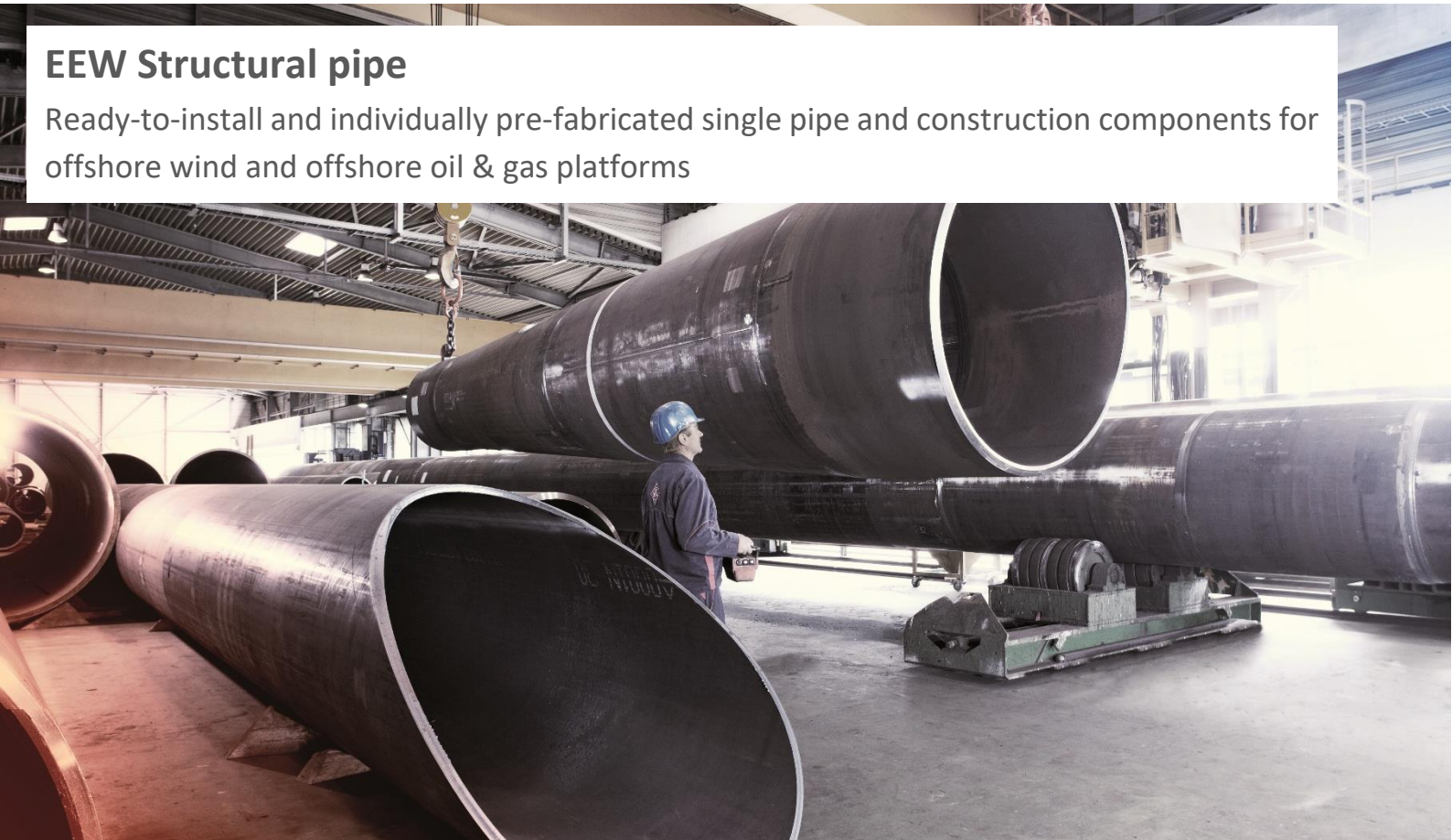
Environmental Product Declaration

as per ISO 14025 and EN 15804

Owner of the declaration:	EEW Pipe Production Erndtebrueck GmbH & Co. KG
Publisher:	Kiwa-Ecobility Experts
Programme operator:	Kiwa-Ecobility Experts
Registration number:	EPD-EEW-251-EN
Issue date:	17.11.2022
Valid to:	17.11.2027



