Environmental Product Declaration

STEEL DEFORMED BARS FOR CONCRETE REINFORCEMENT

Ferriera Valsabbia

BASED ON	PCR 2012:01 CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES, VERSION 2.2, 2017-05-30, EN 15804:2014, ISO 14025
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Programme operator	EPD International AB

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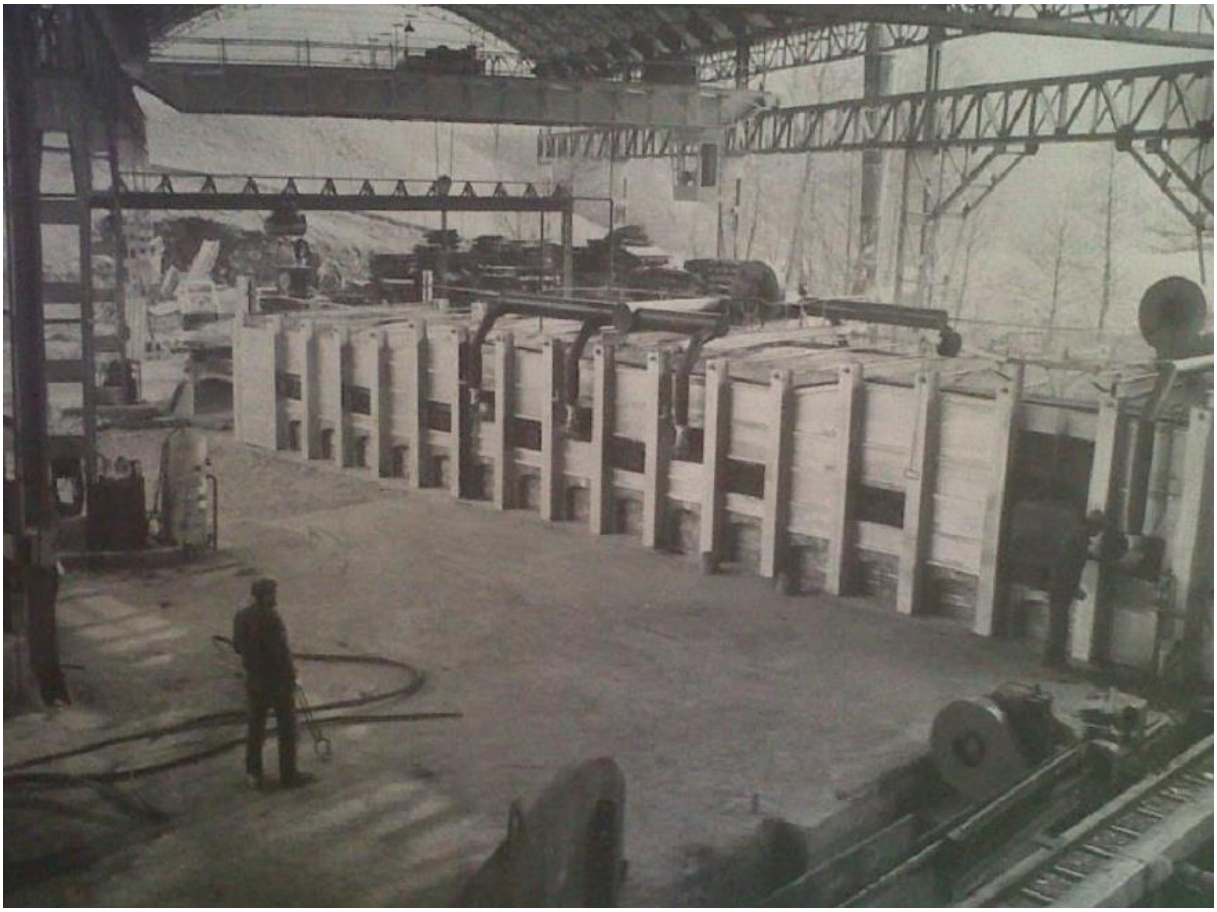
Company and Product Presentation

Knot with cold-drawn steel deformed bars for concrete reinforcement, diameter Ø 28 mm



Pre-heat oven, year 1963

The company and its history

Half a Century of Steel

1954 - The Laminatoio Valsabbia is founded at Odolo.

