Environmental Product Declaration

as per ISO 14025 and EN 15804+A2

Owner of the declaration:	SIA LSEZ RT metāls
Publisher:	Kiwa-Ecobility Experts
Program operator:	Kiwa-Ecobility Experts
Registration number:	EPD-RTMetals-255-EN
Issue date:	14.12.2022
Valid to:	14.12.2027

ZINC COATED STEEL STRUCTURES

1. General information

SIA LSEZ RT metāls

Programme operator

Kiwa-Ecobility Experts
Kiwa GmbH
Voltastr. 5
13355 Berlin
Germany

Declaration number

EPD-RTMetals-255-EN

This declaration is based on the Product Category Rules

PCR A – General Program Category Rules for Construction Products; version 2.1

PCR B – Product Category Rules for steel construction products, Requirements on the Environmental Product Declarations for steel construction products; version 2020-03-13 (draft)

Issue date

14.12.2022

Valid to

14.12.2027

Frank Huppertz
(Head of Kiwa-Ecobility Experts)

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

Zinc coated steel structures

Owner of the declaration

SIA LSEZ RT metāls
Laboratorijas iela 20-1
Liepāja, LV-3402
Latvia

Declared product / declared unit

1 kg of steel structures

Scope

The average EPD (type: Cradle to gate with options, modules C1-C4 and module D (A1-A4, C, D)) is based on LCA of the custom made zinc coated steel structures, manufactured in Liepāja, Latvia. This EPD contains results of two sub-types: zinc coated steel structures and zinc coated and additionally painted steel structures. The calculation is based on 1 kg of zinc coated steel structure with a share of 93,27% steel materials and zinc coated and painted steel structure with a share of 90,94% steel materials.

Kiwa-Ecobility Experts shall not be liable with respect to manufacturer information, life cycle assessment data and evidence.

Verification

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

Independent verification of the declaration and data according to ISO 14025:2011-10

☐internally ☒externally

Elisabet Amat Guasch
(External verifier)

2. Product

2.1 Company description

SIA LSEZ RT Metals was founded in 1999 and since then has grown to employ more than 130 people. The main areas of our activity include various elements of building load-bearing structures: columns, beams, bracings, trusses, welded profiles of complicated cross-section, as well as various auxiliary instalments, such as bridge elements, carports, etc.

2.2 Product description

Zinc coated or hot-dip galvanized steel structures are used in various areas of construction, for example construction of bridges, telecommunications towers, engineering, industrial and public buildings, as well as in the agriculture and energy industry. Hot-dip galvanizing is especially valued in objects that are located in an aggressive, corrosion-enhancing environment.The steel structures are manufactured according to EN 1090-2, up to EXC 4, and are CE marked.

UN CPC code: 421 Structural metal products and parts thereof.

2.3 Application

The area of application of zinc coated steel structure includes mostly outdoor residential and commercial construction elements, where high corrosion protection is needed (galvanized balconies, car ports, stairs, railings, balustrades, canopies, etc.), street furniture (fencing, walkways, gates), as well as various leisure, sport and playground elements (swings, football goals, railings, etc).

2.4 Technical Data

Technical Parameters – Zinc coated / zinc coated and additionally painted steel structures

Parameter	Value	Unit
Steel material	S235-S355 (according to EN 10025)	-
Execution Class (EN 1090)	Up to EXC 4	-
Zinc coating*	85 (required minimum average coating thickness on one side for steel >6mm as per EN 1461)	µm

** The hot dip galvanized coating is applied according to the requirements of EN ISO 1461. The life of the coating varies dependent on the exposure conditions and, for most situations can be estimated using EN ISO 14713-1.*

2.5 Placing on the market / Application rules

The steel structures are manufactured according to the requirements of the harmonized standard for steel structures EN 1090-1 (certification under system 2+). Welding processes are certified according to EN ISO 3834-2 standard. According to the Regulation (EU) No. 305/2011 Construction Products Regulation or CPR, the essential properties of products are declared in the CE marking and Declaration of Performance, which are delivered with the product.

Market: Europe. The Danish market is used for modelling A4.

2.6 Base materials

Base materials – Zinc coated steel structures

Name	Value	Unit
Steel material*	93,27	%
Welding consumables	0,73	%
Zinc coating**	6,00	%

*Note: * The steel delivered to SIA LSEZ RT metāls is an average of steel plates (9,33%), steel profiles (IPE profiles, INP profiles, HEB, HEA, UPE, U-profiles, UNP, angle bars; 55,96%), bars and hollow sections (flat bars, square bars, round bars, hollow sections; 27,98%); hot rolled steel, with secondary content 96,95%.*

*** According to the data of the zinc coating process supplier, a 100 kg metal structure after galvanizing weights 106 kg.*

Base materials – Zinc coated and additionally painted steel structures

Name	Value	Unit
Steel material*	90,94	%
Welding consumables	0,71	%
Zinc coating**	6,00	%
Coating/finishing (primer, paint)***	2,35	%

*Note: * The steel delivered to SIA LSEZ RT metāls is an average of steel plates (9,09%), steel profiles (IPE profiles, INP profiles, HEB, HEA, UPE, U-profiles, UNP, angle bars; 54,57%), bars and hollow sections (flat bars, square bars, round bars, hollow sections; 27,28%); hot rolled steel, with secondary content 96,95%.*

*** According to the data of the zinc coating process supplier, a 100 kg metal structure after galvanizing weights 106 kg.*

**** After zinc coating process, the products are additionally primed and painted.*

No dangerous substances from the candidate list of SVHC for Authorisation are used in the product.

2.7 Information on biogenic carbon content

Name	Value	Unit
Product	0,00E+00	kg C
Packaging	1,74E-02	kg C

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO2.

2.8 Manufacturing

The steel structures of industrial and civil objects are made according to the developed drawings. The manufacturing contains the following processes:

- Extraction and delivery of raw materials;
- Cutting;
- Assembling;
- Welding;
- Sand blasting;
- Coating (hot-dip galvanization (external treatment) and additional priming and painting);
- Storage;
- Transportation (delivery of finished products).

