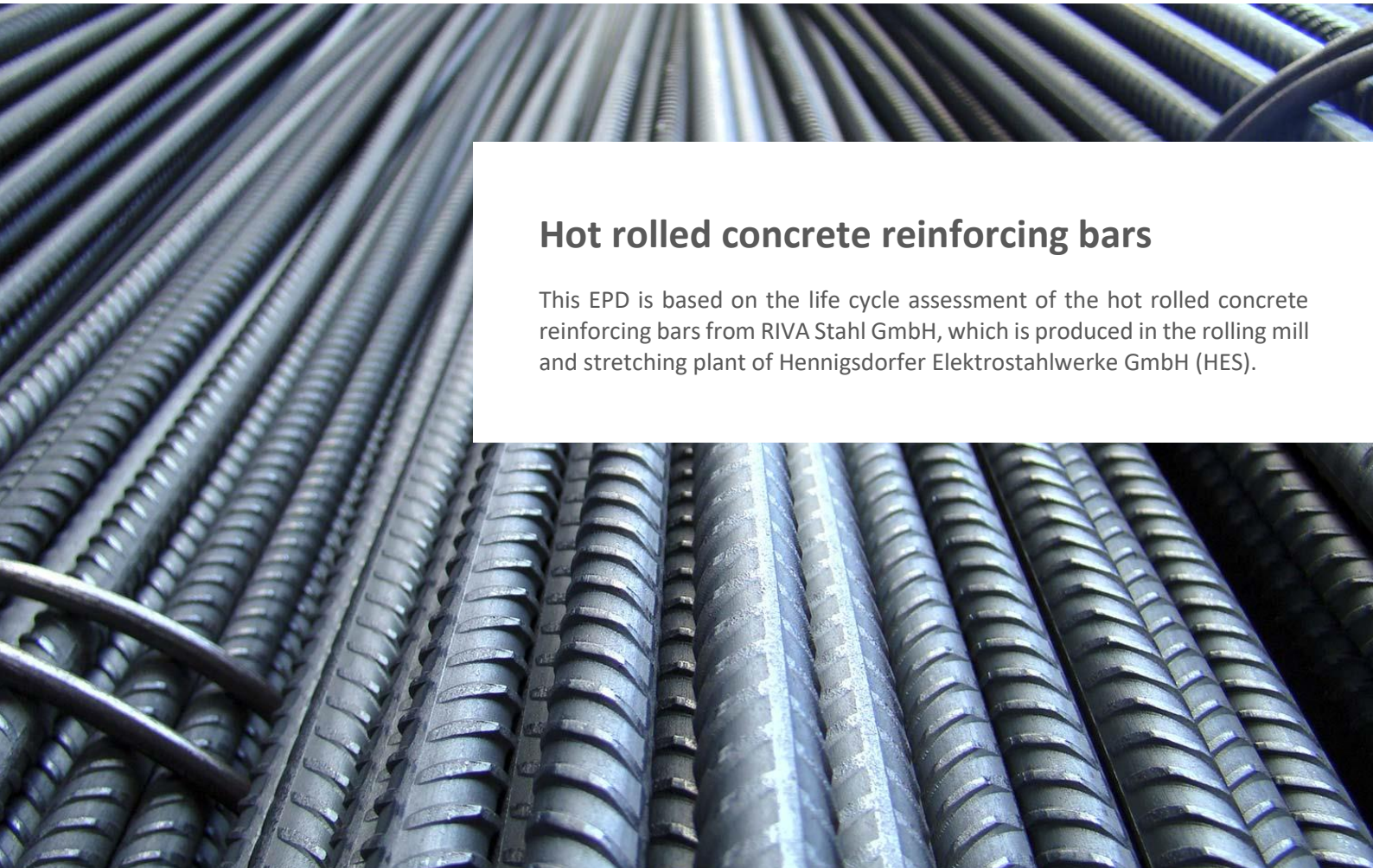
Environmental Product Declaration

as per ISO 14025 and EN 15804

Owner of the declaration:	RIVA Stahl GmbH
Publisher:	Kiwa-Ecobility Experts
Programme operator:	Kiwa-Ecobility Experts
Registration number:	EPD-KIWA-EE-000133-EN
Issue date:	20.04.2021
Valid to:	19.04.2026



Hot rolled concrete reinforcing bars

This EPD is based on the life cycle assessment of the hot rolled concrete reinforcing bars from RIVA Stahl GmbH, which is produced in the rolling mill and stretching plant of Hennigsdorfer Elektrostahlwerke GmbH (HES).

