Environmental Product Declaration

In accordance with ISO 14025 and EN 15804:2012+A1:2013 for:

Steel reinforcing bar (weldable and non-weldable)

from

CAP Acero

	The International EPD® System, www.environdec.com
Programme:	EPD registered through the fully aligned regional program/hub: EPD Latin America www.epd-americalatina.com
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What is an EPD?

An Environmental Product Declaration (EPD) is an independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products.

The following EPD has been developed by CAP Acero for its steel reinforcing bars, including non-weldable and weldable (also known as CAPSOL®) bars. This EPD is an updated version that includes the difference between both types of bars.

Company information

Owner of the EPD

CAP Acero, Compañía Siderúrgica Huachipato S.A.

Web: www.capacero.cl

Phone: (56-2) 2818 6500 –

(56-41) 2544455

Description of the organisation

CAP Acero - Compañía Siderúrgica Huachipato S.A. - is a company of the CAP Group and the main steel producing industry in Chile. The steel company is located in Talcahuano, on the shores of San Vicente's bay, and has stood out for its positive productive, economic and social impact in the Bio Bío Region.

Since 1950, the Company leads the steel business in Chile and currently has a production capacity of 800,000 tons of liquid steel per year. CAP Acero is the only integrated steel producer in the country, which means that it produces steel from basic raw materials, such as iron ore, coal and limestone, which guarantees products of high purity and controlled quality.

Through a wide range of products of recognized quality, CAP Acero contributes to the country's growth. It supplies important sectors of the economy, mainly mining, metallurgy and construction.

Currently, its production is oriented to long products, such as grinding bars, wire rod, concrete reinforcement bars and special steels.

Sustainability

From its origins the company has been concerned with developing its productive activity adjusted to quality standards, safeguarding the social and environmental balance of its operations. The company has an integrated management system, which guarantees continuous process improvement and guarantees the quality of products and services; and they have the following certifications:

- ISO 50001: 2011 Energy Management Systems
- ISO 14001: 2015 Environmental Management System
- ISO 9001: 2015 Quality Management System
- OHSAS 18001: 2007 Occupational Health and Safety.
- ISO 45001:2018 (starting in 2021)

CAP Acero has also developed a Sustainability Report aligned with Global Reporting Initiative (GRI)[1], where information about these initiatives can be found.

Energy

In addition to ISO 50001, the company has the Chilean Ministry of Environment Energy Efficiency seal Gold category, due to the implementation of several projects, including the reduction of steam in the manufacturing process through the implementation of better technologies.

Zero waste

CAP Acero has a zero-waste strategy. This means that all waste has a use, avoiding waste going to landfill. The strategy has allowed that only 2% of waste goes to external landfill, while the rest is recycled, reused or sent to a zone of waste management (Zomare).

Emissions

CAP Acero has emission abatement systems in place to control air emissions. Among initiatives are the use of baghouse and sprinkling of coal and coke areas. In terms of fuel use, the consumption of petroleum has decreased in recent years, allowing an impact reduction.

Biodiversity

Inside CAP Acero's facilities there is a wet area, formed by 3 lagoons and a flooding area, reaching 65 hectares. This ecosystem is protected, maintained and monitored periodically. Additionally, in 2018 the company planted 13,500 native trees in Talcahuano, as part of its reforestation initiative.

Water

The company constantly monitors underground water and discharges. In recent years, this monitory has allowed discharges of water with contamination levels well below what is requested by law.

Contribution to LEED Certification v4.1

CAP Acero's steel reinforcing bars provide credits for LEED v4.1 certification. Specificaly, the Sustainability Report and the recyled content provide credits in Materials and Resources. For more information, visit Chile Green Building Council website.

Name and location of production site

CAP Acero - Compañía Siderúrgica Huachipato S.A
Avenida Gran Bretaña N° 2910, Talcahuano, Bío Bío Region.

For more information about CAP Acero's products call (56-2) 2818 6500 or visit www.capacero.cl

[1] Available in the following link: https://www.cap.cl/reporte-sostenibilidad-2018/

Product information

Product name

The product included in this EPD is CAP Acero' steel reinforcing bar, including non - weldable and weldable (CAPSOL®) bars.

Product identification

Steel reinforcing bars for concrete included in this EPD are A440- 280H and A630- 420H, in his weldable and non- weldable format (Figure 1- for weldable bar, the identification includes an "S", which stands for *"Soldable"* (Weldable")). The specifications are presented in Table 1. The impact presented for a declared unit of 1 ton is representative of all bars since the difference between them is not higher than ± 10% in all impact indicators.

