Environmental Product Declaration

as per ISO 14025 and EN 15804+A2

Owner of the declaration:	SIA BELMAST
Publisher:	Kiwa-Ecobility Experts
Program operator:	Kiwa-Ecobility Experts
Registration number:	EPD-BELMAST-278-EN
Issue date:	09.12.2022
Valid to:	09.12.2027

ZINC COATED STEEL STRUCTURES

1. General information

SIA BELMAST	Zinc coated steel structures
Programme operator Kiwa-Ecobility Experts Kiwa GmbH Voltastr. 5 13355 Berlin Germany	**Owner of the declaration** SIA BELMAST Višķu iela 21Z, Daugavpils LV-5410 Latvia
Registration number EPD-BELMAST-278-EN	**Declared product / declared unit** 1 kg of steel structures
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)	**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 galvinized steel structures, manufactured in Daugavpils, Latvia. The calculation is based on 1 kg of zinc coated steel structure with a share of 94,43% steel materials. Kiwa-Ecobility Experts shall not be liable with respect to manufacturer information, life cycle assessment data and evidence.
Issue date 09.12.2022	
Valid to 09.12.2027	
	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

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2. Product

2.1 Company description

SIA BELMAST was founded in 2000 and since then has grown to employ more than 150 people. The company actively develops steel frame and other structures manufacture for civil and industrial engineering.

2.2 Product description

Painted steel structures are customized construction components for many applications, including load-bearing and non-load bearing structures. The steel structures are manufactured according to EN 1090-2, up to EXC 3, and are CE marked.

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

2.3 Application

Zinc coated steel structures are used in various areas of construction, for example, construction of bridges, telecommunication towers, engineering, industrial and public buildings (incl. stairs, balcony, walkway, frames, gates etc.), as well as in the agriculture and energy industry. Hot-dip galvanizing is especially important on sites that are located in an aggressive, corrosion-enhancing environment.

2.4 Technical Data

Technical Parameters – Zinc coated steel structures

Parameter	Value	Unit
Steel material grades (main)	S355 (according to EN 10025)	-
Dimensions	Vary based on specific project requirements	-
Thickness of coating	45-85 (as per EN 1461)	µm

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+). 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.

Additional certifications: ISO 9001, ISO 14001.

Market: Europe. The Swedish and Finnish market is used for modelling A4.

2.6 Base materials

Base materials – Zinc coated steel structures

Name	Value	Unit
Steel material*	94,43	%
Welding consumables	0,57	%
Coating (primer, paint)	0,00	%
Zinc coating	5,00	%

*Note: *The steel delivered to SIA BELMAST is an average of 37% hollow sections, 17% plates and 46% beams (hot rolled steel, with secondary content 49,2%).*

*** According to the data of the zinc coating process supplier - a 100 kg metal structure after hot-dip galvanizing - weights approximately 105 kg. Since galvanization is outsourced process, A1 for zinc layer does not include transportation. Transportation is included in A3 (incl. both ways).*

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	1,02E-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;
- Zinc coating (external treatment);
- Storage;
- Transportation (delivery of finished products).