Since hot-dip galvanization is outsourced process, A1 for zinc layer does not include transportation. Transportation is included in A3 (incl. both ways).

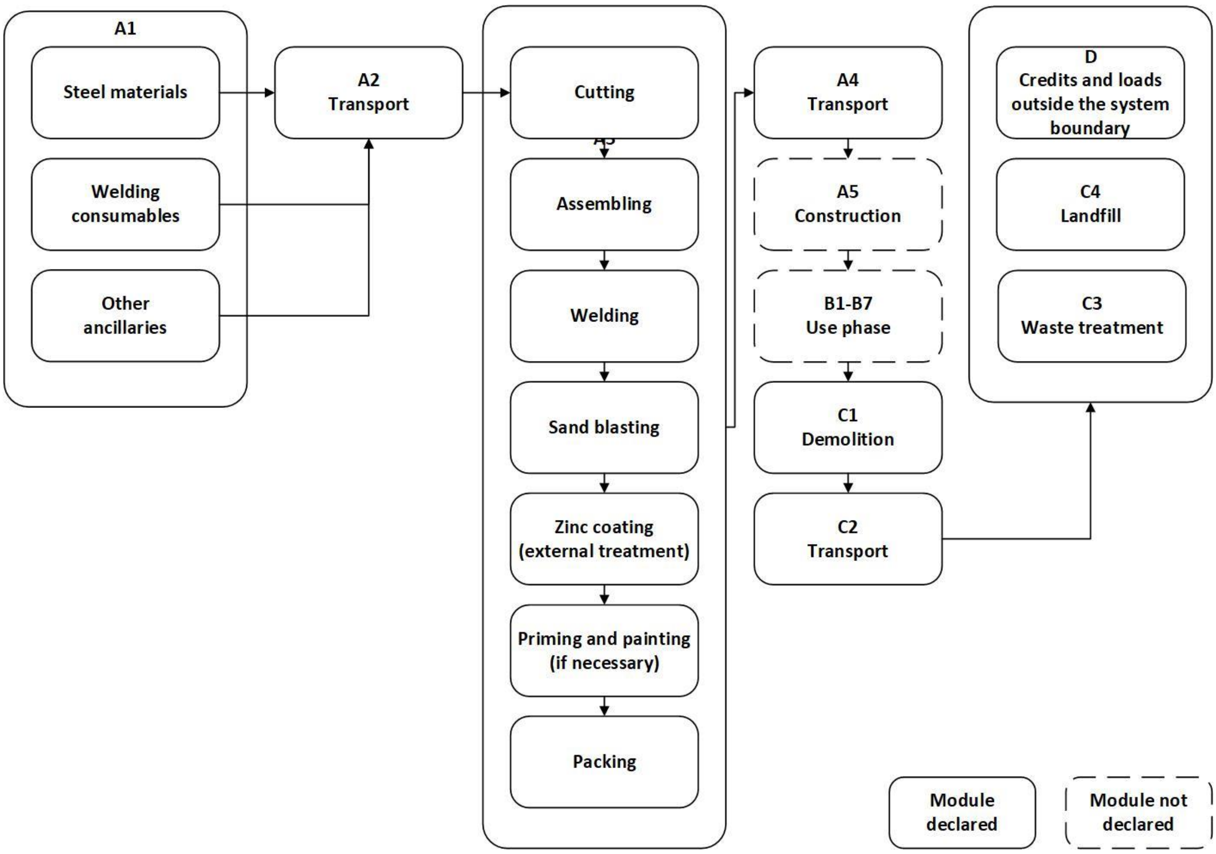

Figure 1: Overview of the production route of zinc coated steel structures (A1-A4, C1-C4, D)

2.9 Packaging

The packaging is based on wooden pallets, re-usable timber spacers/ beams and metal strips to tie the product. PE film is also used, rarely. The transportation does not cause any losses as products are secured properly. After use, packaging materials can be re-used or recycled.

2.10 Production waste

The data on generated production waste is recorded as accurately as possible. Thus, the generated production waste is allocated per declared unit.

3. LCA: Calculation rules

3.1 Declared unit

The EPD refers to the declared product system of 1 kg of zinc coated/ zinc coated and additionally painted steel structures. This declaration, including data collection and the modelled foreground system including results, represents the production of the steel structures in a production facility located in Liepāja, Latvia. Product specific data are based on average values collected in the period January 2021 to December 2021.

3.2 System boundary

This EPD was created in accordance with the requirements of EN 15804 and includes the production stage, transportation to the site and the End-of-life stage. According to EN 15804 this corresponds to product phases A1-A4, C1-C4 and D (EPD type "Cradle to gate with options, modules C1-C4 and module D" (A1-A3, C, D and additional module A4)).

In a typical steel structure manufacturing process, the individual components such as carbon steel materials (hot rolled steel plates, profiles, bars, sections), welding consumables, coating materials (primers, paints), and other ancillary materials are delivered to the production facility. All the raw materials are mainly delivered by inland transport, truck or rail. Until the materials are actually used in production, they are stored in the warehouse. The steel structures of industrial and civil objects are made according to the developed drawings. The processes that are performed at the production facility are: cutting of profiles and plates, assembly, welding, sand blasting, priming and painting of structures (paint layer depends on customer's requirements) and packing for a delivery. Hot-dip galvanization is external treatment process.

All inputs, including raw materials, primary products, energy, and auxiliary materials as well as the accumulated waste are considered in the assessment. The use of the final product is not within the manufacturer's sphere of influence. Therefore, modules B1-7 have not been considered.

Production stage

A1: This stage considers the extraction and processing of raw materials as well as energy consumption. All installed raw materials of the products were analysed, and the masses were determined. Steel material is given as a sum of different carbonsteel raw materials.