Figure 1: CAP Acero steel reinforcing bars included in this EPD

Table 1: Product specifications

Nominal diameter (mm)	Nominal section (cm^2)	Nominal weight (kg/m)	Delivery mode
6 (only with smooth surface)	0.283	0.222	Rolls and straight
8	0.503	0.395	
10	0.785	0.617	
12	1.131	0.888	
16	2.011	1.578	Straight
18	2.545	1.998	
22	3.801	2.984	
25	4.909	3.853	
28	6.158	4.834	
32	8.043	6.313	
36	10.179	7.990	

Product description

The evaluated product is steel reinforcing bar. These bars are products of circular section with longitudinal ribs and inclined projections with respect to its axis. CAP Acero's bars are used in the construction of reinforcements of any element of reinforced steel; and are certified under the Chilean Standard NCh204: 2006 for non- weldable bars and NCh3334:2014 for weldable (CAPSOL®) bars. The chemical composition of bars is also in compliance Chilean regulations, and the specific content

declaration are presented in Table 2 and Table 3 for non- weldable and weldable bars, respectively. The bars do not present any substances of very high concern.

Table 2: Content declaracion- non- weldable bars

Products	Chemical composition	%	CAS Number
A440-280H & A630- 420H (non-weldable)	Iron	~99%	7439-89-6
	Carbon	0.18%- 0.44%	7440-44-0
	Manganese	0.60% - 1.10%	7439-96-5
	Phosphorus	0.040%	7723-14-0
	Sulphur	0.05%	7704-34-9

Table 3: Content declaracion- weldable bars (CAPSOL®)

Products	Chemical composition	%	CAS Number
A630- 420H S (weldable)	Iron	~99%	7439-89-6
	Carbon	0.27%- 0.33%	7440-44-0
	Manganese	1%	7439-96-5
	Phosphorus	0.03%	7723-14-0
	Sulphur	0.04%	7704-34-9

Packaging

The steel reinforcing bars are tied with wire made also from steel and include a wire rod in of the end with a plastic label containing the information of the product.

Recycled material

CAP Acero's steel reinforcing bars are a mix of pig iron and scrap recollected throughout the country (post-consumer). In the production of liquid steel, the scrap represents 28% of the total weight, with pig iron representing the remaining 72%. Companies can request the certification of recycled content to CAP Acero.

UN CPC code

The UN CPC code for the product is CPC 4126, which is drawn and folded products of iron or steel.

Geographical scope

The EPD covers manufacture in Chile.

LCA information

A life cycle assessment is a technique for assessing the environmental aspects and potential impacts associated with a product. By considering potential impacts throughout the life cycle of a product (upstream and downstream), the analysis avoids the shifting of burdens from one type of environmental impact to another, from one political region to another and from one stage to the other.

An Environmental Product Declaration (EPD) is an independently verified and registered document that communicates transparent and comparable information about the life cycle environmental impacts of products. The following information describes the scope and methodology of this EPD for CAP Acero's steel reinforcing bars, allowing for comparison with other EPDs, following the guidelines of EN 15804.

Declared unit

This EPD has a cradle to gate scope, with a declared unit of 1 ton of reinforcement steel bar (weldable and non- weldable), ready for distribution.

Time representativeness and data collection

Core data collection

Foreground data on physical properties, raw material & energy requirements, transport of raw materials and manufacture of the bars was collected by the company for the year 2018. The information is considered good, as is summarized in Table 4.

Table 4: Foreground data sources and quality

	Product data	Module A1	Module A2	Module A3
Data	Range and physical properties	Raw material inputs Energy inputs	Transportation from overseas suppliers to Chile	Water inputs Consumable inputs Waste outputs Internal transport distances Emissions
Source	Collected by CAP Acero staff for 2018.	Collected by CAP Acero staff for 2018.	Supplier locations provided by CAP Acero staff for 2018. Distances calculated with online tool. Transport specifications assumed from ecoinvent 3.6 processes.	Collected by CAP Acero staff for 2018, with the exception of CO2 direct emissions from the burning of coke, obtained from ecoinvent 3.6
Quality	Good.	Good.	Good.	Good.

Background data

Background data was retrieved from ecoinvent 3.6, which dates from 2019, for processes occurring in Chile. In compliance with the relevant PCR, generic processes were used for feedstock materials.

