Steel Rebar and Merchant Bar Quality

ARCELORMITTAL LONG PRODUCTS CANADA

ENVIRONMENTAL PRODUCT DECLARATION

ISO 14025:2006

ArcelorMittal Long Products Canada is pleased to present this Environmental Product Declaration (EPD) for Steel Rebar and Merchant Bar Quality. This EPD was developed in compliance with CAN/CSA-ISO 14025 and has been verified by Lindita Bushi from the Athena Sustainable Materials Institute.

These LCA and EPD were prepared by Vertima Inc. The EPD includes cradle-to-gate life cycle assessment (LCA) results.

For more information about ArcelorMittal Long Products Canada's products, visit https://long-canada.arcelormittal.com/en

For explanatory materials regarding this EPD, please contact the program operator.

Environmental Product Declaration

CSA Group Registered Based on ISO 14025 and Other Requirements

For more information visit csaregistries.ca/epd

#4937-6316

March 2019 - 2024

1 GENERAL INFORMATION

This EPD was not written to support comparative assertions. Even for similar products, differences in declared units, use and end-of-life stage assumptions and data quality may produce incomparable results. Comparing EPDs from different organization is not recommended as there may be differences in methodology, assumptions, allocation methods, data quality such as variability in data sets and variable results in the assessment software tools used.

PCR GENERAL INFORMATION			
Reference PCR	North American Product Category Rule for Designated Steel Construction Products SCS Global May 5, 2015 to May 5, 2020		
The PCR review was conducted by	Thomas P. Gloria Industrial Ecology Consultants *t.gloria@industrial-ecology.com*	Alain Dubrueil Independent Consultant	James Littlefield Independent Consultant

EPD GENERAL INFORMATION		
Program Operator	CSA Group 178 Rexdale Blvd Toronto, ON Canada M9W 1R3 *www.csagroup.org*	
Declared Product	Steel Rebar and Merchant Bar Quality	
EPD Registration Number 4937-6316	EPD Date of Issue March 26, 2019	EPD Period of Validity March 25, 2024
EPD Recipient Organization	ArcelorMittal Long Products Canada 4000, route des Aciéries Contrecoeur (Quebec) Canada J0L 1C0 https://long-canada.arcelormittal.com/en	
EPD Content	Product System Description LCA Calculation Rules LCIA Results Additional environmental information References	

This LCA and EPD were prepared by:	Chantal Lavigne, M.A.Sc. Vertima Inc. *www.vertima.ca*
This EPD and related data were independently verified, according to CAN/CSA-ISO 14025:2006 and ISO 21930:2007. ☐ Internal ☒ External	Lindita Bushi Lindita Bushi, Ph.D. Athena Sustainable Materials Institute

2 ABOUT ARCELORMITTAL LONG PRODUCTS CANADA

ArcelorMittal Long Products Canada, a division of ArcelorMittal, produces over two million tons of steel every year from iron ore and recycled scrap. Their facilities are located in Quebec and in Ontario and include two steel mills, three rolling mills, two wire mills, one direct reduction plant as well as a steel recycling centre.

ArcelorMittal Long Products Canada specializes in the manufacturing of semi-finished products such as billets, slabs, bars and rods. These products are primarily destined for the construction and automotive markets, but also for other industrial uses.

3 PRODUCT SYSTEM DOCUMENTATION

3.1 Product Description

The weighted average profile of Rebar and Merchant Bar Quality (MBQ) steel are calculated based on 2017 annual production data (on mass basis) of the two steel mills and three rolling mills. The steel mills are located in Contrecoeur (QC) and the rolling mills are located in Contrecoeur (QC) and Longueuil (QC).

3.1.1 Rebar

Rebar, or concrete reinforcing bar, refers to uncoated carbon and low-alloy steel and is the foundation that provides tensile strength to concrete.

Figure 1: Photo of Rebar [photo courtesy of ArcelorMittal]

Rebar is an essential part of roads, buildings and infrastructures around the world. Concrete is a material that is very strong in compression, but relatively weak in tension. To compensate for this imbalance in concrete's behavior, rebar is cast into it to carry the tensile loads. It is manufactured in conformity to:

- CSA G30.18-09 Carbon Steel Bars for Concrete Reinforcement, grade 400R/400W and 500R/500W [1];
- ASTM A615/A615M-18e1 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement, grade 60 and 75 [2];
- ASTM A706 /A706M-16 Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement, grade 60 and 75 [3].

