Environmental Product Declaration

LATIN AMERICA EPD®

ECO PLATFORM EPD EN 15804 VERIFIED

ECO EPD 00000814

In accordance with ISO 14025 and EN 15804 for:

[*Reinforcing Steel Bar*]

[*Aceros AZA S.A.*]

Programme:	The International EPD® System www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-00696
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Geographical scope:	Chile

AZA Acero Sostenible®

Company

In Chile AZA is the leading producer of steel from scrap. It produces long steel products such as reinforcement bars, merchant bars and wire rod. It has an installed capacity of 520 000 t of melted steel per year. In 2015 it produced 326 310 t of finished products. Its main customers are distributors of building materials in the domestic market. AZA is the only company in Chile that produces steel through a "semi-integrated'' process in which ferrous scrap is used as raw material, recycling it in an electric arc furnace. This procedure is an alternative to the "integrated process" in which iron ore is mixed with carbon, oxygen and lime in a furnace to produce steel.

AZA in Chile currently has two production plants located in different industrial sectors of Santiago. The largest one located in Colina has a production capacity of 420 000 tons of rolled steel per year; the other plant located in Renca, also produces rolled steel and has a capacity of 100 000 tons per year.

The Colina plant includes processes for the collection and preparation of scrap (grinding), as well as the smelting of scrap by electric arc furnace, the refining through a spoon furnace and the steel casting process for the production of steel ingots called billets. This plant also has a rolling mill for heating the billets and moulding them to generate reinforcement bars, wire rod and a type of steel profile called round bars. On the other hand, the Renca plant has only one laminator, which produces mainly steel profiles and in smaller quantity reinforcement bars. Since this plant does not have steelworks, requires that the billets be supplied from the Colina plant. The billets are transported by truck, covering a distance of approximately 19 km.

The company´s recycling centers are located in the major cities of the country (in addition to Santiago), such as Antofagasta, Concepción and Temuco, where the scrap is collected and sent to the Plants Santiago.

AZA's business has been intrinsically linked to sustainability since its inception, being a fundamental pillar of its strategic focus. In this way, AZA has been focused on developing the environmental performance of its products as an attribute.

This EPD is intended to be used by diverse actors in the construction industry. It is meant to provide the information needed in the LCA of buildings and structures, which includes rebar fabricated by AZA. Another reason is to make a contribution to those buildings trying to achieve credits for the LEED® v4 Certification. With this EPD, AZA aims to communicate its environmental impacts in a fully transparent and comprehensive way, giving consumers the possibility to compare its performance with other products. This information shall be accessible to any market participants. The complete supporting information of this EPD is presented in the AZA LCA report.

Product:

Steel Bars for concrete reinforcement, CPC 412

This EPD refers to concrete reinforcing bars made in Chile by AZA through a semi-integrated process with an electric arc furnace, using ferrous scrap as raw material.

Function of the Product System

The function of the system is to make steel products for construction. This is accomplished by melting the steel in an electric arc furnace to produce billets, which are then subjected to the hot rolling process.

Product description:

AZA reinforcing bars for reinforced concrete are products with a circular cross-section with longitudinal ribs and ribs inclined with respect to their axis, in accordance with the requirements of the Chilean Standard NCh204 Of.2006. The reinforcing bars are used in the manufacture of reinforcements of any reinforced concrete element in the construction industry, including casting, prestressing and precasting. Specific examples of application are, among others: slabs, walls, beams and columns, retaining walls, water ponds, high-rise buildings, dams, dykes, general and airport pavements.

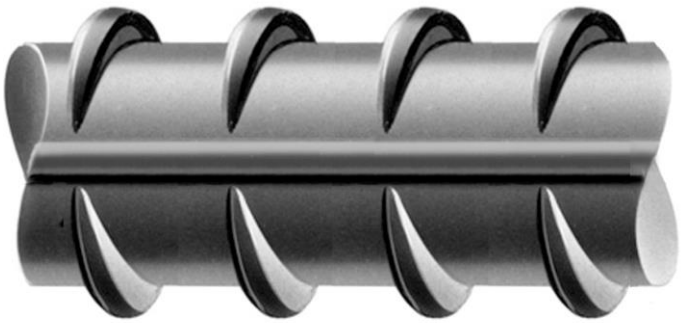
They are offered in grades A440-280H and A630-420H.