Database(s) and LCA software used:
The inventory data for the process are entered in the SimaPro LCA program and linked to the pre-existing data for the upstream feedstocks and services. Data were selected per geographic relevance from ecoinvent 3.6 database.

System diagram:
Figure 2 presents the life cycle diagram of CAP Acero's steel reinforcing bar, while Table 5 summarises the process.

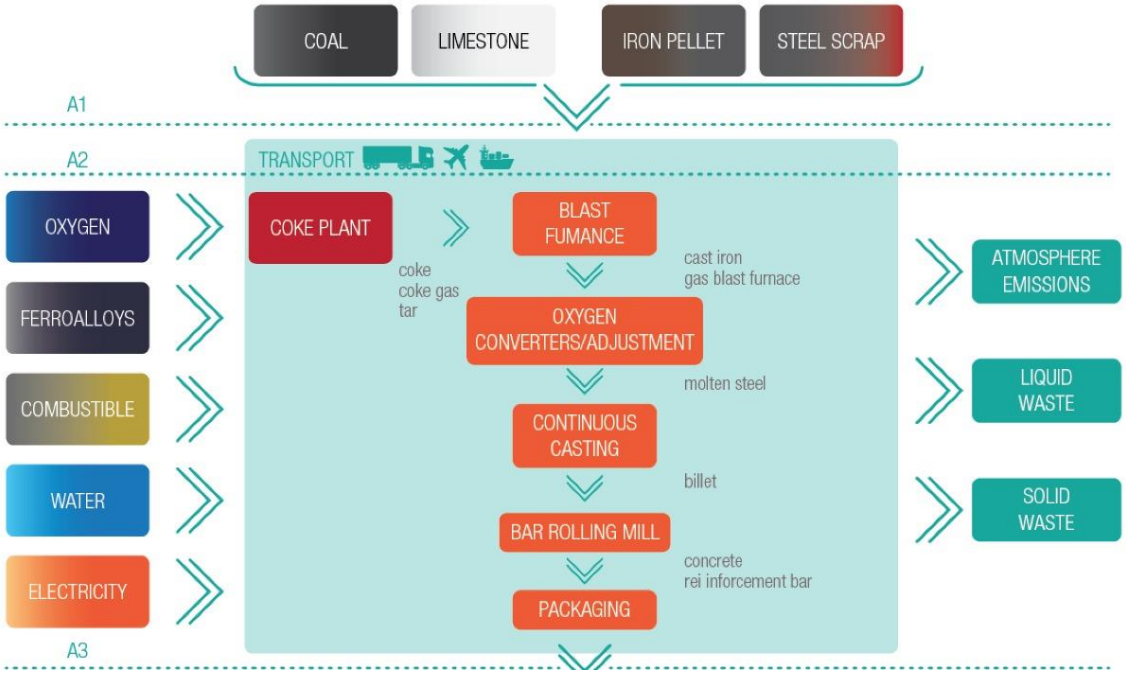
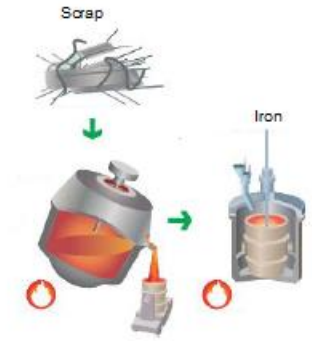
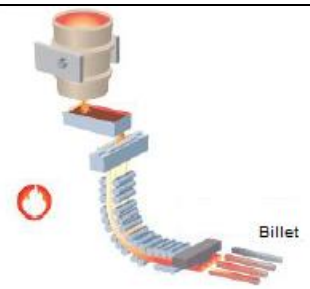
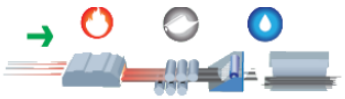


Figure 2: Life Cycle Diagram of CAP Acero's steel reinforcing bar

Table 5: Summary of steel making process

Stage	Description	Scheme
Coke plant	Process to transform coal into coke. After reception of coal, this is crushed and mixed to the right proportions, to then go into the coke furnace. This process also generates coke gas, which is later used as fuel for other processes. The generated coke is cooled with water, which is afterwards saved and reused for further cooling processes. Some water is released as water vapour.	

