epd-norge.no
The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

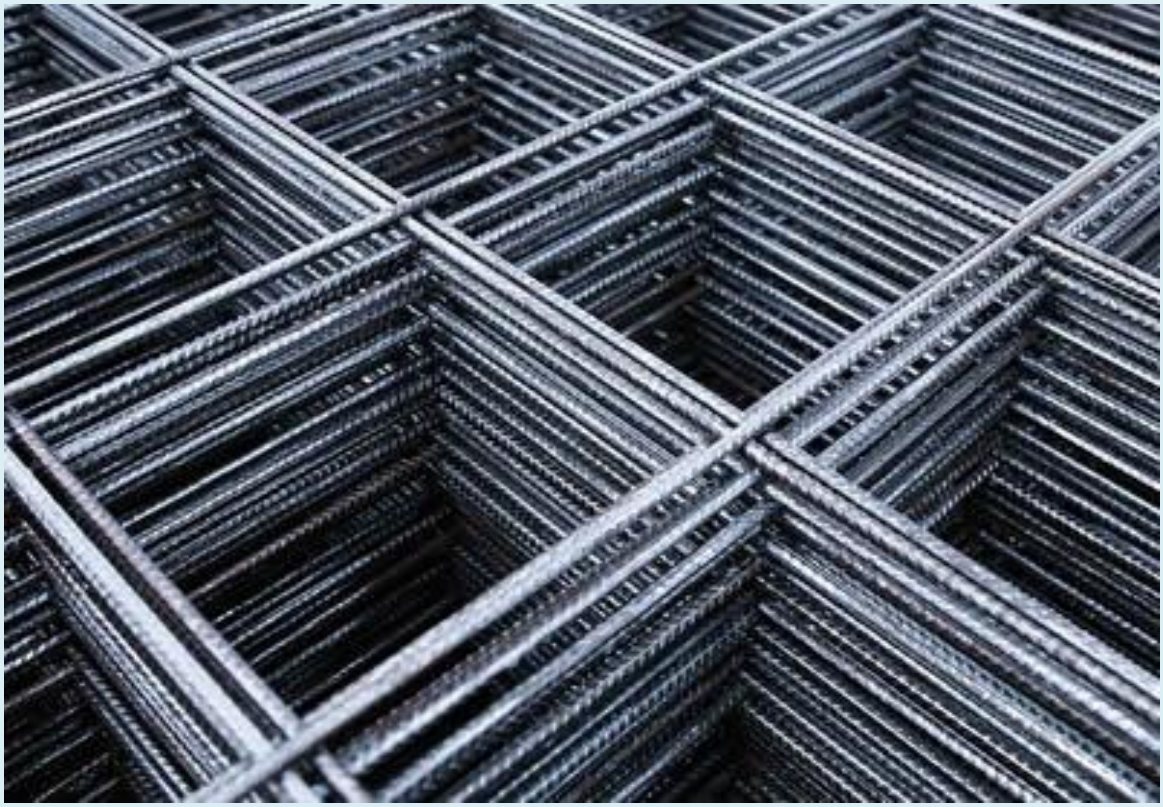
Owner of the declaration:	E.A. Smith AS
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-2193-988-EN
Registration number:	NEPD-2193-988-EN
ECO Platform reference number:	-
Issue date:	14.05.2020
Valid to:	14.05.2025

Steel rebar

E.A. Smith AS (Smith Stål)

SMITH STÅL

www.epd-norge.no



General information

Product:
Steel Rebar

Owner of the declaration:
E.A. Smith AS (Smith Stål)
Contact person: **Steve Reinertsen**

e-mail: steve.reinertsen@smith.no

Program operator:
The Norwegian EPD Foundation
Post Box 5250 Majortusten, 0303 Oslo
Norway
Phone: +47 97722020
e-mail: post@epd-norge.no

Manufacturer:
E.A. Smith AS avd. Smith Stål
Heggstadmoen 13, 7080 Heimdal
Phone: +47 72 59 25 00
e-mail: firmpost@smith.no

Declaration number:
NEPD-2193-988-EN

Place of production:
Oslo, Holmestrand, Stavanger, Haugesund, Bergen, Ålesund, Heimdal, Bodø, Harstad and Tromsø (all sites in Norway).