A630- 420H y A440-280H					
A	=	Steel	A	=	Steel
630	=	630 MPa Fv	440	=	440 MPa Fv
420	=	420 MPa Fy	280	=	280 MPa Fy
H	=	Use of Concrete	H	=	Use of Concrete

Types of Reinforcing Bars:

- Smooth round bars: A bar with a cross-section that is uniform throughout its length. In Chile it is only manufactured in quality steel A440-280H and with a diameter of 6 mm.

- Relief bars: A bar with longitudinal ribs and ribs transverse or inclined with respect to its axis, whose purpose is to increase the adhesion of the steel to the concrete, due to the greater surface of contact developed.



This EPD comprises all the reinforcing bars produced by AZA in Chile, according to the following description:

Relief Identification (2)		Steel Quality	Diameter (1) dn mm	Delivery mode
Mark of Origin and Nominal Diameter	Steel Grades			
		A440-280H	8, 10 y 12	Rolls
			8 a 36	Straight
		A630-420H	6*, 8, 10 y 12	Rolls
			6* a 36	Straight

* The diameter of 6 mm (new product) is supplied only in quality A630-420H and with smooth surface. All other diameters carry projections.

1) The nominal diameter (Dn) of the AZA reinforcing bars for concrete, according to Chilean Standard NCh204 Of.2006, is given by the relation:
   Dn = 12.73 √mn where:
   Dn = Nominal diameter of the bar in mm
   mn = Nominal mass of the bar in kg / m
2) All AZA reinforcing bars are clearly identified, allowing easy determination of the grades of steel on the one hand (G A440 for grade A440-280H and G A630 for grade A630-420H) and nominal diameter in millimeters of the bar on the other.

Declared Unit

The declared unit (DU) is 1 ton of steel reinforcing bars ready for distribution.

Content declaration

Standards and Quality Standards

AZA reinforcement bars are certified under the Chilean Standard NCh204: 2006 and have a chemical composition in compliance with national regulation.

EPD reference products have a chemical composition in compliance with national regulation. All AZA production is destined for the national market.

AZA hires the services of a state-recognized materials testing agency (Idiem) for the control and certification of 100% of steel production for concrete bars. This special certification can be requested by the client to guarantee the use of the items in reinforced concrete works.

Designations according to the national standard NCh204.Of2006

A630-420H	A440-280H
A = Carbon Steel	**A = Carbon Steel**
630 = 630 Mpa	**440= 440 Mpa**
420 = 420 Mpa	**280= 280 Mpa**
H = Use in reinforced concrete	**H = Use in reinforced concrete**

Grade A440-280H

Grade A630-420H

Nominal diameter

Mark of origin

Methodology

The LCA of the reinforcing steel bars is done with a cradle-to-gate scope.

LCA was conducted according to ISO 14040-14044, ISO 14025, EN 15804 and the PCR 2012:01 version 2.01 "Construction Products and Construction Services."

Allocations

Mass allocations were used following the indications of the PCR, to distribute the environmental burden between the two main product categories of AZA, the reinforcing bars and the steel profiles.

Economic allocations were used in the sensitivity analysis of the results. The differences on the environmental impact indicators calculated using economic allocations were only about 1% with respect to the impact calculated using mass allocations.

The contributions of the two production plants of AZA in Santiago to the life cycle impacts of the products were distributed according to the annual mass production by each plant; i.e. the weighted average distribution of the impacts.

Cut-off criteria:

Cut-off rules were applied according to the PCR requirements; that is, 95% of all flows of the core process were included. Wastewater are the only flows which have not been considered due to the lack of reliable data. However, calculations with SimaPro 8.0 showed that their contribution to the overall life-cycle impact of the product was less than 1%.

Data and data collection

Primary data: data was taken directly from the process information at AZA's two productive Plants in Santiago, corresponding to the year 2014.

In order to complete the information, specific questionnaires were developed and interviews were conducted with the managers and professionals in the environmental area, as well as with plant and operations managers.

Secondary data: Electricity data and water-related processes related to transport and raw materials were obtained from national official sources such as the Ministries of Energy, Environment and Transport. Also some generic data, especially those related to mining processes were obtained from commercial databases available in SimaPro 8.0 (mainly Ecoinvent).

