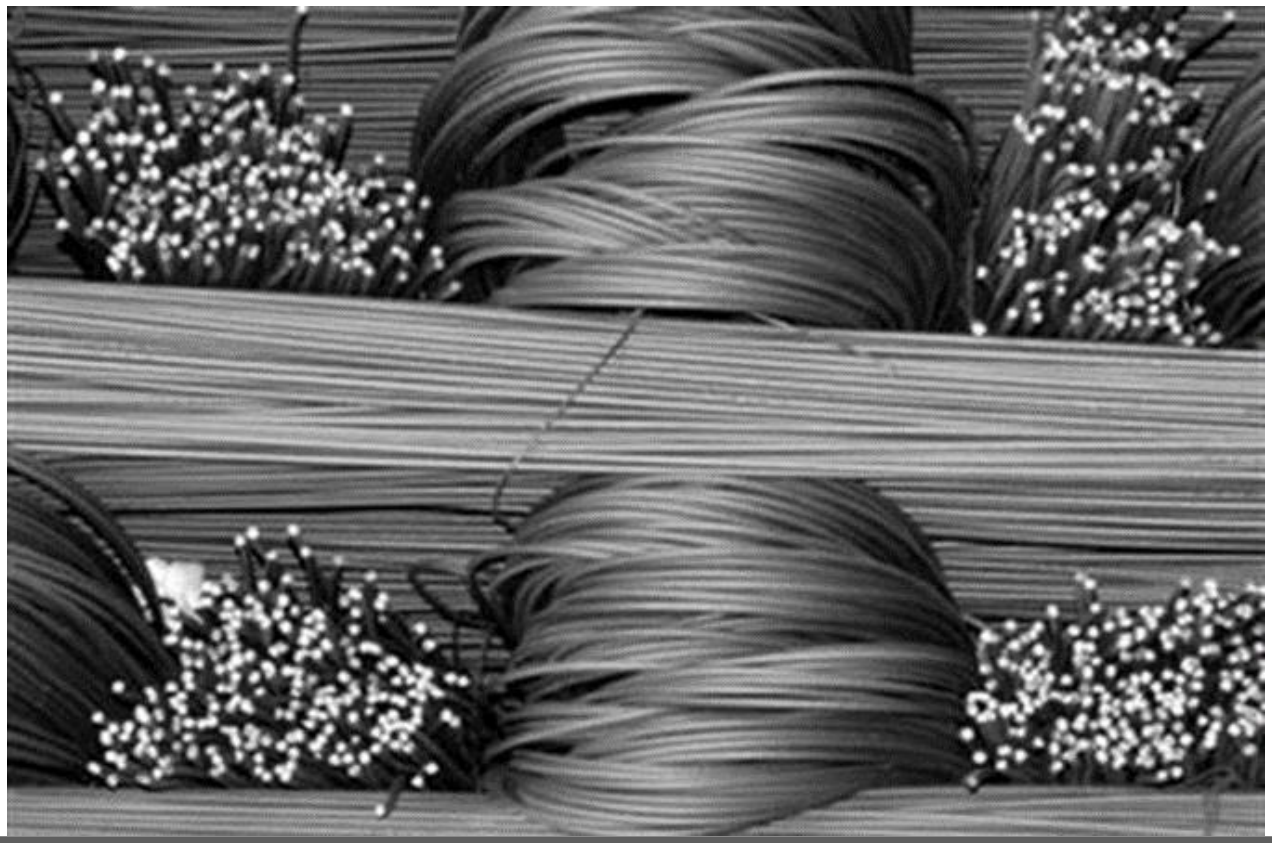
LATIN AMERICA EPD®

GRUPO ACERERO



Environmental Product Declaration (EPD)

The Environmental Product Declaration of 1 metric ton of fabricated reinforcing bar (rebar) 100% low-alloyed steel manufactured using 100% steel scrap as source of iron by GRUPO ACERERO at their plant in SAN LUIS POTOSI, Mexico