ECO Platform reference number:

Management system:

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR
NPCR Part A: Construction products and services
NPCR 013:2019 Part B for Steel and aluminium construction

Organisation no:
816051142

Statement of liability:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturerinformation, life cycle assessment data and evidences.

Issue date:
14.05.2020

Valid to:
14.05.2025

Declared unit:
per kg steel product

Year of study:
2020

Declared unit with option:

Per 1 kg steel from cradle to gate

Comparability:
EPD of construction products may not be comparable if they not comply with EN 15804 and seen in a building context.

Functional unit:

Not relevant

The EPD has been worked out by:
Paritosh Chakor Deshpande
Annik M Fet
Arron Wilde Tippet

NTNU
Kunnskap for en bedre verden

10 May 2020

Verification:

The CEN Norm EN 15804 serves as the core PCR. Independent verification of the declaration and data, according to ISO14025:2010

▫ internal ▪ external

Third party verifier:

Michael M. Jenssen, Asplan Viak AS
(Independent verifier approved by EPD Norway)

Approved

Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
Steel reinforcement bars (ribbed steel bars) that are made out of hot rolled products, transformed into straight ribbed bars, cut and bend, mesh, and combinations of these (special welded products) by European manufacturers. Sections are prefabricated by cutting, bending and welding by a Norwegian steel manufacturer. Reinforcement steel is used in the construction buildings and civil structures. EPD represents an average value for this product based on several production sites in Norway. Variance is <10% between sites.

Technical data:
The product certified is in accordance with standards:
NS 3576-1, NS 3576-3 and NS 3576-4

Product specification:
Typical product composition for reinforcement steel is described in the table below. Typically it consists of more than 99% of steel scrap.

Material	kg	%
Iron	0,98-0,99	98-99
Carbon	0,005-0,002	0,05-0,02
Manganese	0,03-0,07	0,3-0,7
Silicone	0,02	0,2

Market:
Norway

Reference service life, product:
Not relevant for cradle to gate

Reference service life, building:
Not relevant for cradle to gate

LCA: Calculation rules

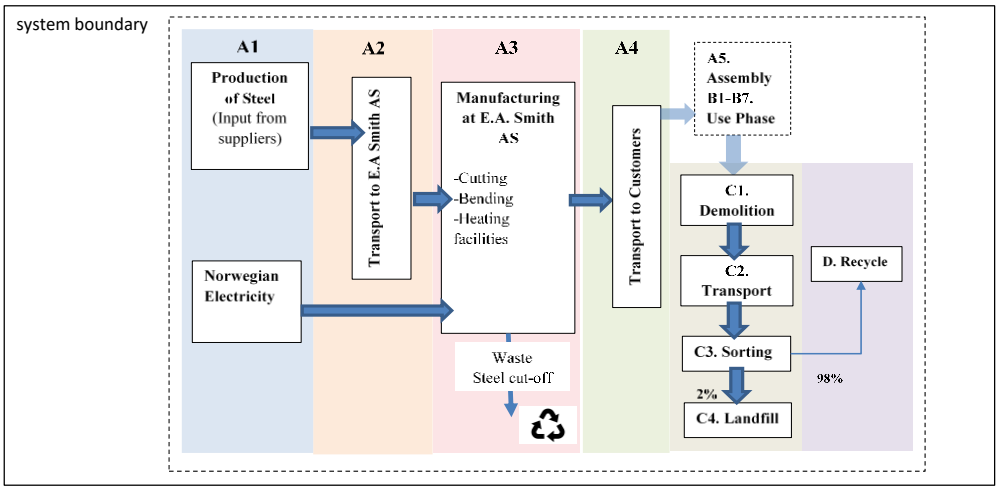
Declared unit:
Per kg building steel

Cradle-to-gate LCA was conducted including modules C1-C4 and D as per the requirments presented in 15804:2012 EPD guidelines.