1963 - The Laminatoio becomes Ferriera Valsabbia. The company produces reinforcing bars from ingots acquired from other metallurgy companies.

1968 - The first smelting furnace is inaugurated. Ferriera Valsabbia is now a continuous cycle integrated company. The production cycle starts from scrap.

1971 - The second smelting furnace comes into operation. The plant at Odolo employs 150 workers and produces 70,000 tons of steel a year.

1977 - Ferriera Valsabbia becomes a joint-stock company.

The 1980s - Subsequent investments enable further rationalisation of the production plants. The Company exports to Germany, France, Switzerland, Austria, the United States and various Eastern countries.

The 1990s - The company's development continues on all fronts. Ferriera Valsabbia start operating under the ISO 29002, (today ISO 9001) Quality Management System.

1992 - Ferriera Valsabbia opens a new market in Italy with the introduction of the galvanized reinforcing bar (Galva Rebar).

1993 - The production of electro welded wire mesh is launched at the new production site at Sabbio Chiese.

1996 - The Company opens a new plant in the Czech Republic.

2003 - Ferriera Valsabbia equips itself with a new and more efficient water treatment plant.

2004 - Ferriera Valsabbia inaugurates another plant in the Slovak Republic. Our on-line certification service is launched providing customers with EN 10204 3.1 test certifications via the corporate Web site.
2005 - Revamp of our fume treatment plant. Ferriera Valsabbia begins operating under the ISO 14001 Environmental Management Systems.

2008 - The brand-new bar rolling and confectioning plant begins operation.

Today - The Company's monthly production reaches the quantities that used to be produced in a year and operates in contact with leading international research institutes. Ferriera Valsabbia becomes a solid reference point for the entire sector.

Technology

Reinforcing bars are not glamorous products that spark people's imagination, yet they are the soul of every new form in architecture. They are not sophisticated products, yet they sustain our world. They are never on show in the foreground, but their quality is seen over time.

A quality which must be able to meet increasingly difficult tasks.

This is exactly the purpose of our work. This is exactly why we have invested in ever new plants and in the most advanced technologies able to provide total control over each and every production parameter.

Panoramic view of Odolo (BS)

Steel scrap loading into the smelting furnace

The product and its production

Steel production

When first arriving at Ferriera Valsabbia after meticulous selection and recycling of the raw materials, steel scrap loads undergo an initial radiometric control. By means of baskets, they are then loaded into the smelting furnace and brought to the liquid state in a matter of minutes.

The new fume suction and filtering system drastically reduces the environmental impact and enables to assess the excellent quality of the scrap loads used through chemical and radiometric controls.

Billet production

The molten metal is transferred from the smelting furnace to the ladle. Samples are taken for accurate chemical and radiometric analyses to determine precisely the characteristics of each steel casting.

The ladle then reaches the continuous casting plant, the liquid steel is poured into special copper ingot moulds and left to solidify in a controlled fashion to take the form of billets, the semi-finished product ready for subsequent rolling.

Reinforcing Bar Production

The reheating furnace, required to bring the billet to rolling temperature, operates on a continuous cycle and is powered directly by the heat recovered from the continuous casting plant and by natural gas burners. By so doing, great energy savings are achieved and environmental impact is remarkably reduced.

In the rolling mill, a series of calibrated cylinders gradually bring the billets to the desired shape and diameter, up to the most delicate stage: the cooling of the bar. The rigorously monitored continuous in-line hardening and tempering treatment is crucial to ensuring optimum characteristics of the products.

