ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A1*

Owner of the Declaration	ERCIYAS Steel Pipe Co.
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-ERC-20200034-IBC1-EN
Issue date	03.12.2020
Valid to	02.12.2025

Steel Pipe

ERCIYAS Steel Pipe Co.

Institut Bauen und Umwelt e.V.

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1. General Information

ERCIYAS Steel Pipe Co.	Steel Pipe
Programme holder IBU – Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the declaration** ERCIYAS Steel Pipe Co. D-100 Karayolu Kirazlı Köyü Mevkii No: 29 81100 Merkez Düzce / TURKEY
Declaration number EPD-ERC-20200034-IBC1-EN	**Declared product / declared unit** 1 metric tonne of an average steel pipe
This declaration is based on the product category rules: Steel pipes for pressure applications, 05.2016 (PCR checked and approved by the SVR)	**Scope:** Within this study a life cycle analysis according to /ISO14040/44/ is performed for 1 metric tonne steel pipe for oil&gas and water pipelines manufactures by Erciyas Steel Pipe Co. at the production plant in Duzce, Turkey.This EPD is a group of EPD which representing life cycle analysis of bare steel pipe, polyethylene coated steel pipe, polyurethane coated steel pipe, polypropylene coated steel pipe, fusion bonded epoxy coated steel pipe, epoxy coated steel pipe, concrete coated steel pipe. In this EPD, separate modeling is made for each product. As the deviation in the results is less than 10%, the vertical averaging approach is applied. Result tables were added by getting an arithmetic average of 7 product results.
Issue date 03.12.2020	The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences. The EPD was created according to the specifications of *EN 15804+A1*. In the following, the standard will be simplified as *EN 15804*.
Valid to 02.12.2025	**Verification** The standard *EN 15804* serves as the core PCR Independent verification of the declaration and data according to *ISO 14025:2010* ☐ internally ☒ externally
Dipl. Ing. Hans Peters (chairman of Institut Bauen und Umwelt e.V.)	
Dr. Alexander Röder (Managing Director Institut Bauen und Umwelt e.V.))	Christina Bocher (Independent verifier appointed by SVR)

2. Product

2.1 Product description/Product definition

Steel pipe represents non-coated and coated steel pipes as a group name in this study. Non-coated and Coated Steel pipes as shown in below.

1. Bare Steel Pipe (Non-Coated Steel Pipe)
2. Polyethylene Coated Steel Pipe
3. Polyurethane Coated Steel Pipe
4. Polypropylene Coated Steel Pipe
5. Fusion Bonded Epoxy Coated Steel Pipe
6. Epoxy Coated Steel Pipe
7. Concrete Coated Steel Pipe

Steel pipe for water pipelines involves pipes made of non-alloyed and low-alloyed structural steel and finegrained steel which can feature cement-based linings and/or polyolefin coatings.

For the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) Regulation (EU) No. 305/2011 (CPR) applies.
The products need a Declaration of Performance taking into consideration *EN 10224:2002+A1:2005: Non-Alloy steel tubes and fittings for the conveyance of water and other aqueous liquids - Technical delivery conditions* and the CE-marking.
For the application and use the respective national provisions apply.

2.2 Application

Steel pipe for water pipelines is used for transporting aqueous media such as waste water, service water,

cooling water, salt water, brines and possibly drinking water. Steel pipes for oil and gas pipelines are used for conveying and transporting liquid and gaseous products under internal pressure.

2.3 Technical Data

Steel pipe for oil/gas pipelines is produced in compliance with /EN ISO 3183:2019/ and *API 5L:2018*, and steel pipe for water pipelines is produced in compliance with *EN 10219-1:2006*, *EN 10217-1:2019*, EN *10224:2002+A1:2005*, *ASTM A 252:2019*.
Depends on the usage area and need, the following coatings are applied to the steel pipes for oil/gas and water pipelines.

- PE covering for oil/gas pipelines in compliance with *DIN 30670*
- PE covering for water pipelines in compliance with *EN ISO 21809-1*
- PU covering for oil/gas pipelines in compliance with EN 10290
- PU covering for water pipelines in compliance with *AWWA C 222*
- PP covering for oil/gas pipelines in compliance with *DIN 30678:2013*
- FBE covering for oil/gas pipelines in compliance with *EN ISO 21809-2*
- Epoxy covering for oil/gas pipelines in compliance with *EN 10289*
- Epoxy covering for water pipelines in compliance with *AWWA C 210*
- Concrete covering for oil/gas pipelines in compliance with *EN 10289*
- Concrete covering for water pipelines in compliance with *AWWA C 205*