Stage	Description	Scheme
Blast furnace	Coke, iron pellets and ore, and limestone are loaded into this furnace to produce cast iron and slag. These raw materials are loaded in the top of the furnace, while the cast iron and slag are received below	
Oxygen converters/adjustments	In this process oxygen is used to remove the excess of coal from the cast iron. Other inputs are used here, such as lime, ferrochromium, magnesium and dolomite. The process also uses scrap. The result from this stage is the molten steel.	
Continuous casting	In this process, the molten steel is poured into copper moulds and transforms into billets. The copper melds allow the circulation of water, which helps the shaping and cooling of the billets.	
Bar rolling mill	The billets from the previous stage are laminated and transformed into specific bars, such as steel reinforcement.	
Packaging	The steel reinforcing bars are tied with wire made also from steel and include a wire rod in of the end with a plastic label containing the information of the product.	

Description of system boundaries:

The analysis is cradle to gate, encompassing raw materials, transport and manufacturing of steel reinforcing bars (Modules A1-A3) in accordance with construction products PCR (Figure 3).

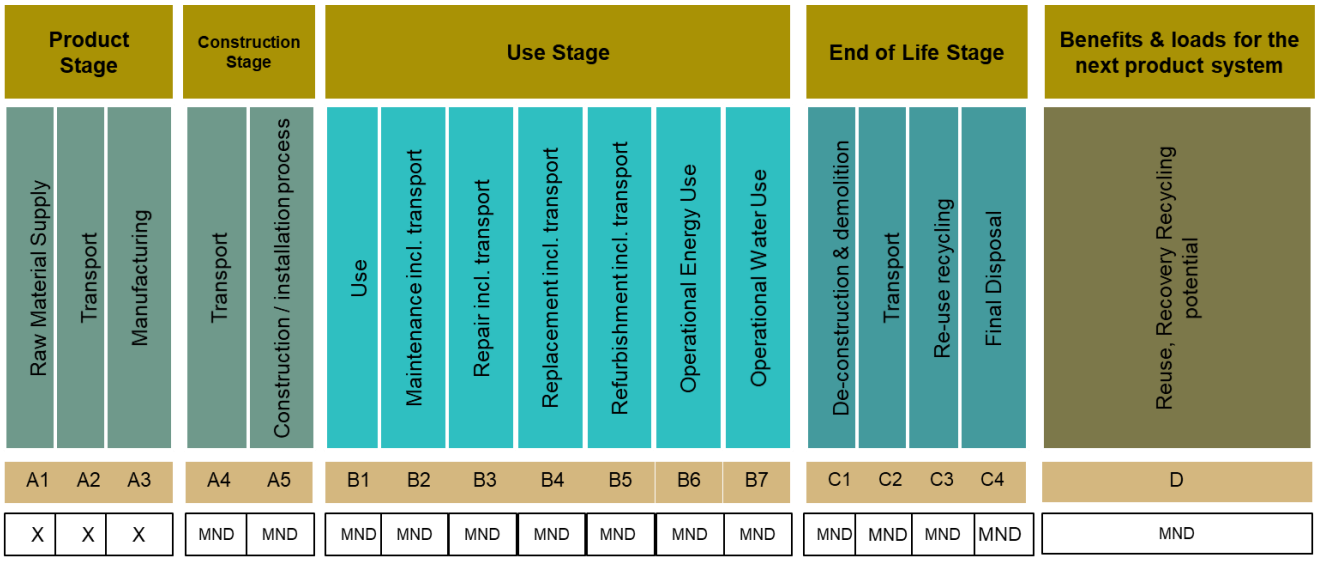


Figure 3: System boundary and scope of the study. MND = module not declared

Excluded lifecycle stages:

The following life cycle stages have not been assessed, as they are deemed negligible, not applicable or too variable for CAP Acero' steel reinforcing bars:

- Transport (A4)
- Construction/installation process (A5)
- Use stage (B)
- End of life stage (C)
- Reuse, recovery, recycling potential (D)

Cut off criteria

Environmental impacts relating to personnel, infrastructure, and production equipment not directly consumed in the process are excluded from the system boundary as per the PCR CPC 54 Version 2.2. 2017-05-30 (EPD International, 2017). All other reported data were incorporated and modelled using the best available life cycle inventory data.

No other cut offs were necessary for the modules included in this EPD.

Allocation

Allocation to co-products was done on a mass basis when the value of the products was in similar ranges. This is the case of other coke co-products from the coke plant and other steel co- products out of the bar rolling mill (mesh, other bars, among others).