The bars thus obtained then pass to the cutting and confectionary stage, where after a final radiometric check on leaving Valsabbia, they are shipped to sites around the world.

The main features of the product object of this EPD and the production process are summarized in Table 1.

Table 1 - Main information and features related to the product object of the EPD

Information	Description
Product identification	Hot-drawn reinforcing steel for concrete in bars
Product features	Bars: Diameter from Ø 8 mm to Ø 40 mm Length up to 16 m
Product properties (under EN10080:2005)	Steel coming from post and pre consumer steel scraps produced in electric arc furnace route (EAF) and further hot rolling process.
	Adherence and surface geometry f_R or f_P : - for Ø≤8mm f_R or f_P≥0.035 - for 8<Ø≤12mm f_R or f_P≥0.040 - for Ø>12mm f_R or f_P≥0.056
	Weldability: C_{eq} <0,52
	Typical yield stress C_v: 400 ≤ C_v ≤ 600 MPa
	Elongation Agt: ≥ 5%
	Successful in bend and rebend test
	Content of recycled materials ≥98% (Certificate IGQ n. C060 following ISO 14021)
	Successful in strength test and oligocyclic strength test
Plant features	Total production, for selling purpose, year 2017: 560345 t
	On-site air emission control system
	On-site dumping water control system
	On-site system to recycle water used in process
	In/out materials/products and casting process undergone radiometric controls to prevent nuclear radiation
	Plant air emissions accounted under ETS (Emission Trading System)

The CPC code is 412 “Products of iron or steel”.

Content declaration

Reference products, object of this EPD, have a chemical composition in compliance with national regulation of the destination countries where the products are sent.

Table 2 - Content declaration of the product object of the EPD

Materials	Substances	Weight %	CAS number	Environ-mental class	Health class
Iron	Iron	>96%	7439-89-6	n.a.	n.a.
Alloy elements	Manganese Silicon Carbon	2% c.a.	7439-96-5 7440-21-3 7440-44-0	n.a.	n.a.
Other elements	Copper Nickel Chromium	complementary to 100%	7440-50-8 7440-02-0 7440-47-3	n.a.	n.a.

In the product there are no substances contained in the product that are listed in the "Candidate List of Substances of Very High Concern (SVHC) for authorisation" exceeding 0.1 % of the weight of the product.

All the steel produced derives from the fusion of recovered scrap.

Environmental Performance Declaration

Fume suction and filtering system realized in 2010

In this part of the Environmental Product Declaration (EPD), the main features and the environmental results of the LCA analysis are presented.

Methodology

The environmental burden of the product has been calculated according to EN 15804:2014[1] and PCR 2012:01 Construction products, v.2.2.

This declaration is a cradle to gate with options EPD type, developed within the International EPD® System and based on the application of Life Cycle Assessment (LCA) methodology to the whole life-cycle system. In the whole LCA model, infrastructures and production equipment are not taken into account. The LCA study was performed using SimaPro 8.5 software and the Ecoinvent 3.4 data bank as supporting tool.

Hot-drawn reinforcing steel for concrete in bars were described by using specific data coming from Ferriera Valsabbia manufacturing plant placed in via Marconi 13, Odolo (Brescia, Italy) and are referred to 2017 production (560345 t of bars). Customized LCA questionnaires were used to gather in-depth information about all aspects of the production system (for example, raw materials contents and specifications, pre-treatments, process efficiencies, air and water emissions, waste management), in order to provide a complete picture of the environmental burden of the system from **Raw Materials supply (A1)** to **Transport (A2)** of raw materials and **Manufacturing (A3)**. Use phase and end of life were not considered according to EN:15804 and PCR 2012:01, while **transport to final destination** has been taken into account **(A4)**.

Declared unit

The function of the whole system is to produce steel products for concrete through two main processes: steel casting in electric arc furnace route (EAF) and further hot rolling process. Environmental burdens have been allocated dividing in/out system mass and energy flows on mass (products and co-products) basis. According to reference PCR 2012:01 and EN:15804, the **declared unit is 1 ton of bars**, ready to be delivered to the final customers.