1. General information

RIVA Stahl GmbH

Programme operator:
Kiwa-Ecobility Experts
Kiwa GmbH, Ecobility Experts
Wattstraße 11-13
13355 Berlin
Germany

Registration number:
EPD-Kiwa-EE-000133-EN
(English version published on 15.07.2024)

This declaration is based on the Product Category Rules:
PCR B – Product Category Rules for steel construction products, Requirements on the Environmental Product Declarations for steel construction products; Version 2020-03-13)

Issue date:
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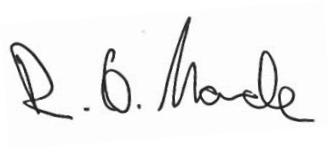
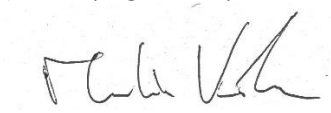


Raoul Mancke
(Head of programme operations, Kiwa-Ecobility Experts)



Martin Koehrer
(Verification body, Kiwa-Ecobility Experts)

Hot rolled concrete reinforcing bars

Owner of the declaration:
RIVA Stahl GmbH
Wolfgang-Küntscher-Straße 18
16761 Hennigsdorf
Germany

Declared product / declared unit:
1 kg hot rolled concrete reinforcing bars

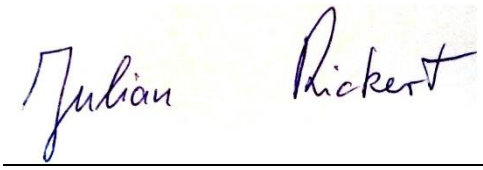
Scope:
This EPD is based on the life cycle assessment of the hot rolled concrete reinforcing bars from RIVA Stahl GmbH, which is produced in the rolling mill and stretching plant of Hennigsdorfer Elektrostahlwerke GmbH (HES). As the production process is similar according to RIVA Stahl GmbH, the representativeness of the average product is guaranteed.

The declaration holder is liable for the underlying information and evidence. Kiwa-Ecobility Experts assumes no liability for manufacturer's information, LCA data and evidence.

Verification:
The European standard EN 15804+A2:2019 serves as the core PCR.

Independent verification of the declaration and data, according to EN ISO 14025:2010.

☐internal ☒external



Julian Rickert
(Third party verifier from GreenDelta GmbH)

2. Product

2.1 Product description

The product to be declared is hot rolled concrete reinforcing bars from RIVA Stahl GmbH, which is produced in the rolling mill and stretching plant of Hennigsdorfer Elektrostahlwerke GmbH (HES).

2.2 Application (Intended Use of the product)

Hot rolled concrete reinforcing bars are used, among other things, as reinforcement for houses or bridges.

2.3 Technical data

The following technical data was provided by RIVA Stahl GmbH

Table 1: Technical specifications for hot rolled concrete reinforcing bars

Parameter	Value
Steel grade	B500 reinforcing steel in ductility classes A, B and C
Yield strength	500 to 650 MPa
Ratio R_m/R_e	at least 1.05 (class A) to at least 1.15 (class C)
Production route	EAF
Standard/Norm	e.g. DIN 488, NF A 35-080, NEN 6008
Range of diameters	8 to 40 mm

2.4 Manufacturing

Reinforcing bars are hot-rolled and heat-treated from the by the heat from the rolling mill. The product is supplied in different lengths as technically straight ribbed bars.

2.5 Raw materials

Table 2 lists the raw materials for the billets from which the hot rolled concrete reinforcing bars are produced, with the average proportions in percent by mass.