System boundary:
System boundaries are shown in the flowchart. Waste flows, especially cut-offs from the steel manufacturing in A3, are treated within the module they occur via system expansion.

Module D represent a possible system in which the steel output from the EOL is recycled, from which an environmental credit is attained and given to this system. Module D is calculated as net scrap * LCI for scrap, where the scrap LCI is calculated as the credit for avoided primary production of steel, minus the burden of recycling steel scrap to make new steel, multiplied by the process yield (>1kg scrap is needed to make 1kg new steel). LCI for scrap has been provided by worldsteel (Worldsteel 2017)

Figure 1: Flowchart showing the system boundaries and processes



Data quality:
Data has been collected in accordance with clause 6.3.6 in NPCR Part A for construction products and services. Specific data are used from the manufacturer for 2018; when collecting data, efforts have been made to create data sets as comprehensive as possible. that no data used >10 years old, or that it is in accordance with 15804. All generic (background) data has been gathered from PE International Gabi ts Professional Database and the Ecoinvent database.
Data source: GaBi, Ecoinvent, E.A Smith AS and Supplier EPDs

Allocation:
The allocation is made in accordance with the provisions of EN 15804. Incoming energy and water and waste production in-house is allocated equally among all products through mass allocation. Effects of primary production of recycled materials allocated to the main product in which the material was used. The recycling process and transportation of the material is allocated to this analysis. No other products and energy is produced at Smith Stål facility other than the declared product.

Cut-off criteria:
All major raw materials and all the essential energy is included. The production process for raw materials and energy flows that are included with very small amounts (<1%) are not included. This cut-off rule does not apply for hazardous materials and substances.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

A4 provides the Transport from the factory gate to the customer. Specific data was obtained from E.A.Smith AS regarding the transport distances and transport type. Truck Euro 6 are typically used to transport the product within Norway. Transport through truck is also used to dispose other operational waste and waste lubricant oil from the process, however this fraction accounts for less than 0,01% of total process and hence neglected through cut-off criteria.

Transport from production place to user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Truck	85	GLO: Truck EURO 6, 26-28 t	60	0,02 l/tkm	1,20E+00

Transport in A2 describe the transport of raw material (steel coil rebar and mesh rebar) from various suppliers (from across EU) to E.A. Smith AS's facility in Norway. Input material from suppliers is transported via ocean-going container ships to Norwegian ports from where Trucks are used to transport the material to E.A Smith AS plant. The distance travelled and type of transport used was provided by the manufacturer. The estimates on average % Capacity utilization has also been provided by the manufacturer.

Transport from production place to user (A2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance	Fuel/Energy consumption	Value (l/t)
Truck	60	GLO: Truck Euro 6 (20-26 Tonnes)	73	0,0225 l/tkm	1,64E+00
Ship	80	GLO: Container ship, 5000 to 200,000 dw	1474	0,0021 l/tkm	3,10E+00

End-of-Life Scenario: 98% recovery rate was assumed considering the high recovery rates of Rebar Steel products (Worldsteel 2017). Among the total recovered, 98% is assumed for recycling, leaving out 2% fraction to landfilling in Norway.

Transportation scenarios for EOL scenario are based on the approx. distances to the waste management facilities. Other parameters for transporting waste such as capacity utilization, fuel consumption, etc. are estimated from GaBi ts and ecoinvent v3.4 database

End of Life (C1, C3, C4)

	Uni	Value
Hazardous waste disposed	kg	0
Collected as mixed construction waste	kg	0
Reuse	kg	0
Recycling	kg	0,98
Energy recovery	kg	0
To landfill	kg	0,02

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption (l/tkm)	Value (l/t)
Truck	65 %	GLO: Truck EURO 6, 26-28 t	100	0,0247	2,47E+00
Truck	65 %	GLO: Truck EURO 5, 7.5-12 t	100	0,00114	1,14E-01

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Net new scrap	kg	-0,13

Additional Technical Information

The EOL formula from15804 was used to calculate Module D
Mer out = 98%
Mer in=110% (Calculated from averaging the value of secondary material from suppliers EPD)
Avoided burden = (Mer out-Mer in)*1,66
Where, 1,66 kg CO2 eq. Is GWP of scrap steel recycle (Worldsteel databse from GaBi ts)
Net credits and burdens for recycling = 0,22 kg CO2 eq.

