E+00 | 3,27E-07 | 0,00E+00 | 2,04E-08 | 7,50E-06 |
| NHWD | kg | 3,65E-02 | 7,86E-03 | 6,27E-02 | 0,00E+00 | 8,18E-03 | 0,00E+00 | 9,44E-02 | 6,13E-03 |
| RWD | kg | 4,58E-06 | 1,14E-06 | 7,48E-05 | 0,00E+00 | 8,47E-07 | 0,00E+00 | 1,15E-07 | -3,70E-07 |
| CRU | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| MFR | kg | 0,00E+00 | 0,00E+00 | 1,18E-02 | 0,00E+00 | 0,00E+00 | 1,08E+00 | 0,00E+00 | 0,00E+00 |
| MER | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| EET | MJ | 0,00E+00 | 0,00E+00 | 9,29E-05 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| EEE | MJ | 0,00E+00 | 0,00E+00 | 5,40E-05 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

PERE = Renewable primary energy ex. raw materials; PERM = Renewable primary energy used as raw materials; PERT = Renewable primary energy total; PENRE = Non-renewable primary energy ex. raw materials; PENRM = Non-renewable primary energy used as raw materials; PENRT = Non-renewable primary energy total; SM = Use of secondary material; RSF = use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water; 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; EET = Exported energy thermic; EEE = Exported energy electric

6. LCA: Interpretation

For an easier understanding, the results are processed graphically, in order to recognize relationships and connections between the data more clearly.

The following figure shows the percentage of the product phases in the environmental impact categories.

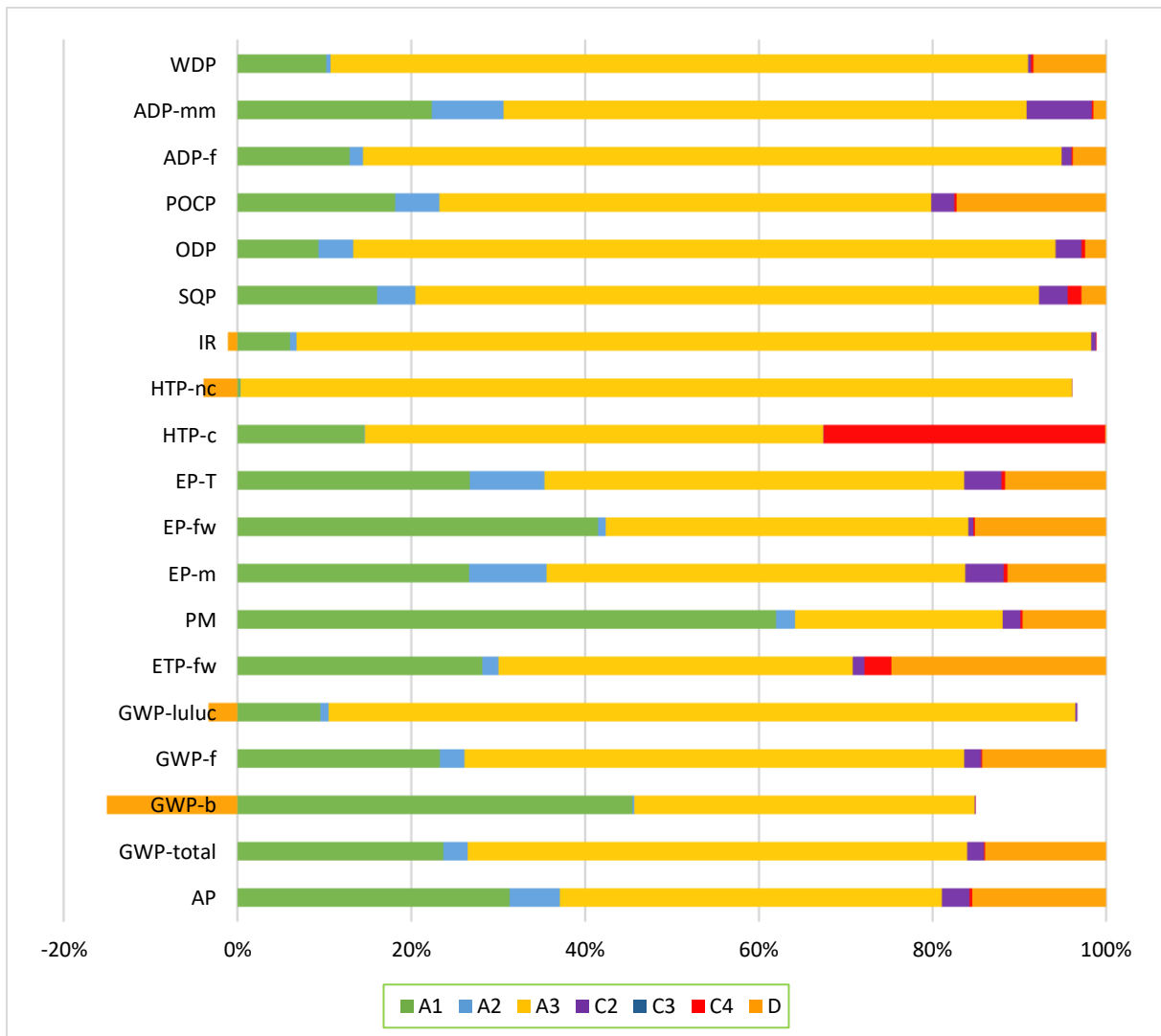


Figure 1: Percentage of the product phases in the environmental impact categories

The figure shows that for the environmental impact categories raw material supply A1 and the manufacturing A3 during the production phase have the highest percentages. The high share of production phase A3 is related to the high electricity consumption in steelmaking with an electric arc furnace (EAF). The high value for the impact category HTP-nc is related to the high share of nuclear energy in electricity production.

7. References

| | |
|-----------------|---|
| Ecoinvent, 2019 | Ecoinvent Datenbank Version 3.6 (2019) |
| EN 15804 | EN 15804:2012+A2:2019: 2020: Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products |
| ISO 14025 | DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures |
| ISO 14040 | DIN EN ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006 |
| ISO 14044 | DIN EN ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14040:2006 |
| NMD | NMD STICHTING NATIONAL ENVIRONMENTAL DATABASE: Environmental Performance Assessment Method for Construction; 1.1 (March 2022); Rijswijk |
| PCR A | General Program Category Rules for Construction Products from the EPD program Kiwa-Ecobility Experts, R.O_2021-07-16 |
| PCR B | Requirements on the Environmental Product Declarations for construction steel products (Edition 2020-03-13 (draft)) |
| R<THiNK, 2021 | R<THiNK; Online-EPD-Tool von Nibe; 2021 |

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