Table 1: Technical information for unfabricated Rebar in uncoated carbon and low-alloy steel

Name	Value	Unit
Key Properties	Weldability and Mechanical properties	
Density	7,850	kg/m^3 (kilograms/cubic meters)
Boiling Point	2,850	ºC (degrees Celcius)
Melting Point	1,450	ºC (degrees Celcius)
Rebar in Length		
Length	6.0 – 18.5	(m) meters
Diameter	0.01 – 0.055	(m) meters
Rebar in Coil		
Outer diameter	1.24	(m) meters
Inner diameter	0.86	(m) meters
Length	1.02	(m) meters
Standard	CSA G30.18 (grade 400R/400W and 500R/500W), ASTM A615 (grade 60 and 75), ASTM A706 (grade 60 and 75) [1]–[3]	

3.1.2 Merchant Bar Quality

Figure 2: Photo of Merchant Bar Quality Steel [photo courtesy of ArcelorMittal].

Merchant Bar Quality steel (MBQ) refers to uncoated carbon and low-alloy steel. MBQ is generally used in structural applications involving bending, forming, punching and welding. Merchant Bars are used by fabricators and manufacturers to produce a wide variety of products including steel frames and structures, brackets, steel floor and roof joists, walkways, ornamental furniture, railings and more.

They are manufactured in conformity to :

- CSA G40.20-13/G40.21-13 General requirements for rolled or welded structural quality steel / Structural-quality steel, grade 44W, 50W, 55W, and 60W [4];
- ASTM A36/ A36-M-14 Standard Specification for Carbon Structural Steel [5];
- ASTM A572/A572M-18 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel, grade 50 type 1 and 2 [6];
- ASTM F1554-18 Standard Specification for Anchor Bolts, Steel 36, 55, and 105-ksi Yield Strength, grade 36 and 55 [7].

Unfabricated Merchant Bar Quality Steel's technical information is summarized in Table 2, and detailed on ArcelorMittal Long Products Canada's website : https://long-canada.arcelormittal.com/flipbook/.

Table 2: Technical information for unfabricated Merchant Bar Quality (MBQ) steel in uncoated carbon and low-alloy steel

Name	Value	Unit
Key Properties	Mechanical Properties and Steel Homogeneity	
Density	7,850	kg/m^3 (kilograms/cubic meters)
Boiling Point	2,850	ºC (degrees Celcius)
Melting Point	1,450	ºC (degrees Celcius)
Dimensions – Rounded Shaped		
Diameter	0.02 – 0.1	(m) meters
Length	4.5 – 18.2	(m) meters
Dimensions – Flat Shaped		
Thickness	0.006 – 0.05	(m) meters
Width	0.03 – 0.15	(m) meters
Length	4.5 – 18.2	(m) meters
Standard	CSA G40.21 (grade 44W, 50W, 55W and 60W), ASTM A36, ASTM F572 (grade 50 type 1 and 2), ASTM F1554 (grade 36 and 55) [4]–[7]	

3.2 Material Content

The approximate material content of Rebar and Merchant Bar Quality (MBQ) steel will vary slightly from batch to batch. In general, the steel will contain, by mass, < 99% Iron, < 2% Manganese, <1% Copper, <0.5% Carbon, <0.5% Silicon and a total of 2% or less of Nickel, Chromium, Molybdenum, Niobium, Nitrogen, Titanium, Boron, Calcium, Lead, Arsenic, Cobalt, Antimony, Sulfur, Tin, Phosphorus and Vanadium.

For details on the material content, refer to the health product declaration (HPD) that can be found at *http://www.hpd-collaborative.org/hpd-public-repository/. These steel products do not include materials or substances which have any potential route of exposure to humans or flora/fauna in the environment.*

3.3 Declared unit

The selected declared unit (DU) for this study is 1 metric ton of uncoated fabricated rebar or uncoated fabricated merchant quality bar. Table 3 presents all products targeted by this report and their respective DU.

Table 3: Declared Unit of studied products, including product density.

Item	Unit	Rebar	Merchant Bar Quality
Declared Unit	MT (metric ton)	1	1
Density	kg/m^3	7,850	7,850

3.4 System boundaries and system description

The system boundaries of this EPD cover Cradle-to-Gate with options; therefore, four (4) information modules are considered, namely A-1) Raw materials extraction and processing, processing of secondary material input (e.g. recycling processes) and all activities necessary for the production of steel, A-2) Transportation to the fabricator, A-3) Fabrication and D) Reuse, recovery, and/or recycling potentials, expressed as net impacts and benefits. Construction (A4 – A5), use (B1 - B7) and end-of-life (C1 - C4) stages are not included in the present study as illustrated in Table 4. Figure 3 presents the process flow diagram.