[1] EN 15804 (2014) Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products.

System boundaries and main hypothesis

Hot-drawn reinforcing steel for concrete in bars production system has been evaluated from raw materials extraction and production, steel production and transport of semi-finished products and final products (Figure 1). Use phase and end of life stages were not considered according to EN:15804 and PCR 2012:01; in general the certified product has a proper unlimited life cycle and ineffectiveness during use phase is bound to all the parameters that could influence concrete product durability of which steel is the core part.

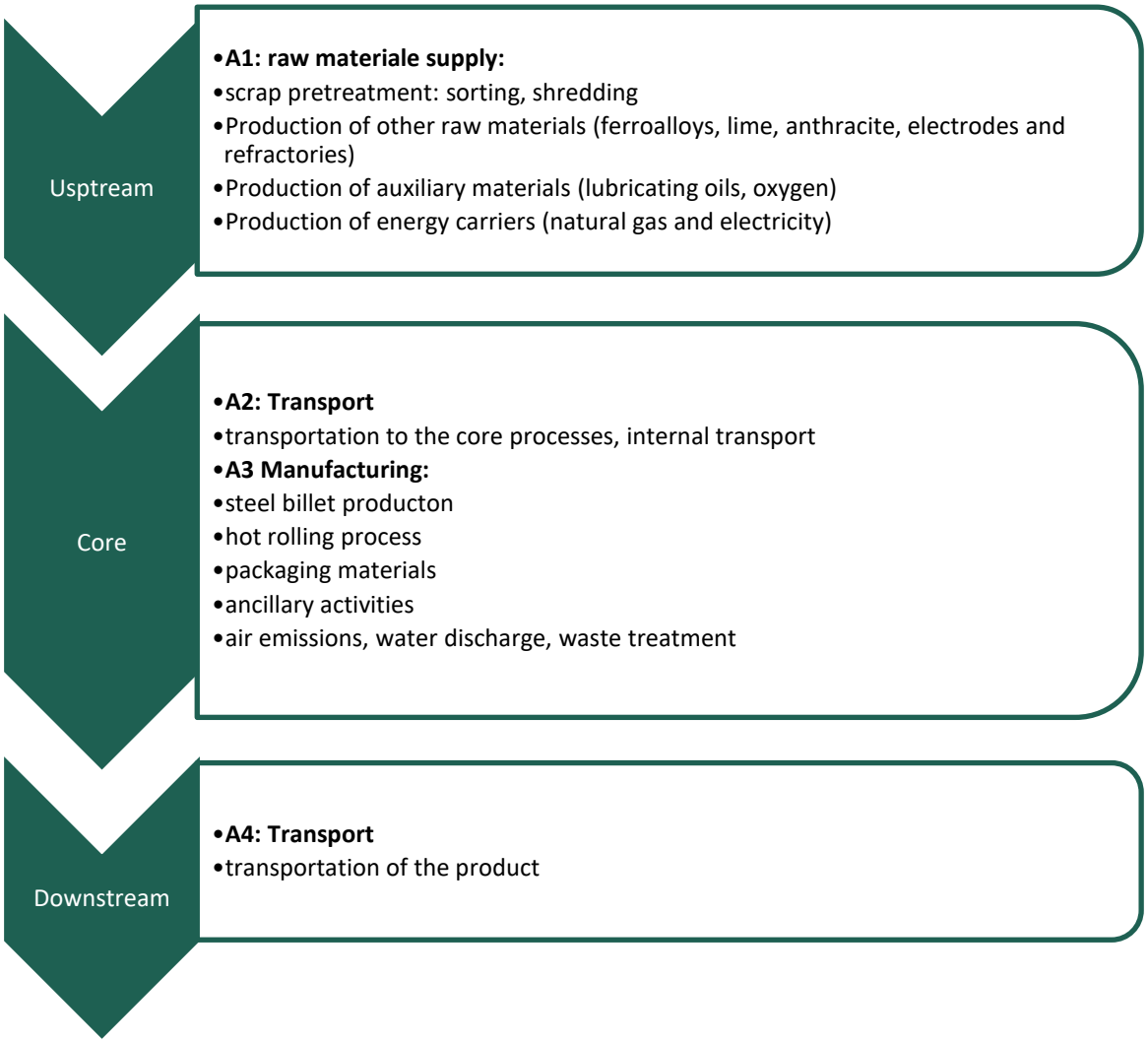


Figure 1 - Broad scheme of hot-rolled reinforcing steel for concrete production, in which the main activities included in the system boundaries, are listed and divided in the three subsystems: UPSTREAM Process, CORE Module and DOWNSTREAM Process.

According to EN 15804 the stages considered are the following:

Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
Raw materials	Transport	Manufacturing	Transport	Construction installation	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	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

The subsystems identified within hot-drawn reinforcing steel for concrete production are the following:

- Subsystem "**scrap pre-treatment**": all the scrap materials is treated before being used in steel billets production (upstream processes); scrap pre-treatments take place in external plants;
- Subsystem "**hot-drawn reinforcing steel for concrete production**": it comprehends scrap and raw materials transports from suppliers to Ferriera Valsabbia, steel billets production and hot rolling process to produce steel bars, included plant ancillary activities and internal handling, air and water emissions, waste management and transport to disposal plants (core process). The total amount of steel billets used in Valsabbia plant is an internal production;
- Subsystem "**market transport**" related to final product distribution from Valsabbia plant to an average customer or place of use (downstream process).
  About the 49,7 % of the final product is delivered to Italian sites and the remaining 50,3% to foreign countries especially Algeria, Germany and Switzerland. The means of transport are truck and freight ship. On average, a tons of steel bars (finished product) is transported for 417 km by lorry and 424 km by ship.