EEW Structural pipe

Ready-to-install and individually pre-fabricated single pipe and construction components for offshore wind and offshore oil & gas platforms

1. General information

Erntdebrücker Eisenwerk (EEW)

Programme operator
Kiwa-Ecobility Experts
Voltastr. 5
13355 Berlin
Germany

Registration number
EPD-EEW-251-EN

This declaration is based on the Product Category Rules
PCR B – construction steel products (Edition 2020-03-13 (draft)) construction steel products (Edition 2020-03-13 (draft))

Issue date
17.11.2022

Valid to
17.11.2027

Frank Huppertz
(Head of Kiwa-Ecobility Experts)

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

Structural pipe

Owner of the declaration
EEW Pipe Production
Erndtebrueck GmbH & Co. KG
Im Günewald 2
57339 Erndtebrück
Germany

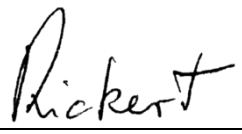
Declared product / declared unit
1 metric ton structural pipe

Scope
Structural pipe is a ready-to-install and individually pre-fabricated single pipe used in offshore wind or offshore oil & gas platforms. It is produced and distributed by EEW PPE GmbH & Co. KG, located in Erntebrück (Germany). The EPD refers to the specific Product.
EPD type: Cradle to gate with modules A4 and A5, modules C1-C4, and module D.
Kiwa-Ecobility Experts shall not be liable with respect to manufacturer information, life cycle assessment data, and evidence.

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

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

☐internal ☒external



Julian Rickert
(Third party verifier)

2. Product

2.1 Product description

The structural pipes from EEW are ready-to-install and individually pre-fabricated single pipes. This is an updated EPD for the structural pipe. The previous EPD was published in December 2020. The main differences versus previous versions are presented in the table below.

Items	Previous EPD	This EPD
version of the EN 15804 standard	EN 15804:2012+A1:2013	EN 15804:2012+A2:2019
Included modules	A1-A3 + C2+C4 + D	A1-A5 + C1-C4+ D
Database version	Ecoinvent 3.5	Ecoinvent 3.6
GWP (A1-A3)	2,22E+03 (Kg CO_2 Equiv)	2,12E+03 (Kg CO_2 Equiv)

2.2 Application

Structural pipe is used in offshore wind or offshore oil & gas platforms.

2.3 Technical data

The technical data is listed in the table below. The values for the unit weight depend on the product type and its corresponding tensile strength. For this reason, only the value ranges for structural pipes are given here.

Name	Value/Tolerance	Unit
Diameter range	406 – 2438	mm
Length range	1200 – 38.000	mm
Wall thickness range	9.5 – 100	mm
Steel Grade DIN EN 10025-2	S355J2+N	
Weight Range	500 – 100.000	kg
Production route (EAF or BOF)	100% BOF	-
Tensile strength	490 – 630	Pa
Yield strength	275 – 345	Pa

2.4 Placing on the market/ Application rules

Structural pipes are marketed worldwide. After the final inspection, the structural pipes are ready to be shipped. No average transport distances could be determined, as the logistics are sometimes organized by the customer and sometimes by EEW. A frequent shipment is transported by railway to Rotterdam port and distributed world-wildly.

2.5 Base materials / Ancillary materials

EEW structural pipes are manufactured from Heavy plate (Material S355). S355 steel is low-carbon steel whose specifications offer high yield strength.

Raw material	Unit	Value
Heavy plate, Material S355 Base material according to EN 10225, EN 10025, or EN 10204 in various grades (unalloyed steel)	100	%

There is no biogenic carbon in the products.

The Product does not contain substances from the "Candidate list of substances of very high concern for authorisation" (SVHC).