Constructional data

Name	Value	Unit
Yield strength pipe [ASTM A370]	235 - 555	N/mm²
Tensile strength pipe [ASTM A370]	415 - 625	N/mm²
Elongation pipe [ASTM A370]	15 - 26	1
Hardness [ASTM E110]	max. 275	HV 10
Notched-bar impact value [ASTM A370]	40	Joule
Ductility [API RP 5L3]	min. 85	%

Note: The technical data is common for each pipe (Bare Steel Pipe, PE Coated Steel Pipe, PU Coated Steel Pipe, PP Coated Steel Pipe, FBE Coated Steel Pipe, Epoxy Coated Steel Pipe, Concrete Coated Steel Pipe)

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN ISO 3183:2019 Petroleum and Natural Gas Industries - Steel Pipe for Pipeline Transportation*, *EN 10224:2002+A1:2005 Non-alloy steel tubes and fittings for conveyance of aqueous liquids including water for human consumption – Technical delivery conditions*.

2.4 Delivery status

The measurements of the products can vary between different lengths, thicknesses and diameters depending on the intended use and demand.
Diameter: 273.1 mm – 4064 mm
Wall Thickness: 4 mm – 35 mm
Length Range: 18 m - 50 m
Steel grades for gas and oil lines, e.g. in accordance with *EN ISO 3183* in steel grades L245 – L555.
Steel grades for water pipelines, e.g. in accordance with *EN 10224+A1*, usually involve steel grades L235 – L355.

2.5 Base materials/Ancillary materials

Steel pipes are primarily made of raw materials such as hot-rolled coils, welding powder and steel wire. The weight percentages of the raw materials of steel pipe are as follows.

Please note that the sums of materials does not equal 100.00% due to rounding.
Bare Steel Pipe,
- Hot-rolled coils[DIN EN ISO 3183][API 5L]: 99,20%
- Steel wire: 0,38 %
- Welding Powder: 0,42%

Polyethylene Coated Steel Pipe,
- Hot-rolled coils[DIN EN ISO 3183][API 5L]: 96,32%
- Steel wire: 0,37%
- Welding Powder: 0,40%
- HDPE/PE-HD: 2,50%
- PE adhesive: 0,28%
- Epoxy: 0,08
- Masterbatch: 0,05%

Polyurethane Coated Steel Pipe ,
- Hot-rolled coils[DIN EN ISO 3183][API 5L]: 98,96%
- Steel wire: 0,38%
- Welding Powder: 0,42%
- Polyurethane (PU): 0,17%
- Hardener: 0,07%

Polypropylene Coated Steel Pipe,
- Hot-rolled coils[DIN EN ISO 3183][API 5L]: 98,92%
- Steel wire: 0,38%
- Welding Powder: 0,42%
- PP granulate (PP): 0,28%

Fusion Bonded Epoxy Coated Steel Pipe,
- Hot-rolled coils[DIN EN ISO 3183][API 5L]: 98,25%
- Steel wire: 0,38%
- Welding Powder: 0,42%
- Fusion Bonded Epoxy: 0,95%

Epoxy Coated Steel Pipe,
- Hot-rolled coils[DIN EN ISO 3183][API 5L]: 97,72%
- Steel wire: 0,38%
- Welding Powder: 0,41%
- Epoxy: 1,49%

Concrete Coated Steel Pipe,
- Hot-rolled coils[DIN EN ISO 3183][API 5L]: 94,12%
- Steel wire: 0,36%
- Welding Powder: 0,39%
- Concrete: 5.13%

1) This product/article/at least one partial article contains substances listed in the ECHA candidate list (date: 16.01.2020) exceeding 0.1 percentage by mass: **no**.

2) This product/article/at least one partial article contains other CMR substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: **no**.

3) Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): **no**.

2.6 Manufacture

Hot-rolled strips of appropriate width and thickness, wound as coils, serve as the preliminary material for manufacturing longitudinal welded steel pipes. The heated strip edges are welded together by pressing. The pipes are rounded and straightened. The pipe string is then cut to the required length.
PE, PU, PP, PP, FBE, epoxy and concrete coatings are applied on the inner and / or outer surfaces of steel pipes according to the usage area and need.

2.7 Environment and health during manufacturing

During the entire manufacturing process, no other health protection measures are required extending beyond the legally specified industrial protection measures for commercial enterprises.
ERCIYAS Steel Pipe Co. is manufactured under the warranty of the *EN ISO 9001* Quality Management System to comply with the product requirement specifications. The company also has *ISO 45001* Occupational Health & Safety, *ISO 14001* Environmental Management Systems, and *EN 50001* Energy Management System in the manufacturing plant.