The main hypothesis of the LCA study are:

- All the phases related to **raw materials production and use** have been taken into account, from raw materials purchasing form suppliers to their production and sale;
- In case of **transports**, all those related to scrap and raw materials supply, waste management (from Ferriera Valsabbia plant to the place of disposal), internal handling and final product delivery, have been considered;
- **Ancillary activities and auxiliary materials use** (heating, lighting, etc.) are included within system boundaries and allocated to the different production stages on mass basis (allocation based on output quantities coming from pre-treatment stage, steel billets production and hot rolling process).

According to the general prescriptions of PCR on construction products as well as EN:15804, no environmental credits have been given to input scrap materials; only scrap pre-treatment process (necessary to make it suitable for steel production purpose) has been considered.

Environmental results

Panoramic view of Odolo (BS) at the crack of dawn

Detailed environmental performance (in terms of use of resources, waste generation and environmental impacts) is presented for the three production stages (Upstream, Core and Downstream) and the related sub-phases (A1-A2-A3-A4).

Note for the reader. The numbers reported in the tables below are the outcome of rounding. For this reason total results could slightly differ from the sum of contributions of the different phases.

Table 3 - Renewable resources use referred to 1 tons of hot-drawn reinforcing steel for concrete in bars

Renewable resources Net calorific value	Data referred to 1 tons of hot-drawn reinforcing steel for concrete in bars				
	UPSTREAM	**CORE**		**DOWNSTREAM**	**TOTAL**
	A1 – Raw materials supply	**A2 – Transportations**	**A3 – Manufacturing**	**A4 – Distribution**	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials [MJ]	1567	13	4	12	1596
Use of renewable primary energy resources used as raw materials [MJ]	0	0	0	0	0
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) [MJ]	1567	13	4	12	1596

Wastewater treatment plant and fume aspiration system

Table 4 – Non renewable resources use referred to 1 tons of hot-drawn reinforcing steel for concrete in bars