2.6 Manufacturing

The manufacturing is located at Erndtebrueck GmbH & Co. KG (EEW) in Grünewald 2, 57339, Erndtebrück, Germany. The production of structural pipes comprises the following process steps and is shown in the following figure:

1. Incoming goods - unload sheet metal, incoming goods inspection; Sheet storage
2. Weld seam preparation - milling or burning sheet edge
3. Bend sheet edge: pre-bending of the prepared sheets
4. Forming sheet: Final bending of the bent sheets to form a raw tube preform
5. Tack welding: Closing the open ends of the tube blank with a tack weld
6. Welding inside weld seam: UP Internal welding of the pipe
7. Milling tack weld: Milling of the outer tacking seam
8. Welding outer weld seam: UP external welding of the pipe
9. Calibrate pipe: Calibration of the finished welded tube
10. None destructive testing
11. Final inspection and marking
12. Pipe storage; Loading for shipment

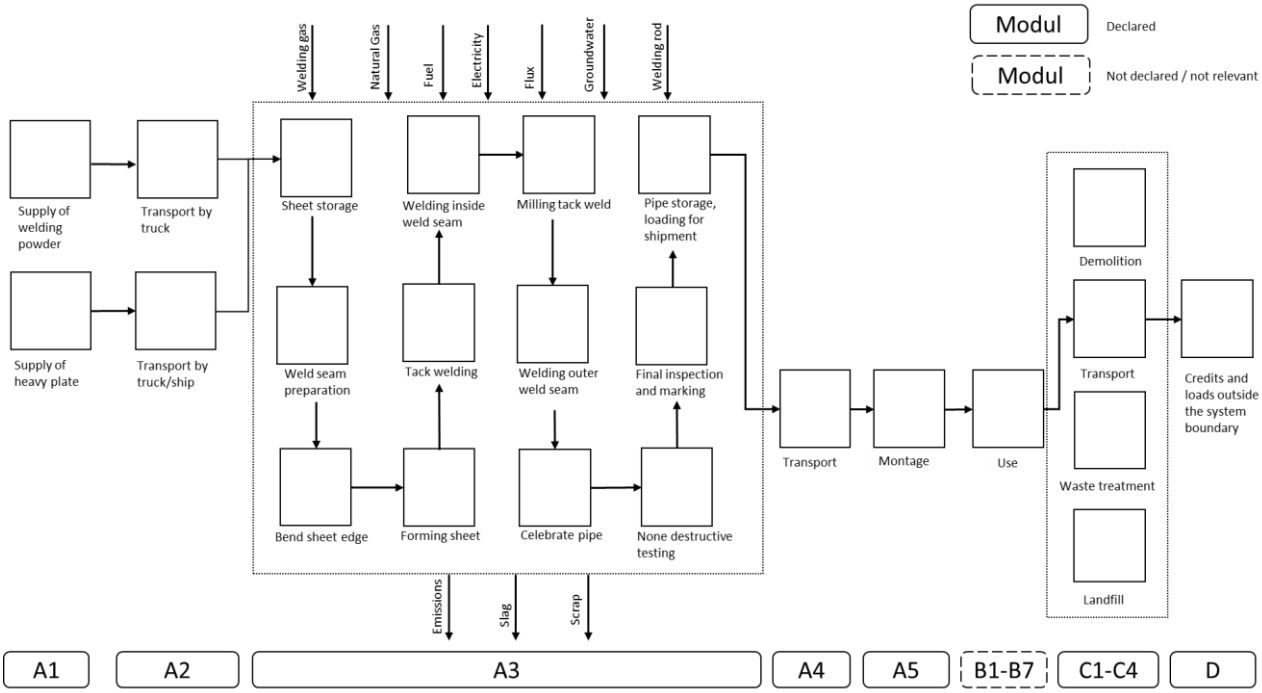


Figure 1: Process flow chart of the production of EEW Structural pipe

2.7 Packaging

There is no packaging used for this product. Only load securing - square timbers, wooden wedges, rubber mats, and tension belts are used.

2.8 Reference Service Life (RSL)

The RSL of the construction will limit the lifetime of structural pipes. Under these circumstances, no RSL can be declared according to the relevant ISO standards and EN 15804.

2.9 Other Information

For further information on structural pipes, please visit the official EEW Pipe Production Erndtebrueck GmbH & Co. KG webpage under the following link: https://eew-group.com/

3. LCA: Calculation rules

3.1 Declared unit

In accordance with PCR B, one metric ton structural pipe is chosen as the declared unit.