In the cases where value differences are high, the allocation was done on an economic basis. This is the case of slag, which is sold for only a fraction of steel products (0.7%).

For co- products of even lower selling value, such as dust and rejected lime, a worst-case scenario was selected, allocating no impact to these.

Environmental performance

This section presents the potencial environmental impacts, use of resources, waste production and output flows of 1 ton of CAP Acero's steel reinforcing bar. These results are for non- weldable bars, which are representative of both types of bars, since the difference between them is lower than ± 10% for all impact indicators (comparison of results available in Annex 1).

Potential environmental impact

- On average, module A1 presents the highest potential impact contribution (60%), with the highest impact in 6 out of 8 categories, particularly abiotic depletion (fossil fuels) and eutrophication (92% contribution in both cases), associated to the use of coal; and also water scarcity, with a 86% contribution to this impact due to the use of water in the iron pellet manufacturing process.
- Module A3 has the second highest impact contribution, with a 25% average. It has the highest impact contribution in photochemical oxidation (84%) and global warming potential (57%). Direct air emissions from the manufacturing process are responsible for most of photochemical oxidation and global warming impact.
- Module A2 only represents an average 15% impact contribution, although it has the second highest impact in ozone layer depletion and acidification, with 46% and 38%, respectively. Sea transport is the main impact contributor to this module in both impact categories.

Table 6: Potential environmental impact of 1 ton of CAP Acero's steel reinforcing bar

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO_2 eq.	4.540E+02	1.665E+02	8.095E+02	1.430E+03
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	2.566E-05	2.434E-05	2.548E-06	5.255E-05
Acidification potential (AP)	kg SO_2 eq.	3.388E+00	2.831E+00	1.305E+00	7.523E+00
Eutrophication potential (EP)	kg PO_4^{3-} eq.	7.617E+00	3.351E-01	3.179E-01	8.270E+00
Photochemical Oxidant Formation Potential (POCP)	kg C_2H_4 eq.	1.201E-01	8.886E-02	1.072E+00	1.281E+00
Abiotic depletion potential – Elements	kg Sb eq.	7.090E-03	9.327E-04	1.380E-03	9.402E-03
Abiotic depletion potential – Fossil resources	MJ, net calorific value	3.307E+04	2.236E+03	5.236E+02	3.583E+04
Water scarcity potential	m^3 eq.	1.470E+03	7.830E+00	2.396E+02	1.717E+03

Use of resources

- Module A1 presents the highest use of resources in all 4 resources categories. The highest is the use of secondary materials (100%), related to the use of scrap steel. Another relevant contribution is to the use of non- renewable primary energy (88%) because of the use of coal.
- Module A3 is the second highest contributor to water use (17%), related to the use of water in the manufacturing process as a cooling agent.
- The contribution of module A2 is below 10% for all use of resources categories.

Table 7: Use of resources of 1 ton of CAP Acero's steel reinforcing bar

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	8.992E+02	6.217E+01	1.361E+02	1.097E+03
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	8.992E+02	6.217E+01	1.361E+02	1.097E+03
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	2.392E+04	2.375E+03	4.952E+02	2.679E+04
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	2.392E+04	2.375E+03	4.952E+02	2.679E+04
Secondary material		kg	1.945E+02	0.000E+00	1.310E-01	1.946E+02
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m^3	2.675E+01	3.343E-01	5.638E+00	3.272E+01

Waste production and output flows

- Module A1 has the highest contribution to hazardous waste disposed (99%) and non-hazardous waste disposed (53%) because of the iron pellet as raw material in both cases. The use of pellets also explains the second highest contribution to radioactive waste (45%).
- Module A3 has the highest contribution to materials for recycling (100%), because of co-products generated in the manufacturing process that are sold to other companies for recycling (coquecillo, slag and dust); and the second highest contribution to non- hazardous waste disposed (34%) mostly due to ferroalloys.
- Module A2 is the highest contribution to radioactive waste disposed (50%), because of sea transport, which also contributes to non- hazardous waste (14%). The contribution to other waste categories is negligible.