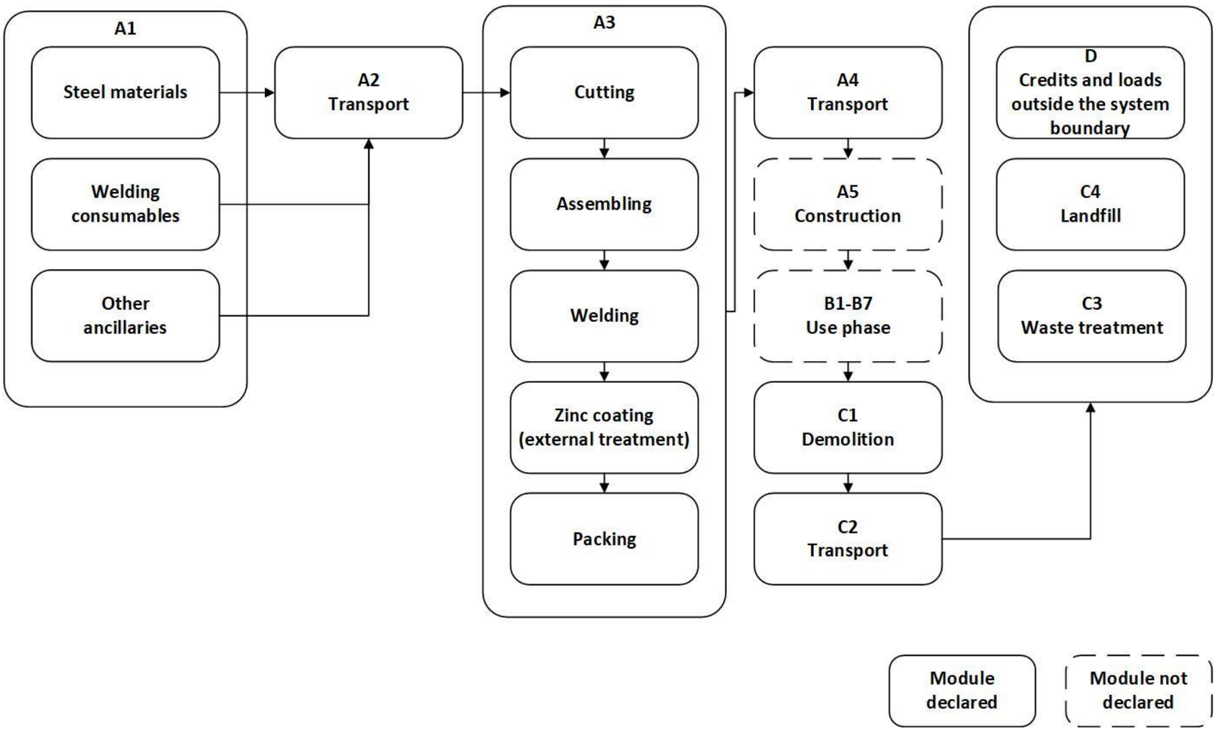

Figure 1: Overview of the production route of zinc coated steel structures (A1-A4, C1-C4, D)

2.9 Packaging

The packaging is based on wooden pallets, re-usable timber spacers/ beams, labels and PET strips to tie the product. PE film is also used, rarely. The transportation does not cause any losses as products are secured properly. The 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 has been 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 steel structure. 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 Daugavpils, 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 EN 15804 requirements 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, hot-dip galvanization (external treatment process) and packing for a delivery.

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 carbon steel 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 BELMAST 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.

Assembly stage

A4: This stage includes transportation from the production stockyard to the construction site where the prefabricated product shall be installed. Two basic scenarios for transportation from SIA BELMAST production facility in Latvia to customer in Stockholm, Sweden, and Helsinki, Finland. 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 BELMAST declares the vehicle type not less than EURO 6. Maritime transportation is done by ferry from Ventspils terminal (Latvia) or Tallinn terminal (Estonia).

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, during 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: 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 BELMAST. 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 BELMAST.

Since the production process is quite similar for all of the steel products produced, 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 has been 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 BELMAST.

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.

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 in the production facility.

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

EPD of construction products may not be comparable if they do not comply with the requirements of EN 15804. 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. It is assumed that the steel used for the painted steel structures consists of 49,3% scrap; conservative assumption.

Module A2: The raw materials are transported to the production facility. In this case, the model includes transportation by a 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, includes 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 the manufacturer and two basic scenarios with parameters described in the following tables.

Transport from production place to the construction site (A4) – Sweden scenario

Parameter	Vehicle type	Distance
Truck	Lorry (Truck) 16-32t, EURO6 | market for (EU)*	510 km**
Maritime	Ferry/ Transoceanic freight ship, containers*	283 km***

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

*** Total distance by truck: from the manufacturing site (Daugavpils, Latvia) to the terminal located in Ventspils, Latvia (450 km) and from the port in Nynashamn, Sweden, to the construction site in Stockholm, Sweden (60 km);*

**** Total distance by ferry: Ventspils – Nynashamn.*

Transport from production place to the construction site (A4) – Finland scenario

Parameter	Vehicle type	Distance
Truck	Lorry (Truck) 16-32t, EURO6 | market for (EU)*	510 km**
Maritime	Ferry/ Transoceanic freight ship, containers*	82 km***

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

*** Total distance by truck: from the manufacturing site (Daugavpils, Latvia) to the terminal located in Tallinn, Estonia (500 km) and from the port in Helsinki, Finland, to the construction site in Helsinki, Finland (10 km);*

**** Total distance by ferry: Tallinn – Helsinki.*

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.