2.8 Product processing/Installation

Steels can be welded manually or automatically. At outdoor temperatures below 5°C, it is recommended to preheat a sufficiently large area between 80°C and 200°C. In any case, the surface should be moisture-free. Stress reduction heat treatment is not usually required and should only be done when requested by a building code or when there is a decrease in welded structures and / or operating conditions internal welding stresses. Suitable welding consumables should be used for arc welding; basic electrodes must be used for grades with a minimum electrode strength of 360 N/mm² or more. If necessary, corrosion protection must be completed in the pipe connection area.
Industrial safety measures are required during processing/installation.
No significant environmental pollution is triggered by processing/assembling these products. No special measures are required to protect the environment.
Residue and packaging materials must be collected separately in the construction site. The specifications of local waste authorities must be followed during processing.

2.9 Packaging

There is no product-specific packaging considered in this EPD. The product is being delivered with no packaging, so there is no packaging waste caused by the transport of steel pipes.
Packaging waste from other raw materials is modeled. Cardboard wastes (packaging from raw materials) arise from the transportation of coating raw materials such as polyethylene and concrete. The amount of cardboard wastes are less than 1%.Cardboard wastes are sent to the waste incineration plant and disposed of.

2.10 Condition of use

Environmental effects of usage stage are not considered in the scope of this study. Nevertheless, the product does not require any maintenance, repair or renewal during usage. As a general rule, the material composition of the product does not change over its lifetime.

2.11 Environment and health during use

There are no health risks for users of steel pipes or for persons manufacturing or processing steel pipes. From an environmental perspective, there are no restrictions governing the use of steel pipes.

2.12 Reference service life

The life cycle of steel pipe is dependent on the respective structural design, use and maintenance. The use phase for steel pipe is not depicted as they involve maintenance-free and generally durable products.

2.13 Extraordinary effects

Fire
Steel pipe complies with the requirements of construction product class A1 “nonflammable” in accordance with *DIN 4102*, Part 1 and *EN 13501-1*. No smoke gas develops.

Fire protection

Name	Value
Building material class	A1

Water
The effects of floods on steel pipe do not cause any changes in the product or any negative environmental effects.

Mechanical destruction
In the event of extraordinary mechanical impact, steel components display very good characteristics thanks to the high degree of ductility of the material. In general, no chips, breaking edges or similar exist.

2.14 Re-use phase

Steel is 95 % recyclable. Steel can be directed to electro-steel plants as scrap.

2.15 Disposal

As steel is 95% recyclable, 5% of the steel is disposed of.
Waste code in accordance with the European List of Wastes (*EWC*), as per the European List of Wastes Ordinance is "17 04 05 Iron and Steel".
Plastic and cement waste, e.g. "AVV no. 12 01 05 Plastics Shavings and Turnings", and "EWC no. 10 13 14 Waste Concrete and Concrete Sludge other than those mentioned in 17 01 06" are sent to landfill.

2.16 Further information

More information can be found at:
https://www.erciyas.com/en/index.html

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is 1 metric tonne of an average steel pipe (declaration of an average product from one plant of one manufacturer).

Declared unit

Name	Value	Unit
Declared unit	1	t
Thickness for Steel Pipe (max. thickness)	18	mm
Thickness for PE Coated Steel Pipe (max. thickness)	21.0	mm
Thickness for PU Coated Steel Pipe (max. thickness)	19.0	mm
Thickness for PP Coated Steel Pipe (max. thickness)	21.0	mm
Thickness for FBE Coated Steel Pipe (max. thickness)	18.4	mm
Thickness for Epoxy Coated Steel Pipe (max. thickness)	18.4	mm
Thickness for Concrete Coated Steel Pipe (max. thickness)	28.0	mm
Conversion factor to 1 kg	0.001	-

3.2 System boundary

Type of EPD: cradle to gate – with options
The EPD comprises the following life cycle phases:
• Product stage (Modules A1-A3)
• End-of-Life stage (Modules C3, C4)
• Benefits and loads beyond the system boundary (Module D)
• Manufacturing of product and primary packaging (raw materials)

Modules A1-A3 comprise both the upstream chain of production and provision of raw materials, and energy resources as well as transport thereof to the plant and the energy expenses incurred there. The raw materials losses taking into the calculations. Steel, plastics, concrete losses consist during the production.