LCA: Results

The following information describe the scenarios in the different modules of the EPD

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assemby stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	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	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

Environmental impact

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D	
GWP	kg CO_2 -eqv	3,93E-01	3,55E-03	6,09E-04	7,30E-03	0,00E+00	1,28E-03	2,17E-01	
ODP	kg CFC11-eqv	6,65E-08	8,85E-19	1,52E-19	1,82E-18	0,00E+00	3,28E-18	-6,59E-16	
POCP	kg C_2H_4 -eqv	1,11E-04	6,72E-10	2,16E-07	-1,31E-07	0,00E+00	-1,79E-08	1,01E-04	
AP	kg SO_2 -eqv	1,74E-03	3,17E-06	2,23E-06	6,82E-06	0,00E+00	3,47E-06	4,17E-04	
EP	kg PO_4^{3-}-eqv	3,29E-04	7,04E-07	5,39E-07	1,54E-06	0,00E+00	4,85E-07	2,90E-05	
ADPM	kg Sb-eqv	-1,15E-05	3,14E-10	5,39-11	6,44E-10	0,00E+00	2,09E-10	3,64E-06	
ADPE	MJ	5,30E+00	4,82E-02	8,27E-03	9,89E-02	0,00E+00	1,88E-02	2,03E+00	

Note: Negative value of ADMP (kg Sb eq.) for A1-A3 here is tracked down to the supplier EPD data used for A1. A quick review EPDs suggested that the negative value comes from the data of Worldsteel due to system expansion and crediting by-products (EAF-dust from recycled material in an electric arc furnace) in the Worldsteel dataset.

Note: There is an inherent flaw in the POCP results in the GaBi 6 software when datasets for trucks have been used with CML 2001. Negative impact results in this category essentially means that the use of transport will in effect clear smog formation.

GWP Global warming potential; **ODP** Depletion potential of the stratospheric ozone layer; **POCP** Formation potential of tropospheric photochemical oxidants; **AP** Acidification potential of land and water; **EP** Eutrophication potential; **ADPM** Abiotic depletion potential for non fossil resources; **ADPE** Abiotic depletion potential for fossil resources

Resource use

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D	
RPEE	MJ	1,41E+00	2,88E-03	4,94E-04	5,91E-03	0,00E+00	1,28E-03	-1,51E-01	
RPEM	MJ	7,32E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,82E-09	
TPE	MJ	2,30E+00	2,88E-03	4,94E-04	5,91E-03	0,00E+00	1,28E-03	-1,51E-01	
NRPE	MJ	4,24E+00	4,85E-02	8,31E-03	9,94E-02	0,00E+00	1,93E-02	1,95E+00	
NRPM	MJ	1,58E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,83E-11	-8,84E-11	
TRPE	MJ	6,14E+00	4,85E-02	8,32E-03	9,94E-02	0,00E+00	1,93E-02	1,95E+00	
SM	kg	1,11E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	
RSF	MJ	6,37E-05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	
NRSF	MJ	2,41E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	
W	m^3	1,10E-02	4,85E-06	8,32E-07	9,95E-06	0,00E+00	7,35E-07	3,40E-04	

RPEE Renewable primary energy resources used as energy carrier; **RPEM** Renewable primary energy resources used as raw materials; **TPE** Total use of renewable primary energy resources; **NRPE** Non renewable primary energy resources used as energy carrier; **NRPM** Non renewable primary energy resources used as materials; **TRPE** Total use of non renewable primary energy resources; **SM** Use of secondary materials; **RSF** Use of renewable secondary fuels; **NRSF** Use of non renewable secondary fuels; **W** Use of net fresh water