Grupo Acerero | 10/10/18 | San Luis Potosi, Mexico

This environmental product declaration was conducted in accordance with ISO 14025:2006. It is a declaration with all the relevant information disclosed per the governing product category rule the International EPD® System PCR Construction products and construction services, V2.2 2012:01 and EN1504. The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

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Reference year for data:	2017
Geographical scope:	Mexico

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PCR review was conducted by: Martin Erlandsson, IVL Swedish Environmental Research Institute, martin.erlandsson@ivl.se
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Third party verifier: Geoff Guest, PhD. Ecogamut Consulting Inc. Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

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Environmental Product Declaration

In accordance with ISO 14025 and EN 15804+A1 and/or ISO 21930 for:

Steel Rebar G42, G52, or A706

from

Grupo Acerero

Programme:	The International EPD® System www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-01234
Publication date:	2018-10-15
Validity date:	+5 years from the finalization of verification / date of the verification report
Geographical scope:	Mexico, United States, and Latin America

EPD Owner

Grupo Acerero

Contact:

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Site Location:

Grupo Acerero Manufacturing plant located at Eje 122 esq. Av. CFE Zona Industrial C.P. 78395 in San Luis Potosi, Mexico.

Company Information

Grupo Acerero is a 100% Mexican capital iron and steel company, dedicated to changing steel. They combine scrap steel supplied from Mexico and the United States, and lamination to manufacture many steel products for the construction industry. For the last 10 years Grupo Acerero has diversified their product catalog as the result of mergers. Grupo Acerero's products are sold in Mexico, Latin America, Canada and the United States. (3)

Grupo Acerero is a member of the US Green Building Council (USGBC). Use of their products in construction projects can help builders earn credits towards LEED ratings.

Product Information

Product Name:

1 metric ton of fabricated reinforcing bar (rebar) 100% low-alloyed steel manufactured using 100% steel scrap as source of iron: G42, G52, A706

Product Identification:

This EPD assumes the impacts from the products manufactured by Grupo Acerero (G42, G52, A706) are in accordance with the following standards: Mexican standard NMX-B506-CANACERO-2011. (2)

The dimensions of the rebar are as follows:

Table 1: G42 and G52 manufactured diameters.

Grade	Diameter						
	3/8	1/2	5/8	3/4	1"	1 ¼"	1 ½"
42		X	X	X	X		X
52				X	X	X	X

Table 2: The physical properties associated with Grupo Acerero's rebar products.

Physical Properties					
Bar Designation Number	**Size**	**Cross-Sectional Area**		**Nominal Weight**	**Nominal Mass**
		In. (Squared)	mm. (Squared)	lb/ft	kg/m
3	3/8"	0.11	71.00	0.38	0.56
4	1/2"	0.20	127.00	0.67	0.99
5	5/8"	0.31	198.00	1.04	1.55
6	3/4"	0.44	285.00	1.50	2.24
8	1"	0.79	507.00	2.67	3.97
10	1" 1/4	1.27	794.00	4.30	6.23
12	1" 1/2	1.76	1140.00	6.46	8.94

UN CPC Code:

CPC 4124: Bars and rods, hot rolled, of iron or steel.

Product Description:

The products analyzed for this EPD are rated as structural grade material suitable in construction applications. Steel rebar is used as a tension mechanism in concrete structures, to help preserve the concrete as it is compressed. The purpose of the rebar and the concrete it is reinforcing are to work under combined loads. Grupo Acerero manufactures rebar to specific sizes and standards, and each bar has a designated number based on its dimensions. There are two different grades of steel modeled: high carbon and medium carbon steel. Both grades of steel rebar are manufactured at the same plant. A706 is medium carbon steel rebar and both Grade 42 and Grade 52 are high carbon steel rebar.