As pipelines for oil&gas and water involve composite pipes, the individual materials are separated in Module C3 and then directed to their designated purposes in Modules C4 and/or D, respectively.
The amount of coating raw material (plastic, concrete) is much less than steel. Steel is 95% recycled. The 5% loss and non-metal fractions are sent to the landfill. . Plastic wastes are sent to incineration plants, cement wastes and the other non-metal fractions are sent to landfill.
The material and energy expenses required for Module C3 and the ensuing emissions are ignored. Coatings take place in Module C4, whereas emissions generated are allocated to this module, and thermal and electric energy is credited to Module D.

3.3 Estimates and assumptions

The basic material for manufacturing the steel pipes is non-alloyed and low-alloyed structural steel and fine-grained steel made of hot-rolled coil. The production of hot-rolled coils is represented by the generic *GaBi database* data set “RER: Stainless steel - Hot rolled coil ts-EPD [2011-2016]”.

In Module D, end-of-life steel is assumed to be recycled by 95% even if it is 100% recyclable. Because collecting and melting loss is assumed to be 5% in total. All the other estimations and assumptions regarding the cut off criteria and the allocation are declared in that parts. There are no other additional estimations and/or assumptions in the scope of this study.

3.4 Cut-off criteria

All inputs and outputs to a (unit) process are included in the calculation, for which data were available. The applied cut off criteria is 1% off renewable and nonrenewable primary energy usage and 1% of the total mass input of that unit process in case of in sufficient input data or data gaps for a unit process. The total of neglected input flows is a maximum of 5% of energy usage and mass.
Product stage (A1-A3), end of life stage (C3-C4) and benefits and loads beyond the system boundary (Module D) includes the provision of raw materials, transportation, manufacturing. End of life stage includes disposal of final waste during production. However, infrastructure, carrying of product to the storage in manufacturing site, production of manufacturing equipment, and personnel-related activities which are accepted as cut-off criteria are not included in this LCA study.

3.5 Background data

The LCA model of Erciyas Boru Steel Pipes were made using the *GaBi Database* Professional (DB version 6.115, year 2016, SP 29) software system for life cycle analysis by ERKE Sustainable Building Design Consultancy Ltd.
In this assessment, all data for the production stage; raw material extraction, manufacturing processes, transportation and packing and waste input were declared by manufacturer.

No innovative energy system such as energy recovery systems, utilizing renewable energy on site is used in the factory. However, as the process “Electricity grid mix of Turkey” is selected, some amount of renewable energy usage is seen in the results. Additionally, due to the some selected processes such as raw materials’ production stages, renewable energy usage is directly calculated by the software.
Lower Heating Values (Net Calorific Values) have been used in the energy declarations.

3.6 Data quality

All processes were calculated using representative data on the products declared by the manufacturer. The manufacturer issues a declaration for the compatibility of technical data with physical reality. All input data like material, energy, transportation and waste were primary data taken from manufacturer. The specific data quality coverages are;
• Geographical coverage: The study generally applies to the actual situation in Turkey. When there is no specific data for Turkey, European data has been preferred to use as the conditions in Europe are similar with Turkey. European data of raw materials, packaging materials, haulage vehicles, diesel used for transportation and waste has been used substitute for Turkey’s specific data.
• Time period covered: Goal of the study is to determine the actual environmental loads for 12 consecutive months, so data for the time period between 01.01.2019 and 31.12.2019 is used.
• Technology coverage: The objective of the study is to use data that apply to average technology which represents actual situation.

Datasets were selected from GaBi as shown below;

RER: Stainless steel - Hot rolled coil ts-EPD / 2011
GLO: Steel wire rod worldsteel / 2016
DE: Top coat powder (aluminium) (EN15804 A1-A3) ts <p-agg> /2016
DE: Polyethylene High Density Granulate HDPE/PE-HD) ts / 2016
DE: Thermoplastic Polyurethane (TPU, TPEU) adhesive ts / 2016
DE: Epoxy Resin (EP) Mix ts / 2016
EU 27: Solvent Paint White (EN15804 A1-A3) ts / 2016
DE: PUR sealing compound (EN 15804 A1-A3) / 2016
DE: Polyester Resin unsaturated (UP) ts / 2016
DE: Top coat powder (EN 15804 A1-A3) ts <p-agg> / 2016
DE: Epoxy Resin (EP) Mix ts / 2016
EU-27: SAND 0/2 ts / 2016
DE: CEMENT (CEM I 42,5) / 2016
EU-27: Acrylic acid (Propene) ts / 2016
TR: Electricity grid mix ts / 2016
TR: Natural gas mix ts / 2016
EU-27: Liquefied Petroleum Gas (LPG) (70% propane, 30% butane) ts / 2016
EU-27: Tap water ts / 2016
GLO Truck diesel driven, Euro 5, cargo| 24,7t payload capacity / 2016
GLO Truck diesel driven, Euro 5, cargo| 18,4t payload capacity / 2016
GLO Truck diesel driven, Euro 5, cargo| 11,4t payload capacity / 2016
EU-27 Diesel mix at filling station / 2016
EU- 27: Waste incineration of plastics (unspecified) fraction in municipal solid waste (MSW) ELCD/CEWEP <p-agg> / 2016
EU- 27 Paper/ Cardboard in waste incineration plan ts <p-agg> / 2016
DE: Inert matter (Construction waste) on landfill ts/2016
DE: Construction waste processing (EN15804 C3) ts/2016
DE: Construction waste dumping (EN15804 C4) ts/2016
GLO: Credit for recycling of steel scrap/2016