A2: The raw materials are transported to the manufacturing plant. In this case, the model includes relevant transportation of each raw material. Supplier information regarding the transport distances and vehicle type were provided by SIA RT metāls or chosen from relevant market profiles.

A3: This stage includes manufacturing of the products and packing. It also considers the energy consumption and waste generated at the manufacturing site. The national electricity mix of Latvia was taken into account. This stages also considers external treatment process and related transportation.

Assembly stage

A4: This stage includes transportation from the production stockyard to the construction site where the prefabricated product shall be installed. Basic scenario transportation from SIA RT metāls production site in Latvia to customer in Denmark, Copenhagen. The transportation does not cause any losses as products are secured properly.

Vehicle capacity utilization volume may vary, but since transportation emission in total results is small, the variation in load is assumed to be negligible and calculated as an average load factor. SIA RT metāls declares the vehicle type not less than EURO 5. Maritime transportation is done by ferry from Klaipeda terminal (Lithuania) to Karslhamn terminal (Denmark).

A5: Installation process is not declared. The packaging is not modelled in C-D modules as it is discarded in module A5 which is not declared.

End of life

C1: This module concerns the removal of a steel structure. The demolition process (C1) consumes energy in the form of diesel fuel used by building machines (e.g. lifting cranes, mobile rough terrain crane, forklift).

At the end-of-life, in the demolition phase 100% of the waste is assumed to be collected as separate construction waste.

C2: Transport module concerns transportation to waste processing. All of end-of-life product is assumed to be sent to the closest facilities (C2).

C3 and C4: Waste processing and final disposal are as following: Waste processing and final disposal are as following: 95% of the End-of-life product is sent to recycling (C3) and 5% is landfilled (C4).

D: Due to the recycling potential of the metal, the end-of-life product is mainly converted into recycled raw materials (D). Loads and benefits of recycling, re-use and exported energy are part of module D. The benefits are calculated based on the primary content and the primary equivalent.

All inputs including raw materials, primary products, energy and ancillary materials as well as the accumulated waste are considered in the assessment. The default End-of-life scenarios of the Annex to the NMD Determination method ver. 1.1 (March, 2022) have been used for the product and various materials of ancillaries.

The transportation to the construction site is overviewed based on the data provided by SIA RT metāls. The use of the final product is not within the manufacturer's sphere of influence. Therefore, modules B1-B7 have not been considered.

The reference year for collecting data is 2021 (01.2021 – 12.2021). The geographical reference area is Europe or Global and can be seen in the table System boundary.

3.3 Estimates and assumptions

All installed raw materials of the product were analysed, and the masses were determined following the allocation and cut-off requirements. Production-specific energy consumption was measured and provided by SIA RT metāls.

Since the production process is quite similar for all of the steel products produced at the manufacturing site, the energy consumption, ancillary materials, and production waste were appropriated according to the annual use of metal raw materials and then declared per 1 kg of the product. The total annual production data is recorded to a high standard of accuracy and precision.

The production waste is collected separately. As the product is marketed internationally, no country-specific waste scenario can be considered. Therefore, the waste scenarios of NMD (2022) were adopted.

3.4 Cut-off criteria

All material flows that contribute to more than 1% of the total mass, energy or environmental impact of the system have been considered in the LCA. It can be assumed that the neglected processes in total contributed less than 5% to the considered impact categories.

The product stage includes materials, energy and waste flows only related to production processes (e.g. energy and water use related to company management and sales activities are excluded where technically possible; production, manufacture, and construction of manufacturing capital goods and infrastructure, other processes which are not directly related to the production of steel structures).

3.5 Background Data

The Life Cycle Assessment was modelled with the R<THiNK software from NIBE. The background data is taken from Ecoinvent version 3.6 (2019) allocation, cut-off database. Geographical reference space of the background data is Europe or Global. Almost all consistent datasets contained in the Ecoinvent database is documented and can be viewed in the online Ecoinvent documentation. Allocation principles in the background are in compliance with the foreground. Specific information on allocations within the background data can be found in the Ecoinvent database version 3.6 (2019) document.

3.6 Data quality

In the operating data survey, all relevant process-specific data has been collected. The data relating to the manufacturing phase of the steel structures were determined by SIA RT metāls.

Secondary data was taken from the Ecoinvent 3.6 (2019) database. The database is regularly checked and thus complies with the requirements of ISO 14040/44 (background data is not older than 10 years). The background data meets the requirements of EN 15804.

The general rule has been followed that specific data from specific production processes or average data derived from specific processes must be given priority when calculating an EPD or Life Cycle Assessment. Data for processes that the manufacturer can not influence or choose, were backed up with generic data.

Environmental Product Declarations (EPDs) of raw materials (steel materials) were available but could not be integrated into this LCA as these EPDs were calculated according to the standard EN 15804:2014 (+A1) and not according to the standard EN 15804:2020 (+A2) used here.

3.7 Period Under review

All process-specific data was collected for the production year 2021. The quantities of raw and auxiliary materials as well as energy consumption, have been recorded and averaged over the entire operating year 2021.

3.8 Allocation

There are no co-products in the raw material supply phase, so no allocation methods were used at this stage. There are no allocations during the manufacturing phase at the plant.

3.9 Calculation methods

For life cycle assessment, the calculation methods described in ISO 14040 have been applied. The evaluation is based on the phases in the system boundaries.

3.10 Mix of electricity and CO_2-Certificates

The electricity mix was chosen according to the energy grid mix in Latvia (reference year 2019). No CO_2 certificates were counted.

3.11 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 considered.

3.12 Reference Service Life (RSL)

The reference service life for the steel structures is set at 50 years. It should be noted that the Use stage with modules B1-B5 is not declared.

4. LCA: Scenarios and additional technical information

Module A1: This stage considers the extraction and processing of raw materials as well as energy consumption. based on the information provided by the metal suppliers, it is assumed that the steel used for the zinc coated steel structures contains 96,95% of scrap.