Product	Unit	Value
Declared Unit	metric ton structural pipe	1
Conversion factor to 1 kg	-	1000

3.2 System boundary

The Environmental Product Declaration is a complete life cycle with a functional unit. It considers all potential environmental impacts of the product from the cradle to the factory gate with options. In addition to the production stage A1-A3, the A4 (transport to customer), A5 (installation), and the end-of-life stage (C1-C4 & D) are considered

The manufacturing phase includes the production or extraction of the source materials, the transport to the respective production plant, and the production of the structural pipes. All inputs (raw materials, precursors, energy, and auxiliary materials), as well as the by-products and waste, are considered for all life cycle phases.

The year 2019 represents the time reference for raw materials and electricity consumption. By defining the scenarios (transport from the production site to Rotterdam and the choice of end-of-life scenarios) according to specifications of the Dutch Environmental Database (NMD), the Netherlands is the relevant geographical reference for this EPD. Due to manufacturing in Erndtebrück (Module A1-A3), the exact geographical reference area is Germany, but it can also be considered representative of the reference area of Europe. Environmental effects such as the greenhouse effect can occur with a substantial spatial and temporal offset.

The following production steps are considered during the production phase:

- Raw material supply (A1)
- Transport of raw materials (A2)
- Energy supply for manufacturing (A3)
- Ancillary materials (A3)
- Production waste – transport and waste treatment (A3)
- Transport to the construction site (A4)
- The installation process (A5)
- De-Construction(C1)
- End-of-Life: Transport waste (C2)
- End-of-Life: Waste treatment (C3)
- End-of-Life: Disposal (C4)
- End-of-Life: Benefits and loads beyond the system boundary (D)

Secondary fuels are not included in the production process and are therefore not considered. The waste materials and quantities produced are included in the respective modules.

3.3 Estimates and assumptions

Almost all datasets chosen for the LCA refer to the EU as the geographic reference. Transport distances for all raw materials (raw materials, operating materials, packaging) could be recorded. A payload

factor of 50% was used for all truck transports (suppliers, disposal transports, and internal transports), which corresponds to a full delivery and empty return trip. A data set for a non-specific truck was used. The energy and material consumptions are average values and refer to the year 2019. The Erndtebrück site also processes other steel products. Measured in terms of output, construction pipes account for 27 percent of mass production.

The total amount of waste products generated, including slag, dust, and scrap, was reported at 18,4 kg per ton of product. The proportions of these three waste products are used as a reference value for calculating the raw material production waste amount.

$$p_{production\ waste\ amount\ (\%)} = \frac{m_{waste,raw\ material}}{m_{raw\ material}}$$

As a result, in the following report, overall, 1.84% of the product is considered waste during production.

Structural pipes are marketed worldwide. No average transport distances could be determined, as the logistics are sometimes organized by the customer and sometimes by EEW. After consultation with EEW's logistics department, frequent transport was chosen as a representative transport route (A4): Erndtebrück – Rotterdam (300 km) by railway.

For installation (A5), a self-propelled jack-up barge, 600 ton, 2x engines 310 liters/hr (steaming) for one day (24 hr) with 1x generator 88 liters/hr (standby) for 12 hr was assumed to work based on literature.

No CO_2 certificates were considered.

3.4 Cut-off criteria

All flows that influence is higher than 1% on the total mass, energy, or environmental impact are included in the LCA. All process-specific data could be determined and modelled by generic data (Ecoinvent 3.6).

3.5 Period under review

The production data have been collected for the operating year 2019.

3.6 Data quality

For all processes, primary data was collected and provided by EEW. The primary data refers to the year 2019. For the data, which the manufacturer does not influence, generic data was used. The secondary data was taken from the database Ecoinvent (version 3.6). The database is maintained regularly and thus meets the requirements of EN 15804 (background data not older than 10 years). The electricity mix for the production of structural pipe was chosen according to the geographical reference area (Germany) and time reference. Based on Ecoivnent, the dataset has been extrapolated from the year 2017 to the year of the calculation (2019). As only the conventional electricity mix is used, no other energy sources were considered. The data quality is good because all process-specific data can be documented and modeled using generic data.