Geographical Scope:

This EPD covers the steel reinforcing bar manufactured at the Grupo Acerero manufacturing facility located at Eje 122 esq. Av. CFE Zona Industrial C.P. 78395 in San Luis Potosi, Mexico.

LCA Information

Functional Unit/Declared Unit:

1 metric ton of fabricated reinforcing bar (rebar) 100% low-alloyed steel manufactured using 100% steel scrap as source of iron.

Time Representativeness:

All primary data reported by Grupo Acerero stem from the 2017 calendar year from utility bills and primary company records.

Database and LCA Software Used:

To perform the LCA for this EPD OpenLCA software with ecoinvent v3.4 database was used.

System Diagram: Markings

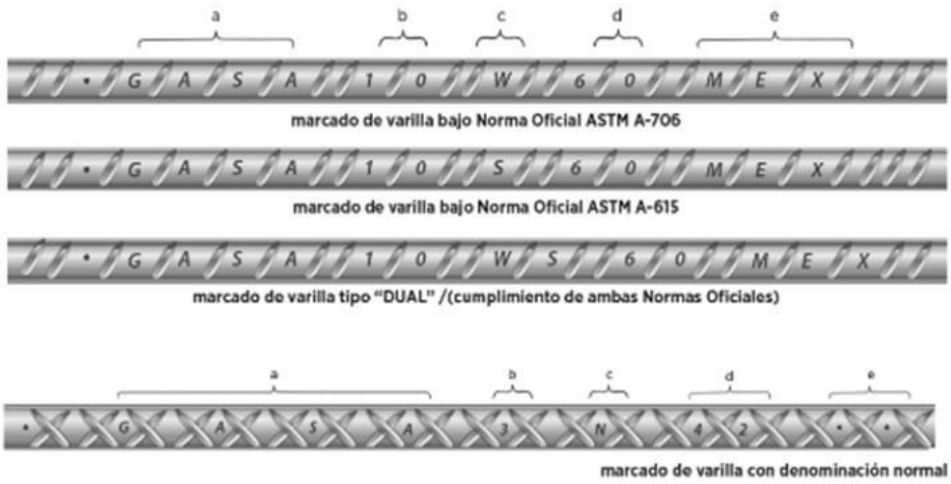


Table 3: Explanation of the system markings used on Grupo Acerero's products.

Standard Rebar Markings	
A) GASA	Identification of the Manufacturer
B) 3,4,5,6,8,10,12	Designation of the Rod
C) N	Standard Designation: NMX-B506-CANACERO-2011
D) 42,52	Designation of the Grade of Rebar
E)	Pace of Origin: Mexico

System Boundaries:

This is a "cradle-to-gate" life cycle analysis reported in accordance with EPD Product Category Rule (PCR) v2.2 2012:01. The following three life cycle stages are included:

A1: Raw material supply (upstream processes)- Extraction, handling, and processing of the materials (including fuels) used in the production of the steel rebar.