Table 1: Raw materials and shares in mass percent

Material	Share [m%]
Aluminium	0.00
Bauxite	0.15
Calcium silicate	0.01
Ferrosilicon	0.16
Lime	1.47
Magnesium oxide	1.22
Scrap	95.99
Silicon manganese	1.00

2.6 Reference Service Life (RSL)

Since the service life of hot rolled concrete reinforcing bars is not considered, there is no need to specify a reference service life.

2.7 Placing on the market

The packaging consists of four to six binding wires, depending on the required length. There is a standard label with steel grade, nominal diameter, and batch number for each bundle. Further information can be found in the technical data sheet for the product from RIVA Stahl GmbH.

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 of hot rolled concrete reinforcing bars.

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 average EPD for hot rolled concrete reinforcing bars, taking into account reinforcing steel bars in 8 mm from the stretching plant and reinforcing steel bars in 10 - 40 mm from the rolling mill of Hennigsdorfer Elektrostahlwerke GmbH (HES). When calculating the average, the respective production volumes for 2018 and their shares were taken into account as shown in Table 3.

Table 2: Shares of the products in the product group " hot rolled concrete reinforcing bars" based on production volume

Product	Production volume 2018 [kg]	Share [%]
Reinforcing steel bars in 8 mm (HES stretching plant)	13,427,900	2.9
Reinforcing steel bars 10-40 mm (HES rolling mill)	452,975,380	97.1

3.2 Scope of declaration and system boundaries

The EPD was created in accordance with DIN EN 15804+A2 and considers the manufacturing phase and parts of the disposal phase as well as the benefits and loads beyond the system boundaries. According to DIN EN 15804, this corresponds to product phases A1-A3, C2-C4 and D. The type of EPD is therefore "from the stretcher to the factory gate with options". As the installation of product A5 is not considered, demolition C1 is also not considered.

In this life cycle assessment in accordance with ISO 14025, 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: Transportation to the manufacturer
- A3: Production
- C2: Transportation for waste treatment
- C3: Waste treatment for reuse, recovery and/or recycling
- C4: Elimination
- D: Reuse, recovery and/or recycling potentials, expressed as net flows and benefits

All inputs (raw materials, preliminary products, energy, and auxiliary materials) and the waste generated were considered for the declared life phases.

Transportation between production sites and transportation of operating resources are assigned to module A3.

Description of the system boundary																
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	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	ND	ND	ND	ND	ND	ND	ND	ND	ND	(X)	X	X	X	X
X=Module declared | ND= Module not declared																

3.3 Estimates and assumptions

The waste scenario for reinforcing steel "Steel, reinforcement" was assigned to the raw materials both for waste during production and at the end of product life. The waste scenario is based on the "Nationale Milieudatabase" (NMD), the national environmental database of the Netherlands. This is due to the fact that the online EPD tool used, "R<THiNK", was developed by Nibe in the Netherlands. The waste scenario used for reinforcing steel has the NMD ID 49. Further information is listed in Chapter 4 below. The "no waste" waste scenario (NMD ID 15) is used for auxiliary materials, as the waste generated is already taken into account elsewhere, for example through production emissions.

3.4 Period under review

All product and process-specific data was collected for the 2018 operating year and is therefore up to date.

3.5 Cut-off Criteria

All process-specific data was collected for process modules A1 to A3. Potential environmental impacts were assigned to the material flows based on the Ecoinvent database V3.5 from 2018. All flows that contribute more than 1 percent of the total mass, energy or environmental impacts of the system were included in the LCA.

It can be assumed that the neglected processes would have contributed less than 5 percent to the impact categories considered.

3.6 Data quality

To ensure the comparability of the results, only consistent background data from the Ecoinvent database V3.5 from 2018 was used in the LCA (e.g. data records on energy, transportation, auxiliary and operating materials). The database is checked regularly and therefore meets the requirements of EN 15804 (background data not older than 10 years). All consistent data records contained in the Ecoinvent database V3.5 from 2018 are documented and can be viewed in the online documentation.