System boundaries

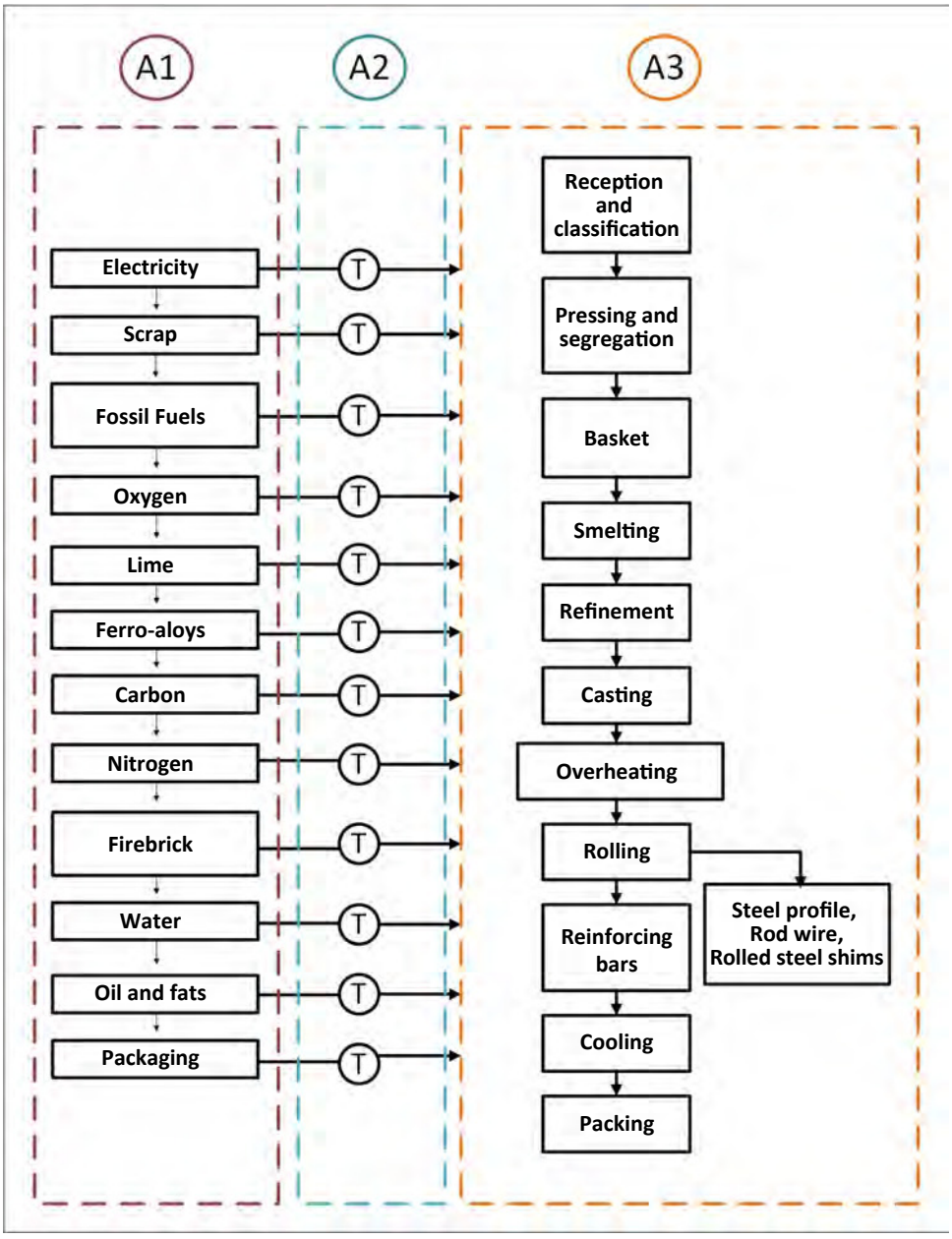
The life-cycle stages included are:
- supply of raw material (A1): extraction and processing of raw materials, and energy production;
- transport of raw material (A2): external transport of raw material to the plants and internal transport;
- product manufacturing (A3): production processes.