As the EPD covers only modules A1 to A3, the reference service life (RSL) in not specified.

Table 4: Description of the system boundary modules

PRODUCT STAGE			CONSTRUC-TION PROCESS STAGE		USE STAGE							END-OF-LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw materiel supply	Transport	Manufacturing	Transport to the Building Site	Installation into the Building	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X

Legend: X = included; MND = module not declared (excluded)

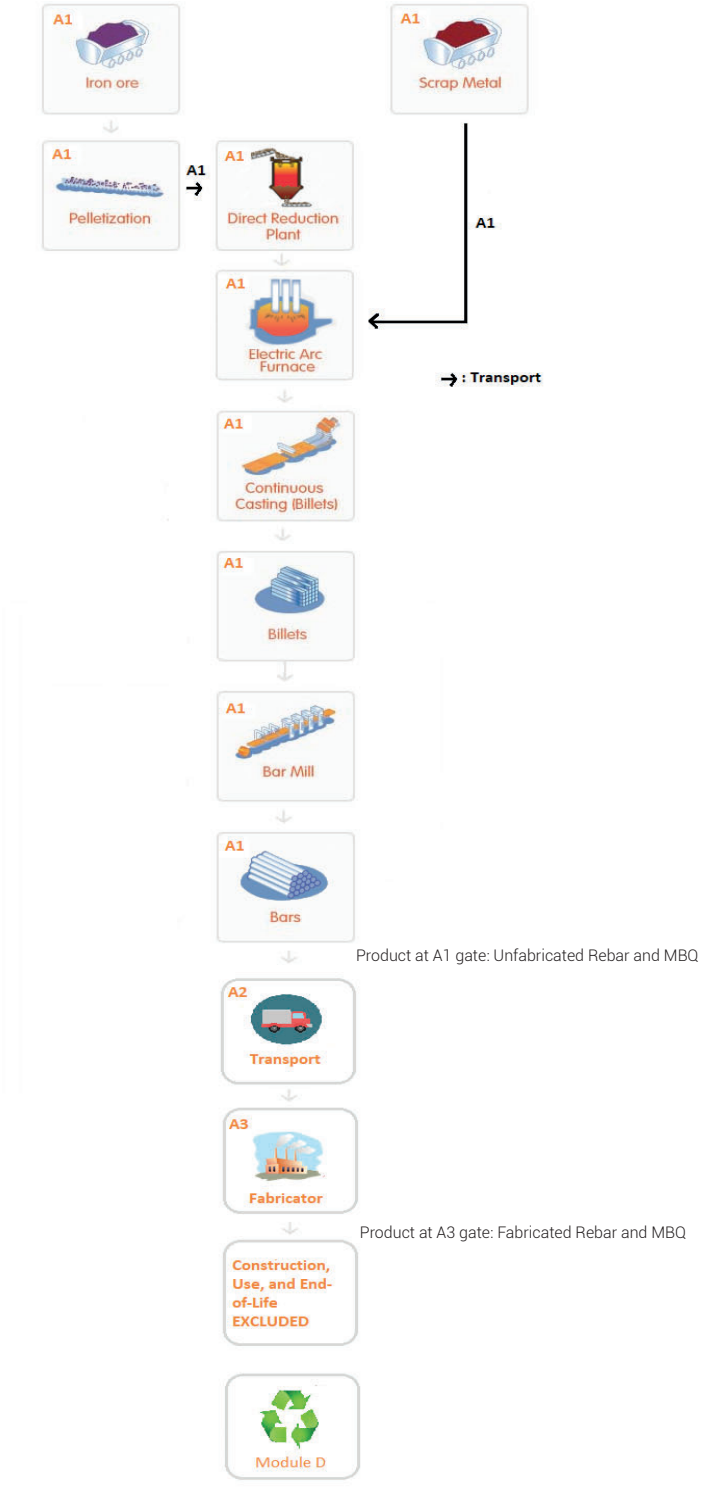

Figure 3: System boundaries of the Cradle-to-Gate with options LCA of ArcelorMittal' Rebar and Merchant Bar Quality Products. Image: courtesy of ArcelorMittal Long Products Canada.[1]

[1]Truck image from: <Icon made by Freepik from www.flaticon.com

Raw materials extraction, transport, and processing (A1):

This stage includes the extraction and transformation of raw materials needed to produce steel, transport of the raw materials to the steel mill, the steel production process and the bar mill process, including transportation from the primary producer to the secondary producer.