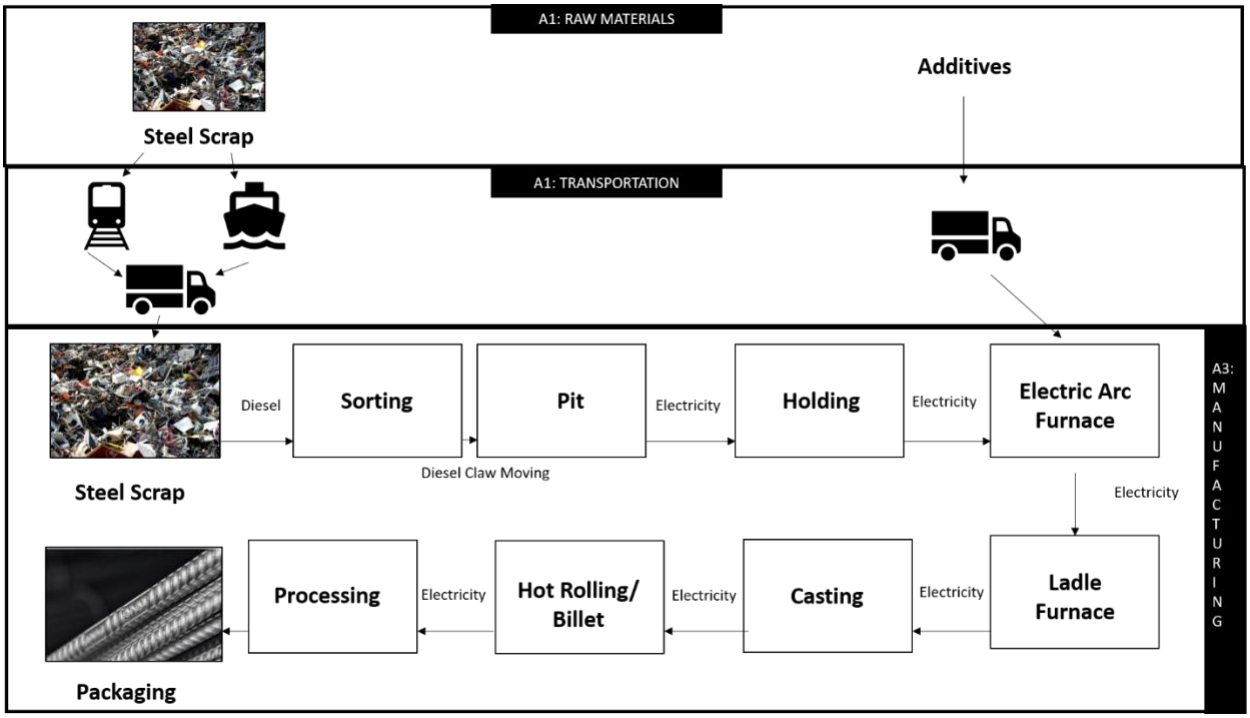
A2: Transportation- Transportation of these materials from the supplier to the "gate" of the concrete producer.

A3: Manufacturing (core processes)- The energy used to store, move, and shape the steel and to operate the facility (steel plant).

Exclusions to the system boundary are mentioned in the PCR and include the functional unit or performance characteristics of the construction product when integrated into the building or the product's referenced service life (RSF). (1)

The entire system is outlined below in Figure 1 outlining Grupo Acerero's cradle to gate product system for manufacturing located at EJE 122 esq. Av. CFE, Zona Industrial C.P. 78395.

Figure 1: Cradle-to-Gate product system for Grupo Acerero's G42, G52, and A706 products.



Excluded Lifecycle Stages:

This EPD does not require and therefore does not include the following stages:

A4-A5: Construction process stage- Transport and construction installation.

B-B 7: Use stage- Use, maintenance, repair, replacement, refurbishment, operational energy use, and operational water use.

C1-C4: End of life stage- De-construction demolition, transport, waste processing, and disposal.

D: Resource recovery stage- Reuse-recycling-recovery potential.

A summary of the limitations of this EPD include the following:

- This "cradle-to-gate" EPD is to understand the environmental impacts of the products listed and is not a comparative study.
- No environmental claim can be implied about the environmental superiority of the products modeled in this study. The EPD reporting process does not make statements that the products modeled in an LCA, or the resulting EPD, are environmentally better or worse than other products.
- The LCIA results do not predict actual impacts and are a direct result of the information modeled only.
- This EPD does not report all the environmental impacts due to manufacturing of the product, but instead the environmental impacts for categories with established LCA-based methods to track and report. Unreported environmental impacts include, but are not limited to, factors attributed to human health, land use changes, and habitat destruction.
- In addition, the manufacturer can report on best practices in sustainability, including social indicators outside this EPD, in an attempt to illustrate a more complete picture of their sustainability practices that cannot be captured in this EPD. (1)

More Information:

Allocation

The PCR, version 2012:01 v2.2, outlines scenarios where allocation is necessary. These areas include: a). a multi-output subprocess delivering goods that are treated equally, b). co-production on electricity and heat, and c). co-production of goods and energy.