In accordance with the EN15804 standard, the phases of use and end of life were not considered, as shown in the following scheme:

Product stage			Assembly 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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

X: declared; MND: mode not declared

Flow diagram of the product system:



Environmental Performancel

The LCA results are included according to the requirements of PCR 2012:01 v2.0 for the two product stages considered in this EPD: upstream and core phases (A1, A2-A3).

Resource use indicators:

The following indicators describe the use of renewable and non-renewable primary energy, and water.

		UPSTREAM		CORE	
Material and Energy	**Unit**	**Raw Materials A1**	**Transport A2**	**Manufacturing A3**	**Total**
Total use of non-renewable primary energy	MJ/DU	10 333	1 230	161	11 724
Use of non-renewable secondary fuels	MJ/DU	2 776	914	-	3 690

Table 1: Non-renewable resources used per DU.

		UPSTREAM	CORE		
Material and Energy	**Unit**	**Raw Materials A1**	**Transport A2**	**Manufacturing A3**	**Total**
Total use of renewable primary energy	MJ/DU	1 505	15	6	1 526
Use of renewable secondary fuels	MJ/DU	-	-	-	-
Steel scrap	t/DU	1.2	-	-	1.2

Table 2: Renewable resources used per DU.

Net water used	Direct use in the core process	0.7 m^3/DU

Table 3. Water use per DU.

The water consumption indicator also includes residual water, which is later used for irrigation.

Limitations: the total water used is not included in full due to the lack of reliable upstream data regarding water accountability in the LCA; water use and water consumption are used interchangeably in many studies.

Potential environmental impact:

The estimated impact results are only relative statements, which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

The environmental impact categories are presented according to the PCR requirements.

The following potential environmental impact indicators were calculated using the CML IA model of SimaPro 8.0.

		UPSTREAM	CORE		
Impact Categories	**Unit**	**Raw Materials A1**	**Transport A2**	**Manufacturing A3**	**Total**
Global warming potential **GWP**(100)	kg CO_2 eq	452	76	239	767
	(%)	59%	10%	31%	100%
Ozone depletion **ODP**	kg CFC-11 eq	5.4E-05	1.4E-05	1.4E-06	7.0E-05
	(%)	78%	20%	2%	100%
Acidification **AC**	kg SO_2 eq	2.9	0.4	0.2	3.5
	(%)	83%	12%	5%	100%
Eutrophication **EU**	kg PO_4^{-3}eq	7.2E-01	9.7E-02	7.8E-02	0.9
	(%)	80%	11%	9%	100%
Photochemical oxidant creation **PO**	kg C_2H_4 eq	1.1	1.5E-02	3.7E-02	1.1
	(%)	96%	1%	3%	100%
Depletion of abiotic resources (elements) **Ade**	kg Sb eq	2.1E-04	2.0E-04	1.1E-05	4.2E-04
	(%)	49%	48%	3%	100%
Depletion of abiotic resources (fossil) **ADf**	MJ	10 219	1 210	155	11 585
	(%)	88%	11%	1%	100%

Table 4. Potential environmental impacts per DU.

When comparing the environmental impacts of the reinforcing bars produced in the Renca and Colina Plants, it results in an average of 7.1% higher for Renca for all impact categories studied; among them, the acidification (AC) is the one with the greatest difference (9.7%). This is probably due to the larger production scale at Colina where 96% of the reinforcing bars are produced.

Other environmental indicators

The recyclability potential of steel products including reinforcing bars: 90% (UNEP IRP 2011).

The indicators presented in tables 5, 6 and 7 describe, the waste production, the generation of residues and the air emissions, respectively, related to the declared unit.

		UPSTREAM	CORE		
Waste	**Unit**	**Raw Materials A1**	**Transport A2**	**Manufacturing A3**	**Total**
Hazardous waste	kg/DU	3.8E-03	7.2E-04	1.8E-04	4.7E-03
Non-hazardous waste	kg/DU	37.8	56.1	238.7	332.6
Radioactive waste	kg/DU	3.0E-02	8.5E-03	7.9E-04	4.0E-02

Table 5. Waste production per DU.

Residues	t/DU
Wood	3.1E-04
Cardboard	2.1E-05
Big bags	9.3E-05
Slag	1.5E-01
Dust	4.0E-02
Liquid waste sludge (Treatment Plant)	1.4E-03
Contaminated garbage	3.7E-04
Mixed liquids	1.4E-04
Organic matter (For Composting)	2.3E-04
Firebrick	1.6E-03

Table 6: Residues generated in the steelmaking process per DU.
These materials are subsequently treated or recycled through specialized external services.