The data relates to the annual average of inputs (energy, operating resources, etc.) consumed during the operating phase 01/2018 - 12/2018 and was converted into reference flows (input / output per declared unit).

The general rule that specific data from specific production processes or average data derived from specific processes must have priority when calculating an LCA was observed. Data for processes over which the manufacturer has no influence were assigned generic data.

The LCA was calculated using the online EPD tool "R<THiNK" from Nibe.

3.7 Allocation

In addition to the reinforcing steel under consideration, the RIVA Stahl GmbH plants also produce some quality steel, so that the corresponding masses are used to calculate the environmental impact of the reinforcing steel in the overall steel production. For data protection reasons, the exact procedure and precise values are only listed in the background report to this EPD. Otherwise, there are no other multi-functional processes that are taken into account. The allocation of production waste is also explained in the background report.

Specific information on allocations within the background data can be found in the documentation of the Ecoinvent database V3.5 from 2018.

3.8 Comparability

A comparison or evaluation of EPD data is only possible if all data sets to be compared have been created in accordance with EN 15804 and the building context or product-specific performance characteristics are considered.

3.9 Data collection

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

The objective and the scope of the study were defined in consultation with RIVA Stahl GmbH. The data was collected using an Excel data collection template provided by Kiwa GmbH. The collected data was reviewed by Kiwa GmbH, for example by checking the extent to which the data matched the different plants and locations. In collaboration with RIVA Stahl GmbH, a number of errors (e.g. unit errors) were corrected. The annual values were then related to the declared unit of one kilogram of reinforcing steel using appropriate calculations. In addition, the assumptions already explained were made and calculations conducted for the missing information and data.

3.10 Calculation method

The calculation methods described in ISO 14044 section 4.3.3 were used for the life cycle assessment. The evaluation is based on the phases within the system boundaries and the processes contained therein.

4. LCA: Scenarios and additional technical information

As explained above, the NMD waste scenario "Steel, reinforcement" with ID 49 was used for the raw material waste streams.

Table 3: C2 - Transportation for waste treatment

Type of waste treatment	Transport profile	Transport distance [km]
Landfilling	Lorry (truck), unspecified (default)	100
Recycling	Lorry (truck), unspecified (default)	50

Table 4: C4 - Proportions of waste treatment types

Waste scenario	Proportion of waste treatment types [%]	
	Landfilling	Recycling
Steel, reinforcement (NMD ID 49)	5	95

Table 5: D - Environmental profiles used for loads

Waste scenario	Environmental profile used for loads	
	Landfilling	Recycling
Steel, reinforcement (NMD ID 49)	Scrap steel {Europe without Switzerland} | treatment of scrap steel, inert material landfill | Cut-off	Materials for recycling, no waste processing considered

Table 6: D - Environmental profiles used for credits

Waste scenario	Environmental profile used for credits	
	Landfilling	Recycling
Steel, reinforcement (NMD ID 49)	-	Pig iron | production (GLO)

5. LCA: Results

The following tables show the results of the impact assessment indicators, resource use, waste, and other output streams. The results presented here refer to the declared average product. As the installation of product A5 is not considered, demolition C1 is also not considered.

Disclaimer on ADP-e, ADP-f, WDP, ETP-fw, HTP-c, HTP-nc, SQP: The results of these environmental impact indicators 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 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																
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	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	ND	ND	ND	ND	ND	ND	ND	ND	ND	(X)	X	X	X	X
X = Module declared | ND = Module not declared																