3.7 Period under review

The period under consideration is defined as one year. The monthly data is collected by the producer and is averaged to obtain the yearly data. Datasets within the last 10 years were used for calculation.

3.8 Allocation

Indirect allocation in background data:
By using the “Stainless steel - Hot rolled coil ts-EPD / 2011” GaBi ts dataset, indirect allocations are applied by mass, market value, calorific value and energy in Module A1.

Allocations in the use of recycled materials and credits
The average hot-rolled coil has a stainless steel scrap content of approx. 60%, which is regarded as unencumbered for Modules A1-A3. Net stainless steel scrap output is 35% (95% recycling – 60% scrap input). This stainless steel scrap is declared as credit in module D.
The necessary amount of secondary material in manufacturing is added from production scrap in the system and end-of-life scrap as closed loop. The net steel scrap amount is calculated taking into account collecting and melting loss for production and end-of-life stage. A credit is included in Module D for the net scrap quantity (substitution of primary material), taking into account a recovery rate (collection rate and losses) of 95%.
The net scrap volume is recycled. Recycling credits are allocated with the “GLO: Credit for recycling of steel scrap”

3.9 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 taken into account.

This LCA model of bare steel pipe, PE coated steel pipe, PU coated steel pipe, PP coated steel pipe, FBE coated steel pipe, epoxy coated steel pipe, concrete coated steel pipe were made by using the *GaBi database* 6 Software. .

4. LCA: Scenarios and additional technical information

End of life (C3-C4)

Name	Value	Unit
Collection Rate	95	%
Loss	5	%
Recycling	931.15	kg
Energy recovery	0	kg
Landfilling	68.85	kg

*Note: Plastic wastes are sent to incineration. In the study, this section has been modeled and the energy recovery result value is close to zero and very small. Therefore the value is shown as 0 in the table.

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Collection Rate	95	%
EOL	372,46	kg

*Note: This is an average product with a 100% recycling scenario. Steel is 95% recycled. There is 5% loss and melting. In addition, there are plastic and concrete wastes originating from coated pipes.

Hot rolled coil, the main raw material of the products, contains 60% steel scrap. The input of secondary material as closed loop is allocated to the process. The input as a closed loop is a component of the production examined and isn't allocated to Module D. Only the net amount is declared in Module D.

5. LCA: Results

The Life Cycle Assessment results are documented below for the system boundary stages; A1, A2, A3 Product Stages C3, C4 end of life stages and Module D. Life Cycle Impact Assessment Results are given according to Product Category Rule (PCR) "*Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project report, Version 1.8, 2019"* and *"Part B: Steel pipes for pressure applications, 05.2016"* created by Institut Bauen und Umwelt e.V.(IBU) based on the EN 15804:2012-04+A1:2013 standard requirements.. Due to relative approach of this LCA study, the results include only amount of life cycle impact category parameters based on declared unit. The declared unit of this LCA study is 1 metric tonne of average Steel Pipe,
The impact estimate results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds and safety margins or risks.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED; MNR = MODULE NOT RELEVANT)

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 the gate to the site	Assembly	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	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 tonne Steel Pipe

Parameter	Unit	A1	A2	A3	C3	C4	D
Global warming potential	[kg CO_2-Eq.]	2.90E+3	1.52E+1	3.28E+1	2.63E+0	1.04E+0	-5.68E+2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	2.04E-4	1.08E-10	9.75E-10	2.68E-11	1.03E-11	1.81E-5
Acidification potential of land and water	[kg SO_2-Eq.]	3.38E+1	3.69E-2	3.92E-1	1.78E-2	6.25E-3	-1.35E+0
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.05E+0	8.56E-3	1.22E-2	4.30E-3	8.50E-4	-3.73E-2
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	2.35E+0	-9.93E-3	2.03E-2	2.60E-3	6.00E-4	-3.02E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	2.06E-1	1.12E-6	3.45E-6	4.59E-6	3.59E-7	-5.77E-3
Abiotic depletion potential for fossil resources	[MJ]	2.96E+4	2.06E+2	5.40E+2	4.89E+1	1.36E+1	-5.97E+3