Air emissions	t/DU
NOx	2.1E-03
PM	7.6-04

Table 7. Air emissions per DU.

Additional environmental information

AZA has a long tradition in recycling steel scrap from construction and also from other industrial sectors. The principal source of raw materials is ferrous scrap generated mainly by steel consumer goods in their end-of-life phase. There are well-established systems in Chile to recover such materials, and AZA in particular is quite effective in applying logistic and management procedures to recover a significant amount of the ferrous scrap generated in the country for subsequent processing according to international good practices regarding social and environmental responsibility.

AZA carefully sorts and selects recycling materials to efficiently manufacture different steel products under the high quality requirements on physical and mechanical parameters established by national regulations. The function of rebar is to reinforce a structure made of concrete. During the use phase, the bars remain unchanged inside of the structure, with no direct contact to the exterior environment, thus not needing any processes related to maintenance.

One of steel's major benefits is that it can be completely recycled or reused at the end of the building's life. The end of life for rebar coincides with the same phase of the building whose structures it is contributing to reinforce. According to the World Steel Association[1], up to 98% of structural steel in commercial and industrial buildings is recycled. Given the value of scrap steel and that it is easily retrieved from almost any waste stream using magnetic separation, the incentive to recover and recycle these components is high and it proves to be more cost-effective than paying for them to be placed in landfills.

Additional information that fully complies with the Global Reporting Initiative[2] standards regarding AZA's rebar production and its sustainable performance can be found in the CSR Annual Report[3].

[1] www.worldsteel.org
[2] www.globalreporting.org
[3] www.gerdau.cl/sostenibilidad/reportes-de-sostenibilidad

General information

This declaration has been made according to General Program Instruction vrs. 2.5 (2015) of the International EPD® System. All information available at: www.environdec.com.

CEN standard EN 15804 served as the core PCR 2012:01 Construction Products and Construction Services. This EPD meets the requirements for compliance with ISO 14025 and EN15804.

Programme-related information and verification

See PCR for detailed requirements.

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com; www.epd-americalatina.com
EPD registration number:	S-P- 00696
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Product Category Rules:	PCR 2012:01 Version 2.01 (2016-3-9)
Product group classification:	UN CPC 4126 drawn and folded products of iron or steel
Reference year for data:	2014
Geographical scope:	Chile

Product category rules (PCR): CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES PRODUCT GROUP CLASSIFICATION: MULTIPLE UN CPC CODES 2012:01. VERSION 2.01. VALID UNTIL: 2018-03-03
PCR review was conducted by: The Technical Committee of the International EPD® System. Chair: Massimo Marino. IVL Swedish Environmental Research Institute. Moderator: Martin Erlandsson
Independent verification of the declaration and data according to ISO 14025:2006: ☐ EPD Process Certification (internal) ■ EPD Verification (external)
Third party verifier: *Alejandro Pablo Arena* Accredited by: *Approved by the International EPD System*

Mandatory statements

- This is a cradle to gate declaration made according to the General Program Instruction of the International EPD System.
- The product system and results were organized according to the life cycle stages described in the PCR 2012.01 v2.0 “Construction Products and Construction Services: Upstream (raw material supply, A1; transport, A2) and Core Process (manufacturing, A3).
- This declaration complies also with the EN 15804 of the EPD (for construction product EPDs).
- The use and end of life phases were not considered according to EN15804 for construction products.

EPDs within the same product category but from different programmes may not be comparable. Besides, EPDs of construction products may not be comparable if they do not comply with EN 15804, or if they are produced using different product category rules.

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Idiem (Institute of Research and Material Testing), Faculty of Applied Sciences, University of Chile.

ISO14040: 2006 Environmental management - Life cycle assessment - Principles and framework

ISO14044: 2006 Environmental management - Life cycle assessment - Requirements and guidelines

ISO14025:2006 Environmental labels and declarations — Type III environmental declarations - Principles and procedures.

UNI EN 15804: 2014 Sustainability of construction works — Environmental product declarations -Core rules for the product category of construction products.