Module A2: The raw materials are transported to the manufacturing site. In this case, the model includes transportation by relevant transportation type of each raw material.

Module A3: This stage includes manufacturing of products and packaging. It also considers the energy consumption, external treatment (outsourced processes of galvanization, including trasportation). All the energy consumption and waste generated at the production facility has been considered. Use of water is declared only for technological process (for the preparation of cooling emulsions); no waste scenario is assumed as no wastewater occurs. The data on generated production waste is also recorded separately for each waste flow as accurately as possible. Thus, the generated production waste is stated per declared unit.

Module A4: This stage includes transport from the production stockyard to the construction site where the prefabricated product shall be installed. Transportation is calculated based on data from manufacturer and a scenario with parameters described in the following table.

Transport from production place to the construction site (A4)

Parameter	Vehicle type	Distance
Truck	Lorry (Truck) >32t, EURO5 | market for (EU)*	302 km**
Maritime	Ship/ Transoceanic freight ship, containers*	405 km***

** Data for transport is calculated for an average load factor, including empty return trips*

*** Total distance by truck: from the manufacturing site (Liepaja, Latvia) to the terminal located in Klaipeda city, Lithuania (109 km) and from the port in Karslhamn, Denmark, to the construction site in Copenhagen, Denmark (193 km).*

**** Total distance by ship: Klaipeda – Karslhamn.*

Module A5: not declared.

Modules B1 to B7: not declared. In normal use scenario, it is assumed that no maintenance (B2), repair (B3), replacement (B4) and refurbishment (B5) are needed.

C1 concerns the deconstruction of a steel structure and includes energy in the form of diesel fuel used by building machines. According to Erlandsson, M. and Pettersson D., (2015) energy consumption of a demolition process is on the average 12 kWh/t.

At the End-of-life, C2 - C4 and D, it is assumed that steel material is separated after deconstruction. A waste scenario according to the Dutch National Environmental Database (NMD) is applied: Galvinised steel (i.a. profiles, sheets), where 95% of the end-of-life product is sent to recycling (C3) and 5% is landfilled (C4).

All end-of-life products are assumed to be sent to the closest facilities (C2).

Transport to waste processing (C2)

Parameter	Vehicle type	Distance
Truck*	Transport, freight, lorry, unspecified	Landfill:100 km; Incineration: 150 km; Recycling: 50 km; Re-Use: 0 km

** For all transports, the environmental profile of a non-specific truck transport was used (conservative assumption): The vehicle operates with diesel, and it provides a fleet average that includes different lorry classes as well as EURO classes. This transport used an average load factor, including empty return trips.*

End of life (C1, C3, C4) – Zinc coated/ zinc coated and painted steel structures

Name	Value	Unit
Collected separately waste type	1,00	kg
Collected as mixed construction waste	0,00	kg
Re-use	0,00	kg
Recycle	0,95	kg
Energy recovery	0,00	kg
Landfilling	0,05	kg

The scenarios included are currently in use and are the most representative scenarios. End of life treatment is based on current practices taking place in Europe.

Benefits and loads beyond the system boundary (D) – Zinc coated steel structures

Name	Value	Unit
Substitution of electricity	0,00	MJ
Substitution of thermal energy	0,00	MJ
Substitution of raw materials	0,09	kg

Benefits and loads beyond the system boundary (D) – Zinc coated and painted steel structures

Name	Value	Unit
Substitution of electricity	0,00	MJ
Substitution of thermal energy	0,00	MJ
Substitution of raw materials	0,10	kg

The benefits of avoided materials are calculated based on the primary content and the primary equivalent.

5. LCA: Results

This Life cycle assessment is made for EPD type "Cradle to gate with options, modules C1-C4 and module D". The Environmental Product Declaration analyses the Production stage (A1-A4), the End-of-life stage (C1-C4) and the Benefits and Loads beyond the system boundary (D).

System boundary description

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 manu-facturer to place of use	Construction-installation process	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	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X
Geography																
EU, GLO	EU, GLO	LV, EU	EU	-	-	-	-	-	-	-	-	EU	EU	EU	EU	EU, GLO
X=Module declared | MND=Module not declared																

All major materials, production energy use and waste are included for phases A1, A2, A3, A4, C1, C2, C3 and C4. Use stage B1-B7 is not relevant for this type of product and is not declared.

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 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.

The following tables show the results of the impact assessment indicators, resource use, waste and other output streams. The results presented refer to the declared average product.