RESULTS OF THE LCA - RESOURCE USE according to EN 15804+A1: 1 tonne Steel Pipe

Parameter	Unit	A1	A2	A3	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	8.86E+3	1.19E+1	7.54E+1	3.76E+0	1.60E+0	3.08E+2
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	8.86E+3	1.19E+1	7.54E+1	3.76E+0	1.60E+0	3.08E+2
Non-renewable primary energy as energy carrier	[MJ]	3.92E+4	2.22E+2	5.77E+2	5.37E+1	1.49E+1	-5.46E+3
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	3.92E+4	2.22E+2	5.77E+2	5.37E+1	1.49E+1	-5.46E+3
Use of secondary material	[kg]	5.85E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.74E+2
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	3.17E+4	1.23E+3	1.14E+5	1.23E+3	7.84E+2	4.63E+2

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES according to EN 15804+A1: 1 tonne Steel Pipe

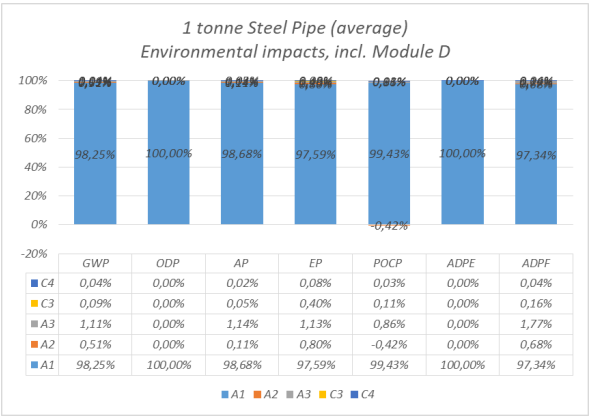
Parameter	Unit	A1	A2	A3	C3	C4	D
Hazardous waste disposed	[kg]	9.87E-7	1.55E-5	2.36E-7	3.57E-6	3.27E-7	0.00E+0
Non-hazardous waste disposed	[kg]	1.05E+2	1.78E-2	3.15E-1	2.38E-2	6.50E+1	0.00E+0
Radioactive waste disposed	[kg]	1.31E-2	4.61E-4	1.02E-3	5.12E-4	1.94E-4	5.00E-1
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	0.00E+0	0.00E+0	9.34E+2	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

6. LCA: Interpretation

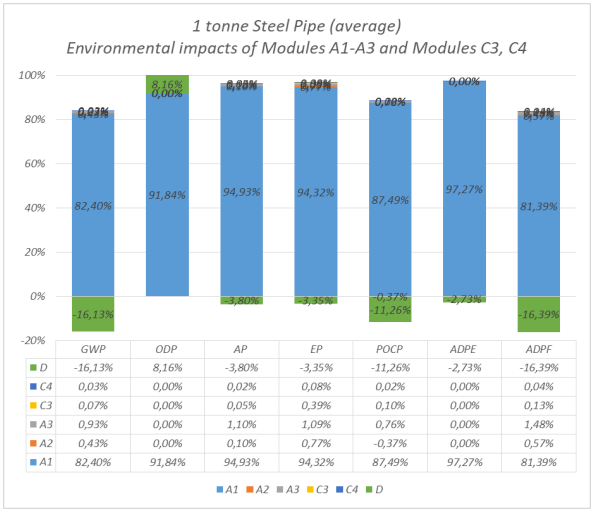
This EPD is a group of EPD which representing life cycle analysis of bare steel pipe, polyethylene coated steel pipe, polyurethane coated steel pipe, polypropylene coated steel pipe, fusion bonded epoxy coated steel pipe, epoxy coated steel pipe, concrete coated steel pipe. In this EPD, separate modeling is made for each product. As the deviation in the results is less than 10%, the vertical averaging approach is applied. Result tables were added by getting an arithmetic average of 7 product results.
The greatest contributor to the environmental indicators for the life cycle of steel pipe is the raw material supply (module A1) process, within the product stage (A1-A3) and the end-of-life stage with modules C3, C4. The module consistently demonstrated the considerable inputs in environmental

considerations of the product's development as seen on the chart.
When the product stage modules A1, A2, A3 are analyzed, it seems that the effect of raw material supply (Module A1) is approximately 99%. The raw material value is primarily dominated by hot rolled steel coil.
LCA study also reveals that the manufacturing process has a relatively lower environmental impacts profile as compared to the raw material process. The A2 (transportation) module is responsible for less than 1% of the related environmental impact categories. The end-of-life modules C3 and C4 contribute the least to all environmental impact categories. The C3, C4 (end of life) modules are responsible for less than 1% of the related environmental impact categories.