Module C1: This stage 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 materials are 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)

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)

Name	Value	Unit
Substitution of electricity	0,00	MJ
Substitution of thermal energy	0,00	MJ
Substitution of raw materials	0,51	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

<table>
<tr><th colspan="17">Description of the system boundary</th></tr>
<tr><td colspan="3">Product stage</td><td colspan="2">Construction process stage</td><td colspan="7">Use stage</td><td colspan="4">End of life stage</td><td>Benefits and loads beyond the system boundaries</td></tr>
<tr><td>Raw material supply</td><td>Transport</td><td>Manufacturing</td><td>Transport from manu-facturer to place of use</td><td>Construction-installation process</td><td>Use</td><td>Maintenance</td><td>Repair</td><td>Replacement</td><td>Refurbishment</td><td>Operational energy use</td><td>Operational water use</td><td>De-construction / demolition</td><td>Transport</td><td>Waste processing</td><td>Disposal</td><td>Reuse-Recovery-Recycling-potential</td></tr>
<tr><td>A1</td><td>A2</td><td>A3</td><td>A4</td><td>A5</td><td>B1</td><td>B2</td><td>B3</td><td>B4</td><td>B5</td><td>B6</td><td>B7</td><td>C1</td><td>C2</td><td>C3</td><td>C4</td><td>D</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>MND</td><td>MND</td><td>MND</td><td>MND</td><td>MND</td><td>MND</td><td>MND</td><td>MND</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td colspan="17">Geography</td></tr>
<tr><td>EU, GLO</td><td>EU, GLO</td><td>LV, EU</td><td>EU</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>EU</td><td>EU</td><td>EU</td><td>EU</td><td>EU, GLO</td></tr>
<tr><td colspan="17">X=Module declared | MND=Module not declared</td></tr>
</table>

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.

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.

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.