Waste production

Table 8: Waste production of 1 ton of CAP Acero's steel reinforcing bar

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	5.175E-01	2.850E-03	1.110E-03	5.214E-01
Non-hazardous waste disposed	kg	9.339E+01	2.401E+01	5.926E+01	1.767E+02
Radioactive waste disposed	kg	1.273E-02	1.426E-02	1.612E-03	2.860E-02

Output flows

Table 9: Output flows of 1 ton of CAP Acero's steel reinforcing bar

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	4.351E+02	4.351E+02
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

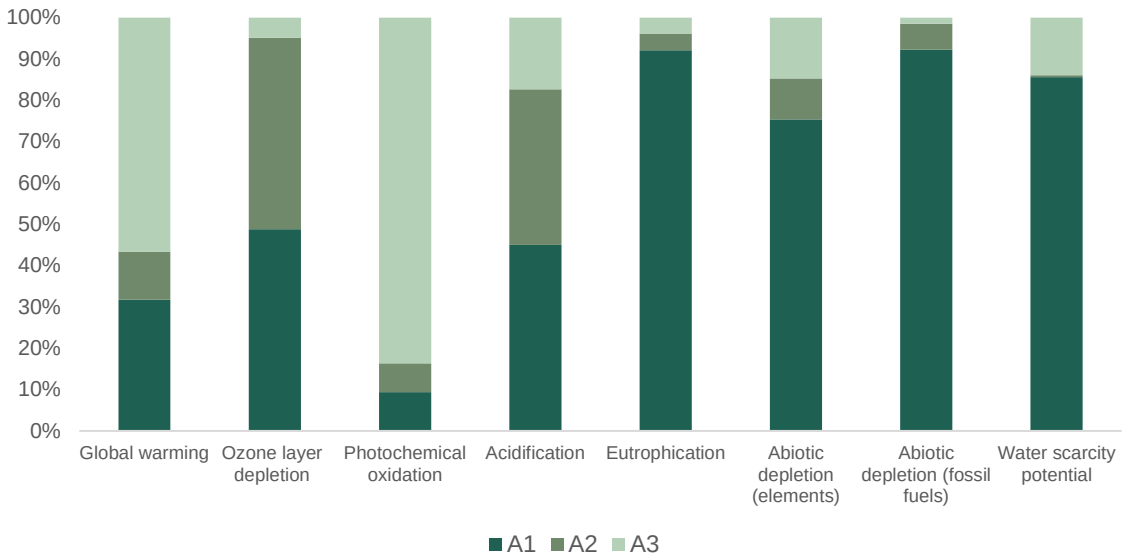


Figure 4: Percentage contribution of life cycle stages to the different potential environmental impact categories.

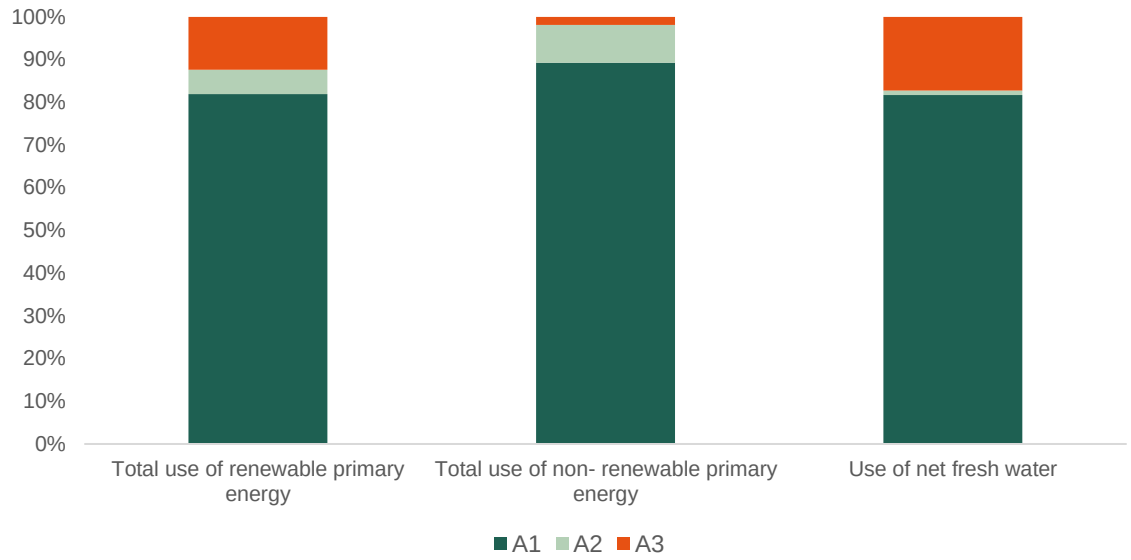


Figure 5: Percentage contribution of life cycle stages to the different use of resources categories.