Sending the generated steel scrap for recycling and considering the end-of-life steel product (100% recyclable) to be recycled by 95% is decreasing on the environmental impacts. The effect of D module on GWP varies between 15,92 and 16,23 for 7 products.



	GWP	ODP	AP	EP	POCP	ADPE	ADPF
C4	0,04%	0,00%	0,02%	0,08%	0,03%	0,00%	0,04%
C3	0,09%	0,00%	0,05%	0,40%	0,11%	0,00%	0,16%
A3	1,11%	0,00%	1,14%	1,13%	0,86%	0,00%	1,77%
A2	0,51%	0,00%	0,11%	0,80%	-0,42%	0,00%	0,68%
A1	98,25%	100,00%	98,68%	97,59%	99,43%	100,00%	97,34%



	GWP	ODP	AP	EP	POCP	ADPE	ADPF
D	-16,13%	8,16%	-3,80%	-3,35%	-11,26%	-2,73%	-16,39%
C4	0,03%	0,00%	0,02%	0,08%	0,02%	0,00%	0,04%
C3	0,07%	0,00%	0,05%	0,39%	0,10%	0,00%	0,13%
A3	0,93%	0,00%	1,10%	1,09%	0,76%	0,00%	1,48%
A2	0,43%	0,00%	0,10%	0,77%	-0,37%	0,00%	0,57%
A1	82,40%	91,84%	94,93%	94,32%	87,49%	97,27%	81,39%

The raw material value is primarily dominated by hot rolled steel coil. The average amount of steel in each pipe is 980 kg. The amount of coating raw material (plastic, concrete) is much less than steel. Steel is 95% recycled. The 5% loss and non-metal fractions are sent to the landfill. Plastic wastes from the coating are sent to incineration. The contribution of the pipes to the environmental impacts are very close to each other. The highest value affecting GWP is due to 98,76% Steel Pipe (average) Module A1 (raw material supply). GWP is highest affect by the steel supply Module A1. It also affects 0.50% from Module A2 and 0,54% from Module A3 . Steel is 95% recycled. There is 5% loss and the non-metal fractions are sent to landfill. Plastic wastes from coated are sent to incineration. There are 0,03% and 0,09% effects caused by C3 and C4, respectively.
Module A1 (raw material supply) causes ODP with 100% rate. Modules A2, A3, C3, C4 and D have no effect on ODP.
Steel supply in Module A1 which the highest affected all the other environmental impact categories (AP, EP, POCP, ADPE, ADPF) with 99,26%, 98,06%, 99,85%, 100,00%, 97,89% rates respectively. The transportation and manufacturing (Modules A2, A3) and end of life stage (Modules C3, C4) affect below 1% all the other environmental impact categories.

7. Requisite evidence

This EPD concerns steel pipes for oil/gas and water pipelines made from structural steel. Further processing depends on the respective application. Evidence of tests in line with the technical conditions governing delivery is provided by works test certificates.

7.1 Evidence for drinking water installations (where relevant)

Hygienic evidence may be required for drinking water installations. Steel pipes for drinking water installations are lined with cement mortar. Suitability as drinking water is verified in accordance with the *DIN EN 10224*.

7.2 Evidence of mechanical pipe properties (if relevant)

Apart from the structural technical data provided in section 2.3, evidence and results of additional mechanical tests must be provided depending on customer requirements.

These include:
· Guided Bend Test in accordance with *ASTM A 370*
· Bend Test in accordance with *ASTM A 370*
· Flattening Test in accordance with *ASTM A 370*

8. References

Standards

EN 15804+A1
EN 15804:2012-04+A1:2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products English version EN 15804:2012-04+A1:2013

EN ISO 14040
EN ISO 14040:2006, Environmental management – Life cycle assessment - Principles and framework; English version EN ISO 14040:2006

EN ISO 14044
EN ISO 14044:2006, Environment Management – Life Cycle Assessment – Requirements and Instructions; English version EN ISO 14044:2006.

EN ISO 14025
EN ISO 14025:2010, Environmental labels and declarations - Type III environmental declarations - Principles and procedures; English version EN ISO 14025:2010

ISO 45001
ISO 45001:2018, Occupational Health and Safety Management Systems Requirements, English version EN ISO 45001:2018

EWC European List of Wastes
EWC/ European List of Wastes**,** 2000/ , The European Waste Catalogue (EWC)

DIN 4102-1
DIN 4102-1:1998, Fire behaviour of building materials and building components - Part 1: Building materials; concepts, requirements and tests. German version DIN 4102-1:1998

EN ISO 14001
EN ISO 14001:2015,Environmental Management System Requirements Standard. English version EN ISO 14001:2015.