ReTHiNK EPD web application from the company NIBE was used to model the life cycle for the production and disposal of the declared product systems. To ensure that the results are comparable, consistent background data from the international database Ecoinvent was used in the LCA (e.g., data records on energy, transport, auxiliary materials, and supplies). Almost all consistent data sets contained in the Ecoinvent database are documented and can be viewed online.

3.7 Allocation

There are no co-products in the raw material supply phase, so no allocation methods were used at this stage. Construction pipes (A3) account for 27% of total output by mass. This proportion is taken into account in the use of operating materials, process energy, and infrastructure (lighting and heating).

3.8 Comparability

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

4. LCA: Scenarios and additional technical information

The distance to the construction site (A4) was calculated according to the NMD (Nationale Milieu Database (Dutch National Environmental Database)) method. Accordingly, the distance between the production site in Erndtebrück and Rotterdam was considered (300 km) by railway.

It is assumed that no activities for maintenance, repair, transport and replacement, refurbishment, or other material and energy flows take place during the RSL. Modules B1 to B7 are therefore assumed to be zero.

Due to a high life expectancy and the fact that EEW is not responsible for this, there is no company data available on the material recovery of installed structural pipes. However, since there is a high potential for recycling and reusing structural steel pipe, this solution remains an attractive possibility. So, it is assumed that removal will be performed in the same manner as installation, a self-propelled jack-up barge, 600 ton, 2x engines 310 liters/hr (steaming) for one day (24 hr) with 1x generator 88 liters/hr (standby) for 12 hr, with the addition of an oxy-fuel cutting operation are stated for module C1 (demolition).
For the calculation of end-of-life, the standard waste scenario for steel, permanent (100yr) sheet piles placed in soil/marine water was followed based on the "national milieu databank" (NMD ID 90). This defines the waste scenario as 63.2% recycling and 36.8% to be left.

Note: The transport distances of the waste are based on the standard waste scenarios of the NMD Determination Method (SBK 2019): incineration 150 km/ recycling 50 km/landfill 100 km; vehicle: truck, unspecific. For energy recovery, it is assumed that only fossil raw materials are substituted, considering the calorific values of the raw materials of the declared product and energy and thermal efficiencies of 18% and 32%. According to EN 15804, loads are credited in A3 or C3 to C4, and benefits are credited in module D.

For all road transports, the environmental profile of a non-specific truck transport was used (conservative assumption): The vehicle operates with diesel and provides a fleet average that includes different lorry classes and EURO classes. This environmental profile contains data for transport, which is calculated for an average load factor, including empty return trips (Ecoinvent 3.6).

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 specific product.

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 are also not measured by this indicator.

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	Manu-facturing	Transport from manu-facturer to place of use	Construction-installation process	Use	Main-tenance	Repair	Replacement	Refur-bishmen	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	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X
X=Module declared | MND=Module not declared																