The rebar manufacturing process is linear and results in a sole product, therefore, there are no additional products produced that are treated equally, and all inputs and emissions are attributed to the output product of one metric ton of fabricated reinforcing bar (rebar) 100% low-alloyed steel manufactured using 100% steel scrap as source of iron.

Allocation for recycled material was treated under the Polluters Pay Principal. This type of recycling is called open loop recycling. The burden for the environmental impacts is on the original use and only the transportation from the recycling facility to Grupo Acerero's manufacturing facility were recorded as

primary inputs. The Ecoinvent 3.4 unit process “iron scrap, unsorted, Recycled Content” has no incoming inputs.

Cut-off Criteria

ISO 14044:2006 and Product Category Rule (PCR) V2.2 2012:01, section 7.6. requires the LCA model to contain a minimum of 95% of the total inflows (mass and energy) to the upstream and core modules be included in this study. The cut-off criteria were applied to all other processes unless noted above as follows:

- A 1% cut-off is considered for all renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process where the total of the neglected inputs does not exceed 5%.

Data Variability and Quality

This EPD was created using plant-specific data for upstream materials. Potential variations due to supplier locations, manufacturing processes and efficiencies of fuel use are not accounted for in this EPD. Data differences can occur with changing suppliers, mine locations, manufacturing equipment, and overall efficiency. Data quality is judged based on the five indicators below. These indicators apply to the impact categories reported in this study based on the information obtained and used for the model. The corresponding detailed data clarifications are broken down to the process level. The five indicators included are:

Technical representativeness: The degree to which the data reflects the actual technology(ies) used. **Overall quality: Good to very good**

Temporal Representativeness: The degree to which the data reflects the actual time (e.g. year) or age of the activity. **Overall quality: Good with a few fair points of data**

Geographical representativeness: The degree to which the data reflects the actual geographic location of the activity (e.g. country or site). **Overall quality: Good to very good**

Completeness: The degree to which the data are statistically representative of the relevant activity. Completeness includes the percentage of locations for which data is available and used out of the total number that relates to a specific activity. **Overall quality: Good**

Reliability: The degree to which the sources, data collection methods and verification procedures used to obtain the data are dependable. **Overall quality: Very good**

Content Declaration

All products considered for this study have the same manufacturing processes and raw material input. The only difference is the number of rebar rods manufactured per metric ton. Product-specific material and energy inputs/outputs are not recorded by Grupo Acerero for energy, water, and waste. After examination, and per the PCR, "Similar products with differences between the mandatory impact indicators lower than ±10% (concerning A1-A3) could be presented using the impacts of a representative product." (4) The differences were lower than 10%, and therefore the representative product chosen was A706.

Product:

Grade 42 and 52 of Grupo Acerero's steel rebar are both considered high carbon steel alloys.

Table 4: Material ingredient declaration for Grade 42/52 rebar including CAS Rn and Hazard Screening.

RN	Chemical Name	Overall Rating	Product % by Weight
7440-44-0	Graphite	LT - UNK	0.38-0.46
7439-96-5	Manganese	LT - P1	0.85-1.26
7440-21-3	Silicon	LT - UNK	0.20-0.27
7704-34-9	Sulfur, Elemental	LT - UNK	0.05-0.06
7723-14-0	Phosphorus	BM - 2	0.05
7440-47-3	Chromium, metallic	LT - P1	0.20-0.25
7440-02-0	Nickel (Metallic)	LT - 1	0.20
7439-98-7	Molybdenum	LT - UNK	0.05
7439-89-6	Iron	LT - P1	97.41-98.03

A706 is considered a medium carbon steel alloy.