LCA results - Indicators describing environmental impacts based on the impact assessment (LCIA): 1 kg of hot rolled concrete reinforcing bars (EN 15804+A2)									
Parameter	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Core environmental impact indicators (EN 15804+A2)									
GWP-total	kg CO2 eqv.	8.98E-02	3.84E-02	3.79E-01	0.00E+00	8.29E-03	0.00E+00	3.23E-04	2.16E-02
GWP-f	kg CO2 eqv.	8.78E-02	3.83E-02	3.74E-01	0.00E+00	8.28E-03	0.00E+00	3.23E-04	2.17E-02
GWP-b	kg CO2 eqv.	1.95E-03	4.06E-05	4.44E-03	0.00E+00	2.40E-06	0.00E+00	5.51E-07	-1.36E-04
GWP-luluc	kg CO2 eqv.	1.06E-04	1.70E-05	3.40E-04	0.00E+00	2.46E-06	0.00E+00	8.72E-08	3.68E-06
ODP	kg CFC 11 eqv.	4.37E-09	8.26E-09	3.36E-08	0.00E+00	1.93E-09	0.00E+00	1.44E-10	9.99E-10
AP	mol H+ eqv.	5.38E-04	2.92E-04	2.09E-03	0.00E+00	4.73E-05	0.00E+00	3.13E-06	1.04E-04
EP-fw	kg P eqv.	5.06E-06	8.68E-07	2.50E-05	0.00E+00	1.24E-07	0.00E+00	5.68E-09	1.01E-06
EP-m	kg N eqv.	1.06E-04	9.04E-05	4.80E-04	0.00E+00	1.66E-05	0.00E+00	1.03E-06	1.82E-05
EP-T	mol N eqv.	1.35E-03	1.02E-03	6.77E-03	0.00E+00	1.84E-04	0.00E+00	1.14E-05	2.14E-04
POCP	kg NMVOC eqv.	3.75E-04	2.80E-04	1.40E-03	0.00E+00	5.23E-05	0.00E+00	3.31E-06	1.16E-04
ADP-mm	kg Sb-eqv.	1.03E-07	9.42E-08	6.58E-07	0.00E+00	2.34E-08	0.00E+00	3.56E-10	5.92E-09
ADP-f	MJ	1.01E+00	5.88E-01	6.46E+00	0.00E+00	1.28E-01	0.00E+00	9.72E-03	2.18E-01
WDP	m3 world eqv.	1.66E-02	4.70E-03	8.41E-02	0.00E+00	9.14E-04	0.00E+00	4.30E-04	1.67E-03
Additional environmental impact indicators (EN 15804+A2)									
PM	disease incidence	1.79E-08	3.23E-09	1.51E-08	0.00E+00	7.51E-10	0.00E+00	5.86E-11	1.85E-09
IR	kBq U235 eqv.	5.22E-03	2.63E-03	2.62E-02	0.00E+00	5.46E-04	0.00E+00	4.02E-05	2.11E-04
ETP-fw	CTUe	5.06E-06	8.68E-07	2.50E-05	0.00E+00	1.24E-07	0.00E+00	5.68E-09	1.01E-06
HTP-c	CTUh	1.28E-09	1.90E-11	4.00E-10	0.00E+00	3.50E-12	0.00E+00	1.30E-13	1.16E-10
HTP-nc	CTUh	1.84E-09	5.40E-10	4.47E-09	0.00E+00	1.17E-10	0.00E+00	4.08E-12	7.18E-10
SQP	Pt	5.65E-01	4.47E-01	6.82E+00	0.00E+00	1.07E-01	0.00E+00	1.86E-02	4.51E-02

ADP-mm= Abiotic depletion potential for non-fossil resources | **ADP-f**=Abiotic depletion for fossil resources potential | **AP**= Acidification potential, Accumulated Exceedance | **EP-fw** = Eutrophication potential, fraction of nutrients reaching freshwater end compartment | **EP-m**= Eutrophication potential, fraction of nutrients reaching marine end compartment| **EP-T**= Eutrophication potential, Accumulated Exceedance | **GWP-b**=Global Warming Potential biogenic | **GWP-f**=Global Warming Potential fossil fuels | **GWP-luluc**=Global Warming Potential land use and land use change |**GWP-total**=Global Warming Potential total| **ODP**=Depletion potential of the stratospheric ozone layer |**POCP**=Formation potential of tropospheric ozone | **WDP**=Water (user) deprivation potential, deprivation- weighted water consumption | **ETP-fw**=Potential Comparative Toxic Unit for ecosystems | **HTP-c**=Potential Toxic Unit for Humans toxicity, cancer | **HTP-nc**= Potential Toxic Unit for humans, non-cancer | **IRP**=Potential Human exposure efficiency relative to U235, human health | **PM**=Potential incidence of disease due to Particulate Matter emissions | **SQP**=Potential soil quality index