Results of the LCA – Environmental impact: 1 kg of Zinc coated steel structures										
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Core environmental impact indicators (EN 15804)										
ADP-f	MJ	1,12E+01	3,58E+00	1,23E+01	4,90E-01	4,96E-02	1,07E-01	0,00E+00	1,20E-02	-4,67E-01
ADP-mm	kg Sb-eqv.	8,79E-06	6,02E-06	8,06E-03	5,12E-07	5,53E-09	1,80E-07	0,00E+00	3,94E-09	-6,10E-08
AP	mol H+ eqv.	3,48E-03	1,38E-03	6,49E-03	2,47E-04	3,77E-05	4,11E-05	0,00E+00	3,91E-06	-2,93E-04
EP-fw	kg P eqv.	4,12E-05	2,40E-06	5,22E-05	2,32E-07	1,31E-08	7,15E-08	0,00E+00	5,78E-09	-2,39E-06
EP-m	kg N eqv.	6,84E-04	4,86E-04	1,34E-03	6,72E-05	1,67E-05	1,45E-05	0,00E+00	1,44E-06	-5,95E-05
EP-T	mol N eqv.	7,85E-03	5,36E-03	1,61E-02	7,45E-04	1,83E-04	1,60E-04	0,00E+00	1,60E-05	-7,62E-04
GWP-b	kg CO2 eqv.	5,32E-03	1,10E-04	-7,24E-02	1,94E-05	1,00E-06	3,27E-06	0,00E+00	2,07E-05	1,46E-03
GWP-f	kg CO2 eqv.	6,87E-01	2,38E-01	8,29E-01	3,22E-02	3,61E-03	7,09E-03	0,00E+00	4,48E-04	-6,54E-02
GWP-luluc	kg CO2 eqv.	7,43E-04	8,71E-05	1,56E-03	1,10E-05	2,84E-07	2,60E-06	0,00E+00	1,26E-07	3,01E-05
GWP-total	kg CO2 eqv.	6,93E-01	2,38E-01	7,58E-01	3,23E-02	3,61E-03	7,09E-03	0,00E+00	4,69E-04	-6,39E-02
ODP	kg CFC 11 eqv.	7,12E-08	5,25E-08	1,09E-07	7,44E-09	7,79E-10	1,56E-09	0,00E+00	1,61E-10	-2,02E-09
POCP	kg NMVOC eqv.	2,93E-03	1,53E-03	4,14E-03	2,18E-04	5,02E-05	4,56E-05	0,00E+00	4,57E-06	-4,02E-04
WDP	m3 world eqv.	5,37E-01	1,28E-02	4,74E-01	1,50E-03	6,65E-05	3,82E-04	0,00E+00	5,66E-05	-1,23E-02
Additional environmental impact indicators (EN 15804)										
ETP-fw	CTUe	1,52E+01	3,20E+00	8,18E+01	3,83E-01	2,99E-02	9,53E-02	0,00E+00	5,80E-02	-2,59E+00
HTP-c	CTUh	9,80E-09	1,04E-10	4,10E-09	1,09E-11	1,05E-12	3,09E-12	0,00E+00	5,56E-13	-1,07E-11
HTP-nc	CTUh	2,87E-07	3,50E-09	1,25E-07	4,25E-10	2,57E-11	1,04E-10	0,00E+00	4,54E-11	1,22E-08
IR	kBq U235 eqv.	5,56E-02	1,50E-02	6,48E-02	2,14E-03	2,13E-04	4,48E-04	0,00E+00	5,99E-05	1,02E-03
PM	disease incidence	7,09E-08	2,14E-08	5,93E-08	2,68E-09	1,00E-09	6,37E-10	0,00E+00	8,05E-11	-4,33E-09
SQP	Pt	3,40E+00	3,11E+00	1,63E+01	5,11E-01	6,33E-03	9,27E-02	0,00E+00	2,94E-02	-2,00E+00

ADP-e=Depletion of abiotic resources-elements | **ADP-f**=Depletion of abiotic resources-fossil fuels | **AP**=Acidification of soil and water | **EP-fw** =Eutrophication, freshwater | **EP-m**=Eutrophication marine | **EP-T**=Eutrophication, terrestrial | **GWP-b**=Global warming potential - Biogenic | **GWP-f**=Global warming potential - Fossil | **GWP-luluc**=Global warming potential - Land use and land use change |**GWP-total**=Global warming potential |**ODP**=Ozone layer depletion |**POCP**=Photochemical oxidants creation | **WDP**=Water use | **ETP-fw**=Ecotoxicity, freshwater | **HTP-c**=Human toxicity, cancer | **HTP-nc**=Human toxicity, non-cancer | **IR**=Ionising radiation, human health | **PM**=Particulate Matter | **SQP**=Land use

Resource use and environmental information: 1 kg of Zinc coated steel structures										
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1,11E+00	4,49E-02	3,44E+00	5,88E-03	2,68E-04	1,34E-03	0,00E+00	5,95E-05	-3,71E-01
PERM	MJ	0,00E+00	0,00E+00	3,93E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-2,06E-02
PERT	MJ	1,11E+00	4,49E-02	3,83E+00	5,88E-03	2,68E-04	1,34E-03	0,00E+00	6,77E-04	-3,79E-01
PENRE	MJ	1,19E+01	3,81E+00	1,31E+01	5,21E-01	5,27E-02	1,13E-01	0,00E+00	7,82E-03	-2,97E-02
PENRM	MJ	0,00E+00	0,00E+00	2,24E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-2,93E-04
PENRT	MJ	1,19E+01	3,81E+00	1,31E+01	5,21E-01	5,27E-02	1,13E-01	0,00E+00	1,27E-02	-4,85E-01
SM	kg	9,08E-01	0,00E+00	1,09E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,70E-05
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	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	0,00E+00
FW	m3	1,60E-02	4,37E-04	1,49E-02	5,28E-05	2,55E-06	1,30E-05	0,00E+00	1,50E-05	-2,35E-04
HWD	kg	2,18E-05	9,11E-06	1,04E-03	1,11E-06	1,35E-07	2,71E-07	0,00E+00	1,48E-08	-7,71E-06
NHWD	kg	2,48E-01	2,27E-01	2,07E-01	3,84E-02	5,88E-05	6,78E-03	0,00E+00	5,01E-02	-6,82E-03
RWD	kg	5,10E-05	2,35E-05	5,78E-05	3,35E-06	3,45E-07	7,02E-07	0,00E+00	7,93E-08	2,62E-07
CRU	kg	0,00E+00	0,00E+00	1,14E-02	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	1,11E-01	0,00E+00	0,00E+00	0,00E+00	9,50E-01	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	0,00E+00
EE	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	1,75E-01
EET	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	1,11E-01
EEE	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	6,44E-02
Carbon Content	kg C	0,00E+00	0,00E+00	1,74E-02	0,00E+00	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 | **EE**=Exported energy | **EET**=Exported Energy Thermic | **EEE**=Exported Energy Electric