Results of the LCA – Environmental impact: 1 m^2 Structural pipe (EN 15804+A2)											
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Core environmental impact indicators											
ADP-mm	kg Sb-eqv.	9,40E-03	5,12E-04	6,55E-04	1,13E-04	1,34E-04	1,37E-04	1,08E-04	0,00E+00	1,73E-05	1,81E-05
ADP-f	MJ	2,17E+04	4,34E+02	1,59E+03	2,07E+02	1,20E+03	1,21E+03	6,43E+01	0,00E+00	5,30E+01	-3,99E+03
AP	mol H^+ eqv.	8,82E+00	2,04E-01	3,48E-01	1,20E-01	9,11E-01	9,14E-01	2,47E-02	0,00E+00	1,80E-02	-2,34E+00
EP-fw	kg PO_4 eqv.	9,61E-02	7,11E-04	1,32E-02	5,95E-04	3,17E-04	3,79E-04	4,30E-05	0,00E+00	2,12E-05	-2,06E-02
EP-m	kg N eqv.	1,73E+00	7,18E-02	6,48E-02	4,21E-02	4,02E-01	4,02E-01	8,72E-03	0,00E+00	6,19E-03	-4,27E-01
EP-t	mol N eqv.	1,90E+01	7,94E-01	8,62E-01	4,67E-01	4,41E+00	4,42E+00	9,61E-02	0,00E+00	6,82E-02	-5,06E+00
GWP-b	kg CO_2 eqv.	-4,94E+00	8,18E-02	6,43E+00	8,06E-02	2,42E-02	4,20E-02	1,97E-03	0,00E+00	3,76E-03	7,25E+00
GWP-f	kg CO_2 eqv.	2,08E+03	2,91E+01	1,13E+02	1,41E+01	8,71E+01	8,77E+01	4,26E+00	0,00E+00	1,90E+00	-6,19E+02
GWP-luluc	kg CO_2 eqv.	6,81E-01	2,13E-02	1,32E-01	1,67E-02	6,86E-03	8,22E-03	1,56E-03	0,00E+00	5,28E-04	5,77E-01
GWP-total	kg CO_2 eqv.	2,08E+03	2,92E+01	1,20E+02	1,42E+01	8,71E+01	8,77E+01	4,27E+00	0,00E+00	1,90E+00	-6,12E+02
ODP	kg CFC 11 eqv.	1,10E-04	5,34E-06	6,70E-06	1,93E-06	1,88E-05	1,89E-05	9,41E-07	0,00E+00	7,81E-07	-1,25E-05
POCP	kg NMVOC eqv.	1,02E+01	2,21E-01	2,20E-01	1,27E-01	1,21E+00	1,21E+00	2,74E-02	0,00E+00	1,98E-02	-3,60E+00
WDP	m^3 world eqv.	6,62E+02	2,56E+00	1,59E+01	1,83E+00	1,61E+00	2,62E+00	2,30E-01	0,00E+00	2,38E+00	-1,20E+02
Additional environmental impact indicators											
ETP-fw	CTUe	5,98E+04	4,21E+02	1,50E+03	2,21E+02	7,22E+02	7,30E+02	5,74E+01	0,00E+00	3,44E+01	-2,11E+04
HTP-c	CTUh	1,03E-05	1,95E-08	2,99E-07	1,35E-08	2,52E-08	2,54E-08	1,86E-09	0,00E+00	7,95E-10	5,14E-07
HTP-nc	CTUh	6,94E-05	4,65E-07	7,71E-06	2,48E-07	6,20E-07	6,26E-07	6,27E-08	0,00E+00	2,44E-08	1,47E-04
IRP	kBq U235 eqv.	4,22E+01	2,08E+00	5,06E+00	1,16E+00	5,14E+00	5,24E+00	2,69E-01	0,00E+00	2,17E-01	1,44E+01
PM	disease incidence	1,71E-04	2,42E-06	3,64E-06	1,05E-06	2,41E-05	2,41E-05	3,84E-07	0,00E+00	3,50E-07	-3,26E-05
SQP	-	5,44E+03	3,42E+02	3,12E+02	1,42E+02	1,53E+02	1,56E+02	5,58E+01	0,00E+00	1,11E+02	-8,30E+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

Results of the LCA – Resource and environmental information: 1 m² Structural pipe (EN 15804+A2)											
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	9,63E+02	1,95E+01	1,66E+02	1,78E+01	6,48E+00	8,54E+00	8,05E-01	0,00E+00	4,29E-01	1,95E+02
PERM	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
PERT	MJ	9,63E+02	1,95E+01	1,66E+02	1,78E+01	6,48E+00	8,54E+00	8,05E-01	0,00E+00	4,29E-01	1,95E+02
PENRE	MJ	2,30E+04	4,60E+02	1,71E+03	2,19E+02	1,27E+03	1,29E+03	6,83E+01	0,00E+00	5,63E+01	-4,12E+03
PENRM	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
PENRT	MJ	2,30E+04	4,60E+02	1,71E+03	2,19E+02	1,27E+03	1,29E+03	6,83E+01	0,00E+00	5,63E+01	-4,12E+03
SM	Kg	1,80E+02	0,00E+00	6,53E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,16E+01
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	1,79E+01	1,19E-01	8,51E-01	9,70E-02	6,17E-02	9,22E-02	7,83E-03	0,00E+00	5,66E-02	-2,07E+00
HWD	Kg	1,71E-01	9,86E-04	1,37E-03	4,01E-04	3,26E-03	3,27E-03	1,63E-04	0,00E+00	7,92E-05	-7,81E-02
NHWD	Kg	3,64E+02	1,80E+01	1,49E+01	2,78E+00	1,42E+00	1,46E+00	4,08E+00	0,00E+00	3,60E+02	-5,24E+01
RWD	Kg	4,40E-02	2,76E-03	5,78E-03	1,27E-03	8,32E-03	8,41E-03	4,22E-04	0,00E+00	3,48E-04	6,35E-03
CRU	Kg	0,00E+00	0,00E+00	9,20E-01	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	2,32E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,32E+02	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	0,00E+00