Results of the LCA – Environmental impact: 1 kg of Zinc coated steel structure										
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4 SWE**	**A4 FIN**	**C1**	**C2**	**C3**	**C4**	**D**
Core environmental impact indicators (EN 15804+A2)											
ADP-f	MJ	2,09E+01	3,23E+00	1,13E+01	1,31E+00	1,29E+00	4,96E-02	1,07E-01	0,00E+00	1,20E-02	-4,97E+00
ADP-mm	kg Sb-eqv.	2,82E-05	5,42E-06	6,72E-03	2,37E-06	2,36E-06	5,53E-09	1,80E-07	0,00E+00	3,94E-09	-4,93E-07
AP	mol H+ eqv.	9,16E-03	1,24E-03	5,63E-03	3,00E-04	2,61E-04	3,77E-05	4,11E-05	0,00E+00	3,91E-06	-2,77E-03
EP-fw	kg P eqv.	1,08E-04	2,16E-06	4,86E-05	6,89E-07	6,83E-07	1,31E-08	7,15E-08	0,00E+00	5,78E-09	-2,51E-05
EP-m	kg N eqv.	1,90E-03	4,37E-04	1,14E-03	6,08E-05	5,20E-05	1,67E-05	1,45E-05	0,00E+00	1,44E-06	-5,18E-04
EP-T	mol N eqv.	2,03E-02	4,82E-03	1,35E-02	6,80E-04	5,82E-04	1,83E-04	1,60E-04	0,00E+00	1,60E-05	-6,10E-03
GWP-b	kg CO2 eqv.	2,33E-03	9,88E-05	-5,12E-02	4,48E-05	4,55E-05	1,00E-06	3,27E-06	0,00E+00	2,07E-05	7,99E-03
GWP-f	kg CO2 eqv.	1,81E+00	2,14E-01	7,73E-01	8,70E-02	8,57E-02	3,61E-03	7,09E-03	0,00E+00	4,48E-04	-7,11E-01
GWP-luluc	kg CO2 eqv.	1,25E-03	7,84E-05	1,41E-03	3,19E-05	3,08E-05	2,84E-07	2,60E-06	0,00E+00	1,26E-07	5,11E-04
GWP-total	kg CO2 eqv.	1,81E+00	2,14E-01	7,23E-01	8,71E-02	8,58E-02	3,61E-03	7,09E-03	0,00E+00	4,69E-04	-7,02E-01
ODP	kg CFC 11 eqv.	1,13E-07	4,72E-08	9,69E-08	1,97E-08	1,95E-08	7,79E-10	1,56E-09	0,00E+00	1,61E-10	-1,77E-08
POCP	kg NMVOC eqv.	8,66E-03	1,38E-03	3,47E-03	2,44E-04	2,18E-04	5,02E-05	4,56E-05	0,00E+00	4,57E-06	-4,06E-03
WDP	m3 world eqv.	5,86E-01	1,15E-02	3,94E-01	3,69E-03	3,66E-03	6,65E-05	3,82E-04	0,00E+00	5,66E-05	-1,35E-01
Additional environmental impact indicators (EN 15804)											
ETP-fw	CTUe	7,60E+01	2,88E+00	7,19E+01	1,05E+00	1,04E+00	2,99E-02	9,53E-02	0,00E+00	5,80E-02	-2,41E+01
HTP-c	CTUh	1,51E-08	9,34E-11	4,19E-09	3,01E-11	2,92E-11	1,05E-12	3,09E-12	0,00E+00	5,56E-13	-9,37E-11
HTP-nc	CTUh	1,78E-07	3,15E-09	1,10E-07	1,11E-09	1,10E-09	2,57E-11	1,04E-10	0,00E+00	4,54E-11	1,37E-07
IR	kBq U235 eqv.	5,44E-02	1,35E-02	5,50E-02	5,73E-03	5,66E-03	2,13E-04	4,48E-04	0,00E+00	5,99E-05	1,21E-02
PM	disease incidence	1,64E-07	1,93E-08	4,77E-08	5,48E-09	5,44E-09	1,00E-09	6,37E-10	0,00E+00	8,05E-11	-4,16E-08
SQP	Pt	6,68E+00	2,80E+00	1,11E+01	9,04E-01	9,01E-01	6,33E-03	9,27E-02	0,00E+00	2,94E-02	-2,54E+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 SWE**	**A4 FIN**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1,86E+00	4,04E-02	2,05E+00	1,86E-02	1,85E-02	2,68E-04	1,34E-03	0,00E+00	5,95E-05	-2,85E-01
PERM	MJ	0,00E+00	0,00E+00	3,05E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-1,57E-02
PERT	MJ	1,86E+00	4,04E-02	2,37E+00	1,86E-02	1,85E-02	2,68E-04	1,34E-03	0,00E+00	6,77E-04	-1,55E-01
PENRE	MJ	2,22E+01	3,43E+00	1,27E+01	1,39E+00	1,37E+00	5,27E-02	1,13E-01	0,00E+00	7,82E-03	-9,98E-02
PENRM	MJ	0,00E+00	0,00E+00	3,50E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-2,93E-04
PENRT	MJ	2,22E+01	3,43E+00	1,21E+01	1,39E+00	1,37E+00	5,27E-02	1,13E-01	0,00E+00	1,27E-02	-5,16E+00
SM	kg	4,68E-01	0,00E+00	5,65E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,12E-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	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	0,00E+00
FW	m3	1,85E-02	3,93E-04	1,27E-02	1,39E-04	1,38E-04	2,55E-06	1,30E-05	0,00E+00	1,50E-05	-2,57E-03
HWD	kg	9,86E-05	8,19E-06	8,63E-04	3,40E-06	3,38E-06	1,35E-07	2,71E-07	0,00E+00	1,48E-08	-8,51E-05
NHWD	kg	7,16E-01	2,05E-01	2,28E-01	6,27E-02	6,26E-02	5,88E-05	6,78E-03	0,00E+00	5,01E-02	-6,99E-02
RWD	kg	5,17E-05	2,12E-05	4,83E-05	8,94E-06	8,82E-06	3,45E-07	7,02E-07	0,00E+00	7,93E-08	4,11E-06
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	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	1,14E-01	0,00E+00	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	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	0,00E+00	1,35E-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	0,00E+00	8,53E-02
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	0,00E+00	4,96E-02
Carbon Content	kg C	0,00E+00	0,00E+00	1,02E-02	0,00E+00	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 figure shows the influence of the different life stages for the zin coated steel structures. The results are shown with A4 transportation to construction site in Stockholm, Sweden. 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). Potential credits come mainly from the material recovery.