Table 5: Material ingredient declaration for Grade A706 rebar including CAS RN and Hazard Screening.

RN	Chemical Name	Overall Rating	Product % by Weight
7440-44-0	Graphite	LT - UNK	0.25-0.33
7439-96-5	Manganese	LT - P1	0.7-1.56
7440-21-3	Silicon	LT - UNK	0.18-0.55
7704-34-9	Sulfur, Elemental	LT - UNK	0.04-0.05
7723-14-0	Phosphorus	BM - 2	0.025-0.043
7440-47-3	Chromium, metallic	LT - P1	0.20-0.25
7440-02-0	Nickel (Metallic)	LT - 1	0.20-0.25
7439-98-7	Molybdenum	LT - UNK	0.05
7439-89-6	Iron	LT - P1	96.91-98.38

Packaging:

The packaging used by Grupo Acerero is #7 wire. Approximately 36 pieces are used to tie one metric ton of rebar. No pallets or other packaging is used. The bundled rebar is then loaded onto the delivery vehicles that transport it to the jobsite. In the model this impact was below the threshold and did not show up as an impact in any category result.

Recycled Content:

Grupo Acerero directly recycles scrap metal shipped in from suppliers located in the United States and Mexico, and they also recycled scrap metal internally. The functional unit of 1 metric ton of fabricated steel reinforcing bar (rebar) from scrap metal was modeled with 94% with recycled raw material inputs

to represent purchased post-consumer and postindustrial content and 6% postindustrial internal to Grupo Acerero recycled metal. No virgin materials are used in the manufacturing of Grupo Acerero's rebar.

Environmental Performance

Potential Environmental Impact:

Parameters describing environmental potential impacts were calculated using CML Baseline method, TRACI 2.1 and OpenLCA EN:15804 Method in accordance with the guidelines of the PCR. The rebar is modeled, reviewed, and reported on in this LCIA phase. The outcomes of the LCI modeling and subsequent assessments using OpenLCA software and the impact categories modeled with the TRACI method as recommended by the U.S. EPA are listed in the tables below. The PCR states that "the impact categories shall be calculated using characterization factors recommended in regionally accepted impact assessment methods." The U.S. EPA's TRACI method was chosen over the European CML Baseline because Grupo Acerero is based in Mexico but has offices, does business and exports its products to the United States. Shall any customer wish to examine their product impacts it makes more sense that they are in a U.S. method versus a European one. Grupo Acerero is a company selling its products in the U.S., Canada, and Latin America. (1)

Table 6: LCI Impact results with contribution analysis using TRACI and EN:15804 Open LCIA Methods.

LCI Impact Summary Results (A1-A3) for 1 Metric Ton of G42, G52, and A706 Steel Rebar with Contributions by Module					
Impact Category	**Unit**	**A1: Raw Materials**	**A2: Transportation**	**A3: Manufacturing**	**Total A1-A3**
TRACI 2.1					
Acidification	kg SO2 eq	0.00	.711	3.95	4.66
		0.00%	15.3%	84.7%	100.00%
Eutrophication	kg N eq	0.00	.143	.616	.759
		0.00%	18.9%	81.2%	100.00%
Global warming	kg CO2 eq	0.00	81.3	1 660	1 750
		0.00%	4.66%	95.3%	100.00%