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 reuse | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EE**=Exported energy

Results of the LCA – Environmental impact, optional: 1 m² Structural pipe (Set 1 of the NMD determination method (version 1.0; July 2020))											
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
ADP-e	Kg Sb	9,40E-03	5,12E-04	6,55E-04	1,13E-04	1,34E-04	1,37E-04	1,08E-04	0,00E+00	1,73E-05	1,81E-05
ADP-f	Kg Sb	1,36E+01	2,04E-01	8,34E-01	9,42E-02	5,68E-01	5,73E-01	3,11E-02	0,00E+00	2,53E-02	-3,49E+00
GWP	Kg CO2 eqv.	1,98E+03	2,88E+01	1,13E+02	1,39E+01	8,62E+01	8,68E+01	4,23E+00	0,00E+00	1,86E+00	-5,76E+02
ODP	Kg CFC-11 eqv.	1,18E-04	4,42E-06	7,15E-06	1,72E-06	1,49E-05	1,50E-05	7,50E-07	0,00E+00	6,20E-07	-1,80E-05
POCP	Kg Ethene eqv.	3,24E+00	1,87E-02	3,70E-02	9,85E-03	8,77E-02	8,80E-02	2,55E-03	0,00E+00	1,98E-03	-1,31E+00
AP	Kg SO2 eqv.	7,22E+00	1,54E-01	2,73E-01	9,02E-02	6,49E-01	6,52E-01	1,86E-02	0,00E+00	1,36E-02	-1,91E+00
EP	Kg PO43- eqv.	9,68E-01	2,97E-02	7,03E-02	1,72E-02	1,48E-01	1,48E-01	3,65E-03	0,00E+00	2,62E-03	-2,20E-01
HTP	kg 1.4 DB	1,21E+03	1,23E+01	5,45E+01	6,02E+00	3,19E+01	3,20E+01	1,78E+00	0,00E+00	8,41E-01	-3,58E+02
FAETP	kg 1.4 DB	1,32E+01	2,79E-01	8,80E-01	9,01E-02	4,44E-01	4,47E-01	5,20E-02	0,00E+00	2,00E-02	5,90E+00
MAETP	kg 1.4 DB	3,36E+04	1,03E+03	2,43E+03	3,49E+02	1,54E+03	1,56E+03	1,87E+02	0,00E+00	7,14E+01	6,21E+03
TETP	kg 1.4 DB	3,45E+00	5,33E-02	1,61E+00	3,20E-02	5,25E-02	5,41E-02	6,29E-03	0,00E+00	2,11E-03	3,62E+01
ADP-e= Abiotic depletion potential for elements | **ADP-f**= Abiotic depletion for fossil resources potential | **GWP**=Global Warming Potential | **ODP**=Depletion potential of the stratospheric ozone layer | **POCP**= Formation potential of tropospheric ozone | **AP**= Acidification potential, Accumulated Exceedance | **EP**= Eutrophication potential, Accumulated Exceedance | **HTP**= human-toxicological effects | **FAETP**= ecotoxicological effects, aquatic (freshwater) | **MAETP**= ecotoxicological effects, aquatic (marine water) | **TETP**= ecotoxicological effects, terrestrial											

6. LCA: Interpretation

The following figure shows the impact categories for 1 ton of the structural pipe. As shown in Figure 3, A1 (raw material supply) dominates most environmental core indicators. The primary raw material, heavy plate, significantly affects the product's environmental life cycle impacts. The second highest impact comes from using diesel for a self-propelled jack-up barge for installation (A5) and demolition (C1). In general, structural steels have the potential for recycling. As a result, D has a credit outside of the production system based on the waste scenario. Transports (A2, A4, C2) have rather a minor impact within all core indicators.