Results of the LCA – Environmental impact: 1 kg of Zinc coated and painted steel structures										
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Core environmental impact indicators (EN 15804)										
ADP-f	MJ	1,27E+01	3,56E+00	1,22E+01	4,90E-01	4,96E-02	1,07E-01	0,00E+00	1,20E-02	-6,54E-01
ADP-mm	kg Sb-eqv.	1,02E-05	5,98E-06	8,06E-03	5,12E-07	5,53E-09	1,80E-07	0,00E+00	3,94E-09	-7,73E-08
AP	mol H+ eqv.	3,96E-03	1,37E-03	6,44E-03	2,47E-04	3,77E-05	4,11E-05	0,00E+00	3,91E-06	-3,95E-04
EP-fw	kg P eqv.	4,37E-05	2,38E-06	5,20E-05	2,32E-07	1,31E-08	7,15E-08	0,00E+00	5,78E-09	-3,32E-06
EP-m	kg N eqv.	7,34E-04	4,82E-04	1,33E-03	6,72E-05	1,67E-05	1,45E-05	0,00E+00	1,44E-06	-7,85E-05
EP-T	mol N eqv.	8,41E-03	5,32E-03	1,60E-02	7,45E-04	1,83E-04	1,60E-04	0,00E+00	1,60E-05	-9,80E-04
GWP-b	kg CO2 eqv.	5,36E-03	1,09E-04	-7,28E-02	1,94E-05	1,00E-06	3,27E-06	0,00E+00	2,07E-05	1,75E-03
GWP-f	kg CO2 eqv.	7,57E-01	2,36E-01	8,21E-01	3,22E-02	3,61E-03	7,09E-03	0,00E+00	4,48E-04	-9,25E-02
GWP-luluc	kg CO2 eqv.	7,91E-04	8,66E-05	1,55E-03	1,10E-05	2,84E-07	2,60E-06	0,00E+00	1,26E-07	4,91E-05
GWP-total	kg CO2 eqv.	7,64E-01	2,36E-01	7,50E-01	3,23E-02	3,61E-03	7,09E-03	0,00E+00	4,69E-04	-9,07E-02
ODP	kg CFC 11 eqv.	8,30E-08	5,21E-08	1,08E-07	7,44E-09	7,79E-10	1,56E-09	0,00E+00	1,61E-10	-2,64E-09
POCP	kg NMVOC eqv.	3,17E-03	1,52E-03	4,10E-03	2,18E-04	5,02E-05	4,56E-05	0,00E+00	4,57E-06	-5,48E-04
WDP	m3 world eqv.	5,81E-01	1,27E-02	4,72E-01	1,50E-03	6,65E-05	3,82E-04	0,00E+00	5,66E-05	-1,74E-02
Additional environmental impact indicators (EN 15804)										
ETP-fw	CTUe	1,84E+01	3,18E+00	8,16E+01	3,83E-01	2,99E-02	9,53E-02	0,00E+00	5,80E-02	-3,46E+00
HTP-c	CTUh	9,68E-09	1,03E-10	4,05E-09	1,09E-11	1,05E-12	3,09E-12	0,00E+00	5,56E-13	-1,89E-11
HTP-nc	CTUh	2,83E-07	3,47E-09	1,23E-07	4,25E-10	2,57E-11	1,04E-10	0,00E+00	4,54E-11	1,71E-08
IR	kBq U235 eqv.	5,78E-02	1,49E-02	6,42E-02	2,14E-03	2,13E-04	4,48E-04	0,00E+00	5,99E-05	1,43E-03
PM	disease incidence	7,22E-08	2,12E-08	5,84E-08	2,68E-09	1,00E-09	6,37E-10	0,00E+00	8,05E-11	-5,81E-09
SQP	Pt	3,61E+00	3,09E+00	1,61E+01	5,11E-01	6,33E-03	9,27E-02	0,00E+00	2,94E-02	-2,04E+00

ADP-e=Depletion of abiotic resources-elements | **ADP-f**=Depletion of abiotic resources-fossil fuels | **AP**=Acidification of soil and water | **EP-fw** =Eutrophication, freshwater | **EP-m**=Eutrophication marine | **EP-T**=Eutrophication, terrestrial | **GWP-b**=Global warming potential - Biogenic | **GWP-f**=Global warming potential - Fossil | **GWP-luluc**=Global warming potential - Land use and land use change |**GWP-total**=Global warming potential |**ODP**=Ozone layer depletion |**POCP**=Photochemical oxidants creation | **WDP**=Water use | **ETP-fw**=Ecotoxicity, freshwater | **HTP-c**=Human toxicity, cancer | **HTP-nc**=Human toxicity, non-cancer | **IR**=Ionising radiation, human health | **PM**=Particulate Matter | **SQP**=Land use

Resource use and environmental information: 1 kg of Zinc coated and painted steel structures										
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1,17E+00	4,46E-02	3,40E+00	5,88E-03	2,68E-04	1,34E-03	0,00E+00	5,95E-05	-3,71E-01
PERM	MJ	0,00E+00	0,00E+00	3,93E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-2,06E-02
PERT	MJ	1,17E+00	4,46E-02	3,79E+00	5,88E-03	2,68E-04	1,34E-03	0,00E+00	6,77E-04	-3,74E-01
PENRE	MJ	1,29E+01	3,78E+00	1,30E+01	5,21E-01	5,27E-02	1,13E-01	0,00E+00	7,82E-03	-3,41E-02
PENRM	MJ	5,67E-01	0,00E+00	2,96E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-2,93E-04
PENRT	MJ	1,35E+01	3,78E+00	1,30E+01	5,21E-01	5,27E-02	1,13E-01	0,00E+00	1,27E-02	-6,66E-01
SM	kg	8,90E-01	0,00E+00	1,06E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,51E-05
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	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	0,00E+00
FW	m3	1,71E-02	4,34E-04	1,48E-02	5,28E-05	2,55E-06	1,30E-05	0,00E+00	1,50E-05	-3,27E-04
HWD	kg	2,15E-05	9,08E-06	1,04E-03	1,11E-06	1,35E-07	2,71E-07	0,00E+00	1,48E-08	-1,07E-05
NHWD	kg	2,53E-01	2,26E-01	2,04E-01	3,84E-02	5,88E-05	6,78E-03	0,00E+00	5,01E-02	-9,26E-03
RWD	kg	5,29E-05	2,34E-05	5,72E-05	3,35E-06	3,45E-07	7,02E-07	0,00E+00	7,93E-08	4,05E-07
CRU	kg	0,00E+00	0,00E+00	1,11E-02	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	1,07E-01	0,00E+00	0,00E+00	0,00E+00	9,50E-01	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	0,00E+00
EE	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	1,75E-01
EET	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	1,11E-01
EEE	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	6,44E-02
Carbon Content	kg C	0,00E+00	0,00E+00	1,74E-02	0,00E+00	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 | **EE**=Exported energy | **EET**=Exported Energy Thermic | **EEE**=Exported Energy Electric