Non renewable Resources Net calorific value	Data referred to 1 tons of hot-drawn reinforcing steel for concrete in bars				
	UPSTREAM	**CORE**		**DOWNSTREAM**	**TOTAL**
	A1 – Raw materials supply	**A2 – Transportations**	**A3 – Manufacturing**	**A4 – Distribution**	
Use of non renewable primary energy excluding renewable primary energy resources used as raw materials [MJ]	6140	639	95	656	7531
Use of non renewable primary energy resources used as raw materials [MJ]	321	0	0	0	321
Total use of non renewable primary energy resources (primary energy and primary energy resources used as raw materials) [MJ]	6461	639	95	656	7852

Table 5 - Use of secondary material referred to 1 tons of hot-drawn reinforcing steel for concrete in bars

Use of secondary material	Data referred to 1 tons of hot-drawn reinforcing steel for concrete in bars				
	UPSTREAM	CORE		DOWNSTREAM	TOTAL
	A1 – Raw materials supply	A2 – Transportations	A3 – Manufacturing	A4 – Distribution	
Use of secondary material [kg]	1138	0	0	0	1138
Use of renewable secondary fuels [MJ]	0	0	0	0	0
Use of NON renewable secondary fuels [MJ]	0	0	0	0	0

Table 6 – Net use of fresh water referred to 1 tons of hot-drawn reinforcing steel for concrete in bars

Net use of fresh water	Data referred to 1 tons of hot-drawn reinforcing steel for concrete in bars				
	UPSTREAM	CORE		DOWNSTREAM	TOTAL
	A1 – Raw materials supply	A2 – Transportations	A3 – Manufacturing	A4 – Distribution	
Net use of fresh water [m^3]	2,02	0,14	0,07	0,13	2,37

Rolling stand

Table 7 – Waste production referred to 1 tons of hot-drawn reinforcing steel for concrete in bars

Waste production and treatment	Data referred to 1 tons of hot-drawn reinforcing steel for concrete in bars				
	UPSTREAM	CORE		DOWNSTREAM	TOTAL
	A1 – Raw materials supply	A2 – Transportations	A3 – Manufacturing	A4 – Distribution	
Hazardous waste disposed [kg]	0,02	0,00	0,00	0,00	0,02
Non Hazardous waste disposed [kg]	247	52	208	51	558
Radioactive waste disposed [kg]	0,041	0,004	0,001	0,005	0,050

Fume suction and filtering system realized in 2010

Table 8– Parameters describing environmental impacts referred to 1 tons of hot-drawn reinforcing steel for concrete in bars

Environmental impacts parameters	Data referred to 1 tons of hot-drawn reinforcing steel for concrete in bars				
	UPSTREAM	CORE		DOWNSTREAM	TOTAL
	A1 – Raw materials supply	A2 – Transportations	A3 – Manufacturing	A4 – Distribution	
Global Warming Potential [kg CO_2 eq]	403	39	85	41	568
Ozone Depletion Potential [kg CFC-11 eq]	4,46E-05	8,32E-06	9,48E-07	7,86E-06	6,17E-05
Acidification Potential [kg SO_2 eq]	1,84	0,16	0,02	0,24	2,27
Eutrophication Potential [kg PO_4^{3-} eq]	0,592	0,037	0,223	0,042	0,894
Photochemical Ozone Creation [kg C_2H_4 eq]	0,083	0,007	0,098	0,009	0,196
Depletion of abiotic resources (elements) [kg Sb eq]	9,29E-04	7,44E-05	1,59E-05	7,14E-05	1,09E-03
Depletion of abiotic resources (fossil) [MJ]	5820	616	89	635	7160

Additional information

Ferriera Valsabbia plant in Odolo (BS) is equipped with prevention and reduction systems for air emissions, a recirculating loop cooling to minimize water consumption and a waste management plan to prevent and reduce waste generation.

In Table 9 some additional environmental information are reported.