LCA results - Indicators describing resource use and environmental information derived from life cycle inventory (LCI): 1 kg of hot rolled concrete reinforcing bars (EN 15804+A2)									
Parameter	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	9.47E-04	1.30E-02	8.25E-03	0.00E+00	1.34E-03	0.00E+00	7.95E-05	4.03E-03
PERM	MJ	2.20E-01	0.00E+00	2.55E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	2.21E-01	1.30E-02	2.55E+00	0.00E+00	1.34E-03	0.00E+00	7.95E-05	4.03E-03
PENRE	MJ	9.93E-03	6.24E-01	1.55E+00	0.00E+00	1.36E-01	0.00E+00	1.03E-02	2.30E-01
PENRM	MJ	1.06E+00	0.00E+00	5.29E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	1.07E+00	6.24E-01	6.84E+00	0.00E+00	1.36E-01	0.00E+00	1.03E-02	2.30E-01
SM	Kg	1.15E+00	0.00E+00	2.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	M3	6.45E-04	1.41E-04	2.40E-03	0.00E+00	2.42E-05	0.00E+00	1.01E-05	4.47E-05
HWD	Kg	1.25E-06	4.37E-07	2.05E-05	0.00E+00	8.16E-08	0.00E+00	6.50E-09	2.21E-06
NHWD	Kg	3.78E-02	2.91E-02	4.60E-02	0.00E+00	7.81E-03	0.00E+00	5.99E-02	9.01E-04
RWD	Kg	4.36E-06	3.90E-06	3.60E-05	0.00E+00	8.64E-07	0.00E+00	6.43E-08	2.71E-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	2.23E-01	0.00E+00	0.00E+00	1.14E+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	8.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.62E-05
EEE	MJ	0.00E+00	0.00E+00	5.08E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-05

PERE=Use of renewable primary energy excluding renewable primary energy resources used as raw materials | **PERM**= Use of renewable primary energy resources used as raw materials | **PERT**=Total use of renewable primary energy resources | **PENRE**= Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | **PENRM**= Use of non-renewable primary energy resources used as raw materials | **PENRT**= Total use of non-renewable primary energy resources | **SM**=Use of secondary material | **RSF**=Use of renewable secondary fuels | **NRSF**=Use of non-renewable secondary fuels | **FW**=Use of 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, thermical | **EE**=Exported energy, electrical

6. LCA: Interpretation

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

In Figure 1 shows the percentage shares of the various product life cycle phases in the environmental impacts.