6. LCA: Interpretation

The following figures shows the influence of the different life stages for the zinc coated and zinc coated and painted steel structures. The most of the environmental impact of declared unit is attributed to the raw material processing phase (A1), followed by the production including external treatment (A3) and transportation of the raw materials (A2).

Results of processing phase (A1) theoretically can be expected lower since the suppliers of the main raw material (steel materials) have calculated their own LCA and developed EPD, but these EPDs could not be used because of calculations according to the old version of the standard (EN 15804+A1), therefore secondary data had to be used. Potential credits come mainly from the material recovery.

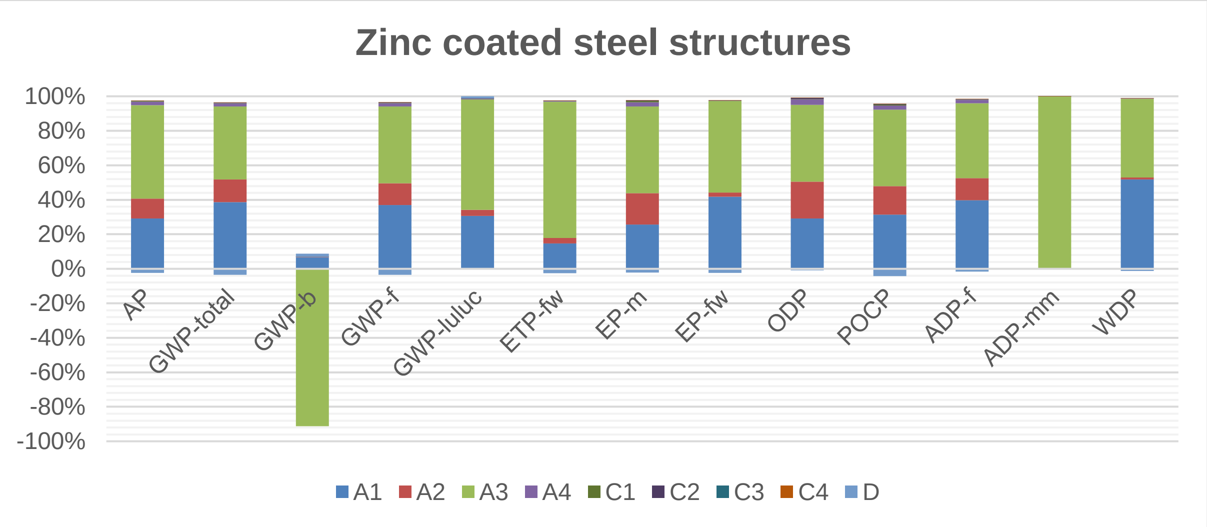

Figure 2: Influence of the modules A1 – A4, C1 - C4 and D on the analysed impact categories for Zinc coated steel structures

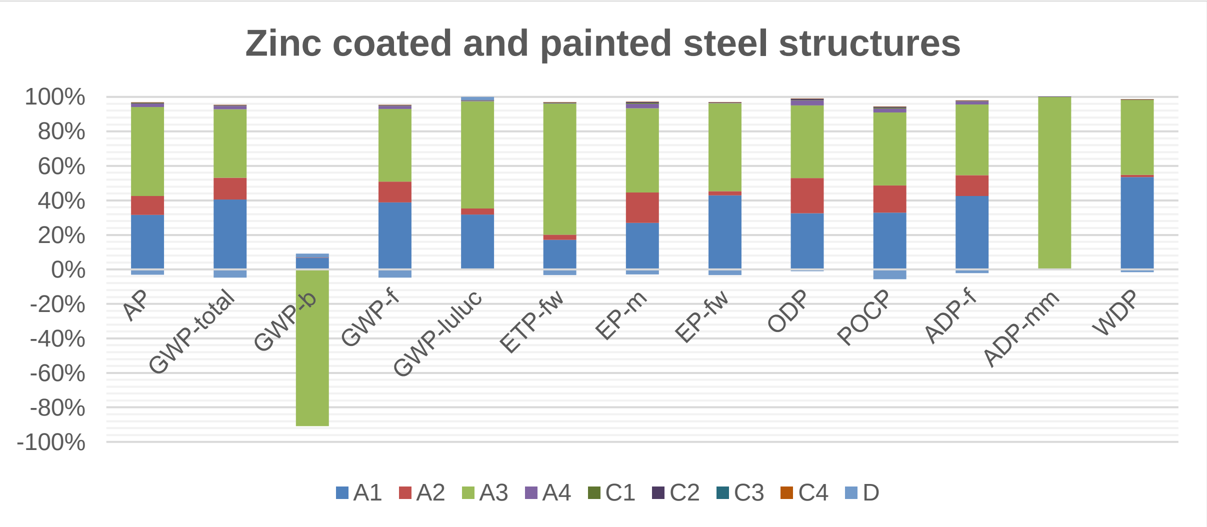

Figure 3: Influence of the modules A1 – A4, C1 - C4 and D on the analysed impact categories for Zinc coated steel structures

Overall, the quality of the data can be considered as good. The primary data collection has been done thoroughly. Data quality was calculated using the Data Quality Rating method according to the PEF approach. The DQRs range from 1,67 to 2,33 for the most abundant inputs in terms of mass.