Table 9 - Other environmental indicators referred to 1 tons of hot-drawn reinforcing steel for concrete in bars

Other environmental indicator for 1 t of product		Unit	UPSTREAM	CORE	DOWNSTREAM	TOTAL
Air emissions	**Dust from electric-arc furnace**	[g]	-	5	-	5
	CO2 from electric- arc furnace and hot rolling process	[kg]	-	80	-	80
	NOx from electric-arc furnace and hot rolling process	[g]	-	84	-	84
	SOx from electric-arc furnace and hot rolling process	[g]	-	6	-	6
Water emission	**Total Suspended Solids**	[g]	-	< 1	-	< 1

In accordance with general EPD® requirements the LCA study used specific, generic and proxy data. This last data are contributing to the environmental indicators less than 10%. Furthermore some consideration on the contribution of other generic data in the environmental indicators considered is available in the final LCA report.

Information and reference

Sheet ingot casting

General information

This declaration has been developed referring to the International EPD® System, following the General Program Instruction and Supporting Annexes (ver. 2.5); further information and the document itself are available at: www.environdec.com.

The main database used within the study: Ecoinvent 3.4.

EPD document valid within the following geographical area: Italy and other countries according to sales market conditions (North Africa and Europe).

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EN 15804 served as the core PCR (PCR 2012:01 Construction products and Construction services, Version 2.2, 2017-05-30) PCR review was conducted by: The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via info@environdec.com
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EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

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Technical support to Ferriera Valsabbia was provided by e3 – studio associato di consulenza, Italy (www.ecubo.it).

References and data sources

- Life Cycle Assessment (LCA) for hot-drawn reinforcing steel for concrete in bars produced by Ferriera Valsabbia S.p.A. for EPD® purpose – 04/09/2018
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- General programme instructions for the International EPD® System; Swedish Environmental Management Council (version 2.5) (www.environdec.com)
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- Terna. (2018). Bilancio Elettrico Italia 2017 - dati generali.
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- Ecoinvent v. 3.4
- UNI EN 10080-2005 (Steel For The Reinforcement Of Concrete - Weldable)

Glossary

Considered parameters describing environmental impacts:

- **Global Warming – GWP**: Phenomenon in which the infrared rays emitted from the Earth's surface, as a result of solar heating, are absorbed by molecules in the atmosphere and re-emitted as heat, causing the over-warming of the atmosphere. The indicator used to evaluate this contribution is the GWP (Global Warming Potential), which includes primarily the emissions of carbon dioxide, the main greenhouse gas , as well as other gases with a lower degree of absorption of infrared rays , such as methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons (CFC) (g CO_2).
- **Acidification Potential – AP**: It is a form of precipitation that is unusually acidic, meaning that it possesses substandard levels of pH. It can have harmful effects on plants, aquatic animals and infrastructure. Acid rain is caused by emissions of SO2, NOx and NH3. The acidification potential is measured in grams of equivalent Sulphur Dioxide (SO_2).
- **Ozone Depletion Potential – ODP**: degradation to the ozone layer, useful to block the ultraviolet component of sunlight, caused by some substances such as chlorofluoromethans or chlorocarbons. Trichlorofluoromethane (R-11 or CFC-11) is the reference substance, being fixed at an ODP of 1.0. The ozone depletion potential is measured in g CFC-11 eq.
- **Eutrophication potential – EP**: It is an extreme proliferation of vegetation in the aquatic ecosystem caused by the addition of nutrients into rivers, lakes or ocean, which determinates a lack of oxygen. Eutrophication potential is mainly caused by emission into water of phosphate and nitrates. It is expressed in equivalent grams of (g PO_4^-).
- **Photochemical ozone creation potential – POCP**: Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight forms the ozone in the troposphere. The indicator mainly consists of VOCs (Volatile Organic Compounds) and is usually expressed in grams of equivalent ethylene oxide (g C_2H_4).

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