End of life - Waste

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D	
HW	kg	2,20E-02	2,69E-09	4,62E-10	5,52E-09	0,00E+00	3,33E-10	2,50E-07	
NHW	kg	7,35E-01	4,08E-06	7,01E-07	8,38E-06	0,00E+00	2,00E-02	-2,33E-02	
RW	kg	1,70E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	

HW Hazardous waste disposed; **NHW** Non hazardous waste disposed; **RW** Radioactive waste disposed

End of life - Output flow

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D	
CR	kg	0	0	0	0	0	0	0	
MR	kg	1,43E-02	0	0	0	0	9,80E-01	0	
MER	kg	7,50E-04	0	0	0	0	0	0	
EEE	MJ	0	0	0	0	0	0	0	
ETE	MJ	0	0	0	0	0	0	0	

*__INA__: Indicator Not Assessed

CR Components for reuse; **MR** Materials for recycling; **MER** Materials for energy recovery; **EEE** Exported electric energy; **ETE** Exported thermal energy

Reading example: 9,0 E-03 = $9,0*10^{-3}$ = 0,009

Additional Norwegian requirements

Greenhous gas emission from the use of electricity in the manufacturing phase

The electricity mix used in the manufacturing stage (A3) is the Norwegian electricity grid mix. transformed to low voltage (production of transmission lines, in addition to direct emissions and losses in grid) for the reference year 2014.

Data source	Amount	Unit
Econinvent v3.4 (Mar 2020)	0,03	kg CO_2-eqv/kWh

Dangerous substances

- 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

No tests have been carried out on the product concerning indoor climate - Not relevant

Carbon footprint
Carbon footprint has not been worked out for the product.

Bibliography

ISO 14025:2010	*Environmental labels and declarations - Type III environmental declarations - Principles and procedures*
ISO 14044:2006	*Environmental management - Life cycle assessment - Requirements and guidelines*
EN 15804:2012+A1:2013	*Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products*
ISO 21930:2007	*Sustainability in building construction - Environmental declaration of building products*
NEPD-S-P-00306	*EPD 2016. Celsa Nordic Steel*
GlobalEPD 001-002	Megasa EPD for Long products of hot rolled structural non-alloy steel coming from electric furnace: ribbed bars. 2018.
EPD-BMG-GB-10.2 and EPD-BS-GB-10.2	Baustahl EPD for reinforcing steel and for reinforcing meshes and lattice girders. 2018.
Deshpande, P.C. (2020)	*LCA- Report Ribbed bars made from reinforcement steel, in the form of mesh as well as straight and shaped bars*
NCPR 2017 Part A	*NPCR Construction products and services – Part A – April 2017.*
NPCR 013 v 3.0 Part B	*NPCR 013:2019 Part B for steel and aluminium construction products version 3.0.*
Worldsteel (2017)	World Steel Association Life Cycle Inventory Methodology Report, Brussels: World Steel Association

epd-norge.no The Norwegian EPD Foundation	**Program operator** The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo Norway	Phone: e-mail: web	+47 97722020 post@epd-norge.no www.epd-norge.no
epd-norge.no The Norwegian EPD Foundation	**Publisher** The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo Norway	Phone: e-mail: web	+47 97722020 post@epd-norge.no www.epd-norge.no
SMITH STÅL	**Owner of the declaration** E.A. Smith AS Heggsatdmoen 13 7080 Heimdal	Phone: e-mail: web	+47 72 59 24 00 firmapost@smith.no www.smithstal.no
NTNU Kunnskap for en bedre verden	**Author of the Life Cycle Assessment** Paritosh Chakor Deshpande NTNU Gløshaugen 7491 Trondheim	Phone: Fax e-mail: web	0047 45 04 09 95 paritosh.deshpande@ntnu.no www.ntnu.no