7. Additional information: Norwegian requirements

Greenhouse gas emissions from the use of electricity mix in the manufacturing phase

National market mix with imports at medium voltage, including production of transfer lines and grid loss, have been applied for electricity in the production process (A3).

Data source	Amount	Unit
Ecoinvent 3.6 (year 2019)	0,526	CO2-eqv/kWh

Dangerous substances disclaimer

☒ The product contains no substances given by the REACH Candidate list or the Norwegian priority list.

☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.

☐ The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.

☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Indoor environment

The EPD does not give information on release of dangerous substances to indoor air because the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available.

The product contains no dangerous substances on the REACH Candidate list or the Norwegian priority list. Based on this it is assumed that the product has a negligible impact on the indoor environment.

Carbon footprint

In order to increase transparency in the biogenic carbon contribution to climate impact, the GWP indicator has been broken up into sub-indicators:

- GWP-IOBC: Climate impact calculated after the principle of immediate oxidation of biogenic carbon.
- GWP-BC: Climate impact from net absorbance and release of biogenic carbon from the materials in each module.

Climate impact – Zinc coated steel structures

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-IOBC	kg CO2 eqv.	1,76E+00	3,22E-02	3,61E-03	7,09E-03	0,00E+00	4,49E-04	-6,54E-02
GWP-BC	kg CO2 eqv.	-6,70E-02	1,94E-05	1,00E-06	3,27E-06	0,00E+00	2,07E-05	1,46E-03
GWP	kg CO2 eqv.	1,69E+00	3,23E-02	3,61E-03	7,09E-03	0,00E+00	4,69E-04	-6,39E-02

Climate impact – Zinc coated and painted steel structures

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-IOBC	kg CO2 eqv.	1,82E+00	3,22E-02	3,61E-03	7,09E-03	0,00E+00	4,49E-04	-9,25E-02
GWP-BC	kg CO2 eqv.	-6,74E-02	1,94E-05	1,00E-06	3,27E-06	0,00E+00	2,07E-05	1,75E-03
GWP	kg CO2 eqv.	1,75E+00	3,23E-02	3,61E-03	7,09E-03	0,00E+00	4,69E-04	-9,07E-02

8. References

ArcelorMittal Europe, 2019: Environmental Product Declaration of Structural steel sections and merchant bars, reference number EPD-ARM-20190015-CBD1-EN

CELSA Barcelona, S.L., 2021: Environmental Product Declaration of Structural steel section steel, reference number EPD-CEL-20200277-IBD1-EN

CML-IA, 2013: Characterisation factors developed by Institute of Environmental Sciences (CML): University Leiden (NL) – http://www.cml.leiden.edu/software/data-cmlia.html

Ecoinvent Database Version 3.6 (2019)

Erlandsson, M., Pettersson D., (2015): Klimatpaverkan for byggnader medolika energiprestandaer. IVL Svenska Miljoinstitutet.

European Commission Joint Research Centre Institute for Prospective Technological Studies (JCR), Seville, 2014: End-of-waste criteria for waste plastic for conversion

European Construction Sector Observatory, 2021: Country profile Denmark

International Zinc Association, 2022: Closing the Loop

International Zinc Association, 2022: Zinc Recycling. Material Supply

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

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)

NIBE, 2022: R<THiNK Online-EPD-Tool

Norwegian EPD foundation, Oslo, 2021: NPCR Part A Construction products and services, Version 2.0

Norwegian EPD foundation, Oslo, 2021: NPCR 013 Part B for steel and aluminium construction products, Version 4.0

OECD, 2019: Environmental Performance Reviews: Denmark. Waste, materials management and the circular economy

REACH Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), available at https://echa.europa.eu/candidate-list-table

Stichting National Environmental Database (NMD), Rijswijk, 2019: verification protocol - inclusion data in the Dutch environmental database

Stichting National Environmental Database (NMD), Rijswijk 2022: Environmental Performance Assessment Method for Construction Works, Version 1.1.

Stichting Bouwkwaliteit (SBK), Rijswijk, 2020: Assessment Method – Environmental Performance Construction and Civil Engineering Works (GWW), Version "3.0 January 2019" incl. amendments July 2019, Jan 2020

United Nations, New York, 2015: Central Product Classification (CPC), Version 2.1.

Standards

EN 15804:2014 (+A1), Sustainability of construction works – Environmental Product Declarations - Core rules for the product category of construction products

EN 15804:2020 (+A2), Sustainability of construction works – Environmental product declarations - Core rules for ,the product category of construction products

EN 16449:2014, Wood and wood-based products – Calculation of the biogenic carbon content of wood and conversion to carbon dioxide

ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures

ISO 14040:2006, Environmental management - Life cycle assessment - Principles and framework

ISO 14044:2006, Environmental management – Life cycle assessment – Requirements and guidelines

ISO 21930:2007, Sustainability in building construction – Environmental declaration of building products

	Publisher Kiwa - Ecobility Experts Kiwa GmbH Voltastr.5, 13355 Berlin Germany	Mail Web	DE.Ecobility.Experts@kiwa.com https://www.kiwa.com/de/de/uber-kiwa/ecobility-experts/
	Programme operator Kiwa - Ecobility Experts Kiwa GmbH Voltastr.5, 13355 Berlin Germany	Mail Web	DE.Ecobility.Experts@kiwa.com https://www.kiwa.com/de/de/uber-kiwa/ecobility-experts/
	Author of the Life Cycle Assessment Inspecta Latvia AS Skanstes iela 54a Riga, LV-1013 Latvia	Tel. Mail Web	+371 67 607 900 jekaterina.krastina@kiwa.com https://www.kiwa.com/lv
	Owner of the declaration SIA LSEZ RT metāls Laboratorijas iela 20-1 Liepāja, LV-3402 Latvia	Tel. Mail Web	+371 63 489 388 ah@rtmetals.lv http://www.rtmetals.lv

Kiwa-Ecobility Experts -
established member of