Ozone depletion	kg CFC-11 eq	0.00	2.23E-05	1.91E-05	4.13E-05
		0.00%	53.9%	46.0%	100.00%
Smog	kg O3 eq	0.00	12.6	60.2	72.8
		0.00%	17.3%	82.7%	100.00%
CML-IA Baseline					
Abiotic depletion potential for fossil resources	MJ	4.63E-13	1 145.7	12 330.2	13 475.8
		0.00%	8.5%	91.5%	100.0%
Abiotic depletion potential for non-fossil resources	kg Sb eq.	4.26E-19	1.45E-04	6.90E-04	8.39E-04
		0.00%	17.3%	82.2%	100.0%
Acidification	kg SO2 eq	3.10E-16	0.673	3.87	4.54
		0.00%	14.8%	85.2%	100.0%
Eutrophication	kg N eq	7.29E-17	0.114	0.537	0.652
		0.00%	17.6%	82.4%	100.0%
Ozone depletion	kg CFC-11 eq	8.01E-20	1.78E-05	1.57E-05	3.36E-05
		0.00%	53.1%	46.9%	100.0%
Photochemical ozone creation	C2H4 eq	9.65E-17	0.026	0.178	0.203
		0.00%	12.6%	87.4%	100.0%
Global warming	kg CO2 eq (GWP_{100})	9.34E-13	81.8	1 665.8	1 747.6
		0.00%	4.68%	95.3%	100.0%

Use of Resources:

Parameters describing the use of resources were calculated using OpenLCA EN15804 Methods, AWARE, direct LCI reporting, and Cumulative Energy Demand. These methods are in accordance with the PCR and EN:15804. (1)

Table 7: Environmental parameters describing the use of renewable and non-renewable material resources,

Impact Category	Unit	A1: Raw Materials	A2: Transportation	A3: Manufacturing	Total A1-A3
Use of Net Fresh Water	m3	2.01E-16	8.04E-03	8.33E-03	1.64E-02
		0.00%	49.1%	50.9%	100.00%
Total use of nonrenewable primary energy resources	MJ	6.64E-13	1 930	13 700	15 700
		0.0%	12.3%	87.7%	100.0%
Use of nonrenewable primary energy	MJ	6.64E-13	1 930	13 700	15 700
		0.0%	12.3%	87.7%	100.0%
Use of non-renewable secondary fuels	MJ	0	0	0	0
Use of non- renewable primary energy resources used as raw materials	MJ	0	0	0	0
Total use of renewable primary energy resources	MJ	2.19E-13	67.2	208	275
		0.0%	24.4%	75.6%	100.0%
Use of renewable primary energy	MJ	2.19E-13	67.2	208	275
		0.0%	24.4%	75.6%	100.0%
Use of renewable primary energy resources used as raw materials	MJ	0	0	0	0
Use of renewable secondary fuels	MJ	0	0	0	0
Use of Secondary Materials	kg	1 210	0.00E+00	10.0	122
		99.18%	0.00%	0.82%	100.00%
Water Scarcity Potential (AWARE)	m3	6.96E-13	15.9	42.7	58.6
		0.00%	27.1%	72.9%	100.00%

Waste Production:

Parameters describing the use of resources were calculated using EDIP 2003 and direct LCI reporting. (1)

Table 8: Environmental indicators describing waste generation.

Impact Category	Unit	A1: Raw Materials	A2: Transportation	A3: Manufacturing	Total A1-A3
Hazardous Waste	kg	0.00E+00	.001	.004	.005
		0.00%	19.8%	80.2%	100.00%
Non-Hazardous Waste	kg	1.49E-13	66.8	11.7	78.4
		0.00%	85.1%	14.9%	100.00%
Radioactive Waste *	kg	0.00E+00	.017	.011	.028
		0.00%	59.7%	40.3%	100.00%
Components for reuse	kg	0	0	0	0
		0.00%	0.00%	0.00%	-
Materials for recycling	kg	0	0	50	50
		0.00%	0.00%	100.0%	100.0%
Materials for enery recovery	kg	0	0	0	0
		0.00%	0.00%	0.00%	-
Exported electricity	MJ	0	0	0	0
		0.00%	0.00%	0.00%	-
Exported heat	MJ	0	0	0	0
		0.00%	0.00%	0.00%	-

Note: 1 No radioactive materials are allowed to be imported with the scrap metal purchased by Grupo Acerero.

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5. **EPD International** (2017) General Programme Instructions for the International EPD® System. Version 3.0, dated 2017-12-11. www.environdec.com.