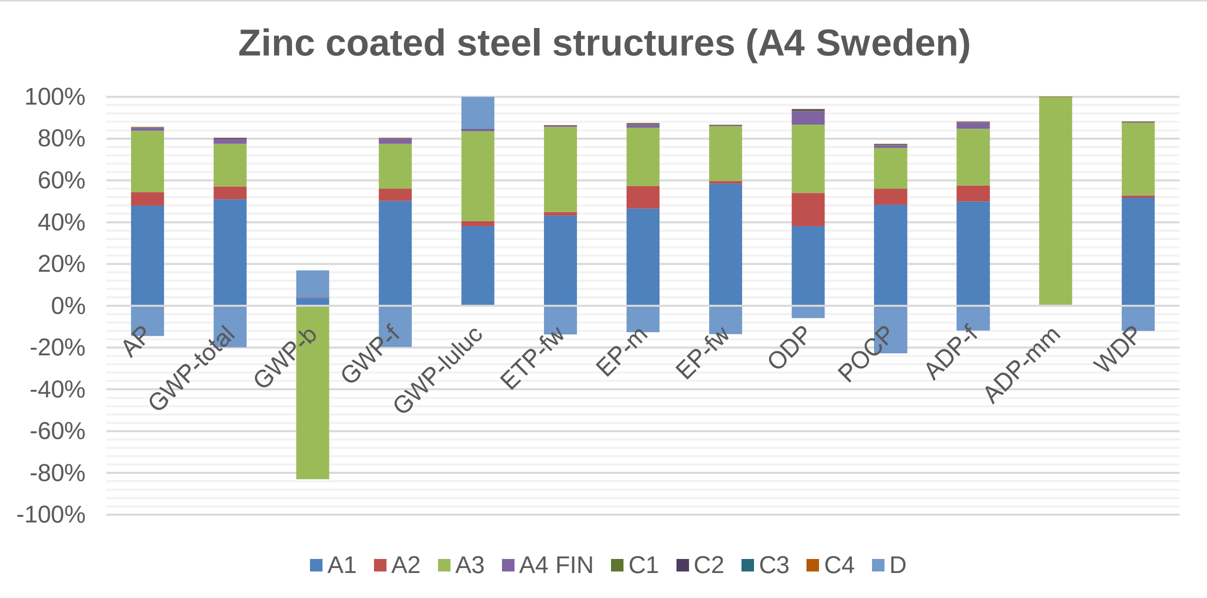

Figure 2: Influence of the modules on the environmental core indicators

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 2,67 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

Parameter	Unit	A1-A3	A4 SWE	A4 FIN	C1	C2	C3	C4	D
GWP-IOBC	kg CO2 eqv.	2,80E+00	8,71E-02	8,57E-02	3,61E-03	7,09E-03	0,00E+00	4,49E-04	-7,10E-01
GWP-BC	kg CO2 eqv.	-4,87E-02	4,48E-05	4,55E-05	1,00E-06	3,27E-06	0,00E+00	2,07E-05	7,99E-03
GWP	kg CO2 eqv.	2,75E+00	8,71E-02	8,58E-02	3,61E-03	7,09E-03	0,00E+00	4,69E-04	-7,02E-01

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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

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