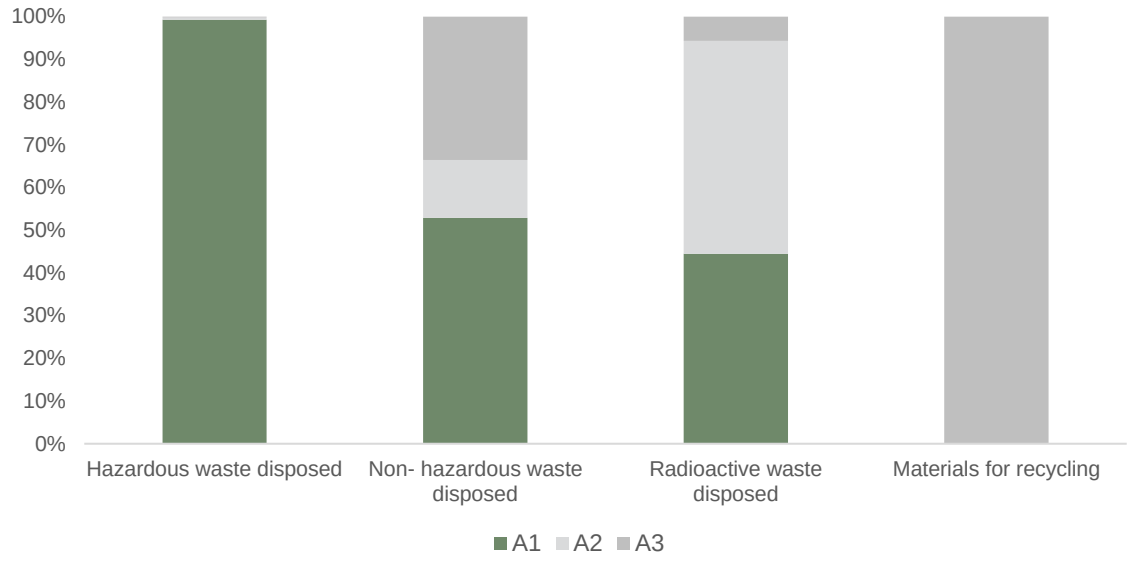


Figure 6: Percentage contribution of life cycle stages to the different waste categories.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Glossary

Abiotic Depletion: impact of the uptake of resources in the world's reserves of metals and of fossil fuels.
Acidification Potential: the impact of the emissions of acidic substances, namely the decrease in pH of soils and aquatic environments.
Declared unit: unit used to present and compare results of an LCA or EPD when the precise function of a product or scenarios at the building level is not stated, unknown or is not taken into account for in the EPD. The declared unit shall relate to the typical applications of products.
End of Life (EoL): is a term used with respect to consumer products, indicating that the product is at the end of its useful life.
Energy Resources: this group of impact categories accounts for the cumulative energy requirements of renewable and non-renewable fuels.
Environmental Product Declaration (EPD): a third-party verified ecolabel that reports on the life cycle environmental impacts of a product according to product-specific guidelines or Product Category Rules.
Eutrophication Potential: the impact of excessive nutrients (for instance nitrogen from fertilizers) in aquatic environments.
Global Warming Potential: the impact of the emission of greenhouse gases to the atmosphere in the transformation of climate.
Greenhouse Gases: umbrella term for the different gaseous substances that are known to interfere with the Earth's atmosphere's ability to deflect radiation incoming from the sun, causing it to accumulate within the atmosphere, which leads to global warming.
LEED: similar to concept to Green Star but operating in the United States of America and on a different evaluation framework, being hosted by the U.S. Green Building Council.
Life Cycle Assessment (LCA): a framework to evaluate the environmental, social and economic impact of delivering a good and service.
Life cycle Inventory (LCI): the compilation of quantitative data that populates a life cycle model, e.g. the amount in kg of a material going into a manufacturing process.
Life Cycle Model: the representation of a production system that organises processes, inputs and outputs and that allows for the execution of a life cycle assessment.
Ozone depletion potential: the impact of ozone-depleting substances, such as some refrigerants, on the decline of ozone in the Earth's stratosphere.
Product Category Rules (PCR): set of product-type specific guidelines to undertake life cycle assessments conducting to EPDs.
Photochemical ozone creation potential: the impact of the emission of substances such as VOCs to the atmosphere, which merge with ozone and create smog.
Secondary materials: resource use indicator conveying the recycled input into life cycles.
System boundaries: term used to describe the limits of the processes and materials that are included and excluded from a life cycle assessment.