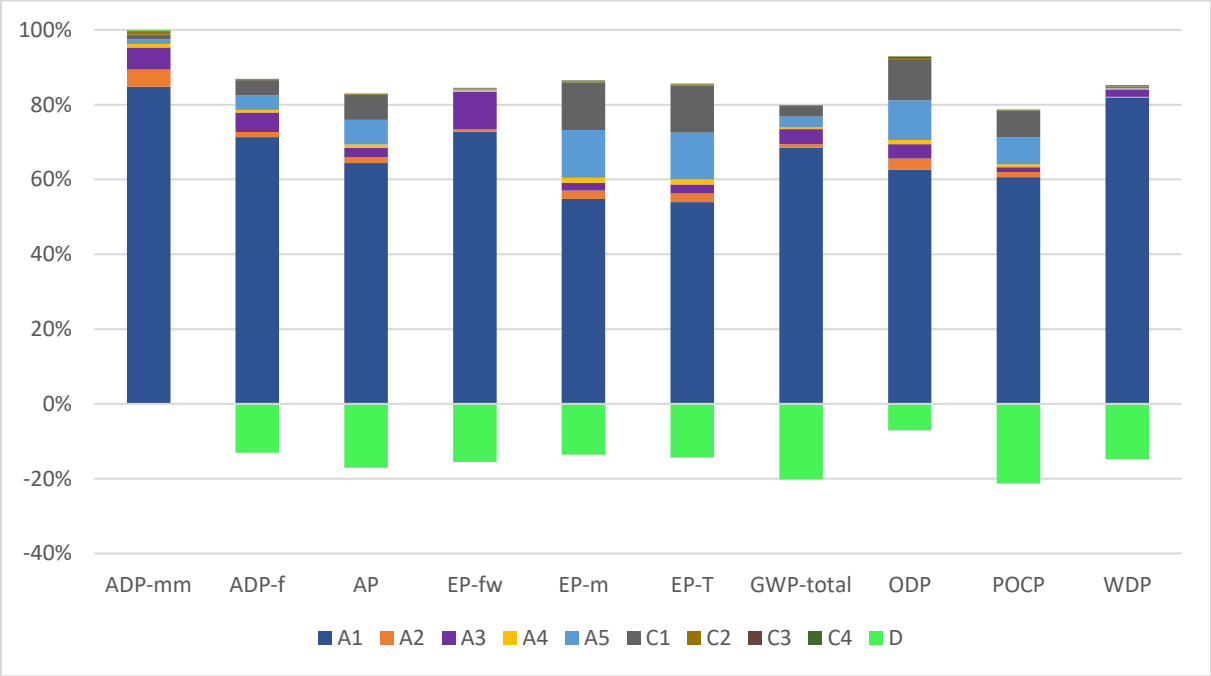


Figure: Structural pipe - Impact of the individual modules on the environmental core indicators (NMD set 1+2)

The MKI (Dutch: Milieukostenindicator) value is 300.2 for (A1-C4) based on the NMD Determination method v 1.0 (July 2020) set1+2.

The data quality can be classified as good overall. All relevant process-specific data could be collected in the operational data collection. Consistent data sets from the Ecoinvent database (version 3.6) were available for almost all inputs and outputs. The background data meet the requirements of EN 15804, and the production data were recorded for the 2019 operating year. The quantities of raw materials and supplies used as well as energy consumption were recorded for the entire operating year.

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ISO 14025:2006: Environmental labels and declarations — Type III environmental declarations — Principles and procedures EN 13249

EN 15804:2012+A2:2019 Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR A: General Program Category Rules for Construction Products from the EPD program Kiwa-Ecobility Experts, R.0_2021-07-16

PCR B: PCR B - Requirements on the Environmental Product Declarations for construction steel products (Edition 2020-03-13 (draft)

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