EN ISO 9001
EN ISO 9001:2015, Quality Management Systems Requirements. English version EN ISO 9001:2015

EN 50001
EN 50001:2001,Energy management systems - Requirements with guidance for use. English version EN ISO 9001:2015

EN ISO 3183
EN ISO 3183:2019, Petroleum and Natural Gas Industries - Steel Pipe For Pipeline Transportation Systems. English version EN ISO 3183:2019.

API 5L
API 5L:2018, American Petroleum Institute API 5L, Petroleum and Natural Gas Industries -Steel Pipe For Pipeline Transportation Systems Requirement

EN 10219-1
EN 10219-1:2006, Cold formed welded structural hollow sections of non-alloy and fine grain steels - Part 1: Technical delivery conditions. English version EN 10219-1:2006.

EN 10219-2
EN 10219-2:2006, Cold formed welded structural hollow sections of non-alloy and fine grain steels - Part 2: Tolerances, dimensions and sectional properties. English version EN 10219-2:2006.

EN 10217-1
EN 10217-1:2019, Welded steel tubes for pressure purposes - Technical delivery conditions. English version EN 10217-1:2019.

EN 10224+A1
EN 10224:2002+A1:2005, Non-alloy steel tubes and fittings for conveyance of aqueous liquids including water for human consumption – Technical delivery conditions. English version EN 10224:2002+A1:2005

ASTM A 252
ASTM A 252 :2019, Standard Specification for Welded and Seamless Steel Pipe Piles

EN ISO 21809-1
EN ISO 21809-1:2012, Petroleum and natural gas industries - External coatings for buried or submerged pipelines used in pipeline transportation systems - Part 1: Polyolefin coatings (3-layer PE and 3-layer PP). English version EN ISO 21809-1:2012

EN ISO 21809-2
EN ISO 21809-2:2015, Petroleum and natural gas industries — External coatings for buried or submerged pipelines used in pipeline transportation systems — Part 2: Single layer fusion-bonded epoxy coatings. English versions EN ISO 21809-2:2015

EN 10289
EN 10289:2004, Steel tubes and fittings for onshore and offshore pipelines- External liquid applied epoxy and epoxy- modified coatings. German and English versions EN 10289:2004.

EN 10290
EN 10290:2002, Steel tubes and fittings for onshore and offshore pipelines - External liquid applied polyurethane and polyurethane-modified coatings. English version EN 10290:2002.

AWWA C 205
AWWA C 205 :2018, American Water Works Association (AWWA), Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4in. (100mm) and large

AWWA C 210
AWWA C 210 :2015, American Water Works Association (AWWA), Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings

AWWA C 222
AWWA C 222 :2018, American Water Works Association (AWWA), Polyurethane Coatings and Linings for Steel Water Pipe and Fitting

DIN 30678

DIN 30678:2013, Polypropylene coatings on steel pipes and fittings - Requirements and testing German version DIN 30678:2013

DIN 30670
DIN 30670:2012, Polyethylene coatings on steel pipes and fittings - Requirements and testing. German version DIN 30670:2012

EN 13501-1
EN 13501-1:2019, Fire classification of construction products and building elements-Part 1: Classification using test data from reaction to fire tests. English version EN 13501-1:2019.

API Spec. Q1
API Spec. Q1:2013, American, Petroleum Institute, Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry.

ASTM E110
ASTM E110:2014, Standard Test Method for Indentation Hardness of Metallic Materials by Portable Hardness Testers

ASTM A370
ASTM A370:2014, Standard test methods and definitions for mechanical testing of steel products.

API RP 5L3
API RP 5L3:1996, Recommended Practice for Conducting Drop-Weight Tear Tests on Line Pipe

GaBi Databases
GaBi Professional Database (DB version 6.115, year 2016, SP 29)

Further References

IBU 2016
IBU 2016, Product Category Rules for Building-Related Products and Services, Part B: Steel pipes for pressure applications, 05.2016

IBU 2018
IBU 2018, Product Category Rules for Building-Related Products and Services, Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Version 1.8

ECHA candidate list
List of Substances of Very High Concern (SVHC) for authorisation (ECHA Candidate List) of 16.01.2020, published in accordance with Article 59(10) of the REACH Regulation. Helsinki: European Chemicals Agency. Available at: https://echa.europa.eu/de/candidate-list-table

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