Programme information

Programme:	The International EPD® System www.environdec.com info@environdec.com EPD registered through the fully aligned regional program/hub: EPD® Latin America www.epd-americalatina.com
Programme Operator	EPD® International AB Box 210 60 SE-100 31 Stockholm, Sweden EPD® Latin America Chile: Alonso de Ercilla 2996, Ñuñoa, Santiago, Chile. Mexico: Av. Convento de Actopan 24 Int. 7ª, Colonia Jardines Santa Monica, Tlalnepantla de Baz, Estado de México, México C.P. 54050
EPD registration number: **Issue date:** **Validity date:** **Revision date:** **Reference year of data:** **Geographical scope:** **Product group classification:**	S-P-02002 2020-04-30 2025-04-29 2020-12-02 2018 Chile UN CPC 4126

Product category rules (PCR): PCR 2012:01 Construction Products and Construction Services VERSION 2.3, *2018-11-15, UN CPC 4126*
PCR review was conducted by: *Technical Committee of the International EPD® System*
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
Third party verifier: *Ruben Carnerero* *Email: r.carnerero@ik-ingenieria.com* *Approved by: The International EPD® System*
Elaborated by: EDGE Chile (https://edgechile.com/)
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ No
Developed by: EDGE Chile *Email: contacto@edgechile.com* *Web: www.edgeenvironment.com*

Mandatory statements

- Exclusion of small amounts follow the rules of Product Category Rules of Construction Materials, and include the infrastructure, construction, production equipment and tools that are not directly consumed in the production process, and personnel related impacts. These are deemed negligible.
- No cut offs were necessary for the modules included in this EPD.
- The scenarios included are currently in use and are representative for one of the most likely scenarios alternatives.
- The EPD of construction products may not be comparable if they do not comply with the requirements of comparability set in EN 15804. EPDs within the same product category but from different programmes may not be comparable.

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Annex 1

Table 10- Impact difference of weldable and non- weldable steel reinforcing bars

Potential environmental impacts of 1 ton of steel reinforcing bar			
	Non- weldable	**Weldable**	**%**
Global warming potential ($kgCO_2$ eq)	1.430E+03	1.438E+03	1%
Depletion potential of the stratospheric ozone layer (kgCFC11 eq)	5.255E-05	5.311E-05	1%
Photochemical oxidant formation potential (kgC_2H_4 eq)	1.281E+00	1.283E+00	0%
Acidification potential ($kgSO_2$ eq)	7.523E+00	7.588E+00	1%
Eutrophication potential ($kgPO_4^{3-}$ eq)	8.270E+00	8.301E+00	0%
Abiotic depletion potential- elements (kgSb eq)	9.402E-03	9.819E-03	4%
Abiotic depletion potential- fossil resources (MJ)	3.583E+04	3.594E+04	0%
Water scarcity potential (m^3 eq.)	1.717E+03	1.721E+03	0%
Use of resources of 1 ton of steel reinforcing bar			
	Non- weldable	**Weldable**	**%**
Primary energy resources – Renewable- use as energy carrier (MJ)	1.097E+03	1.150E+03	5%
Primary energy resources – Renewable- use as raw materials (MJ)	0	0	-
Primary energy resources – Renewable- (MJ)	**1.097E+03**	**1.150E+03**	5%
Primary energy resources – Non-renewable- use as energy carrier (MJ)	2.679E+04	2.690E+04	0%
Primary energy resources – Non-renewable- use as raw materials (MJ)	0	0	-
Primary energy resources – Non-renewable- (MJ)	**2.679E+04**	**2.690E+04**	0%
Secondary materials (kg)	1.946E+02	1.946E+02	0%
Renewable secondary fuels (MJ)	0	0	-
Non-renewable secondary fuels (MJ)	0	0	-
Net use of fresh water (m^3)	3.272E+01	3.281E+01	0%
Waste production and output flows of 1 ton of steel reinforcing bar			
	Non- weldable	**Weldable**	**%**
Hazardous waste disposed (kg)	5.214E-01	5.215E-01	0%
Non- hazardous waste disposed (kg)	1.767E+02	1.916E+02	8%
Radioactive waste disposed (kg)	2.860E-02	2.903E-02	2%
Components for reuse (kg)	0	0	-
Materials for recycling (kg)	0	0	-
Materials for energy recovery (kg)	0	0	-
Exported energy (MJ)- electricity and thermal	0	0	-

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