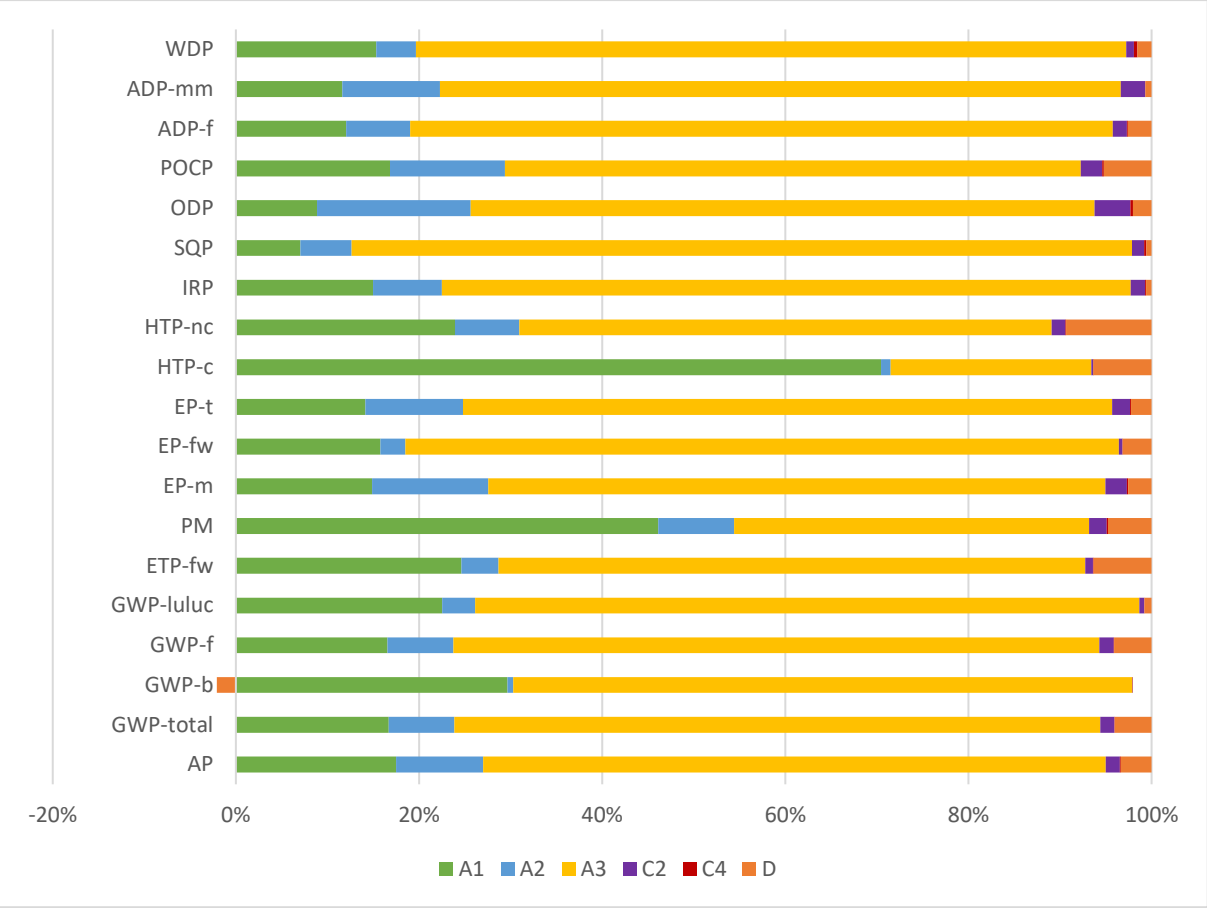


Figure 1 : Shares of the product life cycle phases in the environmental impact categories for categories hot rolled concrete reinforcing bars

It can be clearly seen that in almost all environmental impact categories, production A3 has the largest share, followed by raw material provision A1. The large share of production phase A3 is due to the high electricity consumption in steel production with an electric arc furnace (EAF).

The particularly large proportion of raw material provision A1 in human toxicity with the carcinogenic effect (HTP-c) is due to the alloying elements used and their high effects on human toxicity. However, as previously stated, the results of this environmental impact indicator must be used with caution, as the uncertainties in these results are high or because there is only limited experience with the indicator.

7. References

Ecoinvent 2019	Ecoinvent Database Version 3.6 (2019)
EN 15804	EN 15804:2012+A2:2019: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products
ISO 14025	ISO 14025:2010 Environmental labels and declarations — Type III environmental declarations — Principles and procedures
ISO 14040	ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework
ISO 14044	ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
NMD 2019	NMD STICHTING NATIONAL ENVIRONMENTAL DATABASE: Environmental Performance Assessment Method for Construction; 1.1 (March 2022); Rijswijk
PCR A	Kiwa-Ecobility Experts, Berlin, 2022: PCR A – General Program Category Rules for Construction Products from the EPD programme of Kiwa-Ecobility Experts; Version 2.1
PCR B	Kiwa-Ecobility Experts, Berlin, 2020: PCR B – Product Category Rules for steel construction products, Requirements on the Environmental Product Declarations for steel construction products; Version 2020-03-13 (draft)
R<THiNK 2023	R<THiNK; Online-EPD-Tool by NIBE B.V.
SimaPro Software	Industry data LCA library; website: https://simapro.com/databases/industry-data-lca-library/

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