Iron ore used at ArcelorMittal originates from Northern Quebec mines, run by ArcelorMittal Mining Canada. Before being shipped from Port-Cartier to Contrecoeur, the iron ore is enriched and converted into pellets that are cooked at high temperatures in a pelletization process. Prior to being used in Contrecoeur steelworks, the iron pellets go through the direct reduction process to remove most of the oxygen and increase purity.

Scrap metal, i.e. pre and post-consumer steel, can be used with or without iron ore to make steel. Scrap metal (from cars, home appliances, steel waste, household recycling, etc.) is collected at recycling centres and processed by external suppliers.

Scrap metal and iron ore are melted with very hot electrodes (about 1,650 degrees Celsius) in an electric arc furnace (EAF). Oxygen blown into the furnace during the process removes impurities from the hot metal. The molten steel is then tapped into a ladle furnace where additives are mixed in to refine the composition of the steel and give it certain properties. In continuous casting, steel billets are produced on a four-strand system (four billets at the same time) or six-strand system (six billets at once), depending on the plant. A billet is a long bar of steel, 8 to 12.5 metres long. It can be sold to customers as a base for fabricating other products. However, most of the billets are supplied to ArcelorMittal Long Products Canada's rolling mills before being sent to fabricators. In this study, at the rolling mill gate, products are called **unfabricated Rebar** and **unfabricated MBQ**.

At the rolling mills, billets pass through a series of rolling stands that stretch and reshape the steel into bars of different lengths and sizes. Bars formed this way may be reinforcing bars, such as rebar, for use in residential and road construction, bars used to produce the leaf springs used in light and heavy trucks, special bar quality, merchant bar quality, steel angles, for example.

Transportation (A2):

This stage includes the transportation of the products from the rolling mills to the fabricator.

Fabrication process (A3):

This stage includes inputs and outputs needed to cut, bend and punch holes in the products before delivery to the construction site. In this study, at the fabricator gate, products are called **fabricated Rebar** and **fabricated MBQ**.

Benefits and loads beyond the system boundary (D):

"Collecting scrap at the end of the product's life and recycling it through the steelmaking process enables the saving of primary, virgin steel production." [8] In module D, a credit is given to steel scrap recycled at the end-of-life of the product, and a burden is applied to the use of steel scrap in the steelmaking process. For the products presented in this EPD, more steel is recycled at the end-of-life than is used in the system; hence, module D results in a credit.

4 LIFE CYCLE CALCULATION RULES

4.1 Allocation

The LCA followed the allocation guidelines of ISO 14044 and the PCR [9]. The system expansion approach was used to allocate the four co-products present in the manufacturing of steel products, namely oxides fines and mud from the direct reduction process, slag from steel mills, and mill scale from steel mills and rolling mills. The steel scrap was considered part of a closed loop recycling system, i.e. the inherent properties of the primary and secondary products are equivalent. The World Steel Association methodology, section 3.6.2, was followed [8], and potential benefits or burdens from the displacement of primary materials and/or fuels associated with recycling and recovery at end-of-life are reported in Module D.

4.2 Data Quality and Data Sources

Table 5: Data quality assessment of Life Cycle Inventory

Data Quality Parameter	Data Quality Discussion
Precision: Measure of the variability of the data values for each data expressed	Manufacturing data were primary and obtained from ArcelorMittal Long Products Canada. Most data were modeled based on primary information sources, and very limited assumptions were made to fill data gaps.
Completeness: Percentage of flow that is measured or estimated	All relevant process steps were considered and modeled to satisfy the goal and scope. No known flows were cut off.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Primary data was modeled with a regional grid mix, i.e., Quebec. Some alloy datasets were not available; hence, they were modeled with proxy datasets. Considering that scrap is a globally traded commodity and the significant North American scrap exports, the global geographical coverage of the World Steel Association value of scrap dataset used in module D is appropriate.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	For all information modules and products, the same approach is used for co-product allocation, data selection and scrap steel.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	The LCA report was produced with sufficient transparency relative to data used, dataset choices, and modeling approaches to allow any third party to reproduce the results using the same data and modeling methodology.
Sources of the data: Description of all primary and secondary sources of data	Primary data for Rebar and MBQ manufacturing processes, i.e., iron pellets direct reduction, steel mills and rolling mills were collected from ArcelorMittal's manufacturing plants located in Contrecoeur (QC) and Longueuil (QC) for the 2017 calendar year. Data was reviewed for completeness and accuracy through mass, iron and carbon balances, as well as benchmarking with previous LCI work. Gaps, outliers or other inconsistencies were resolved with the key contact at ArcelorMittal Long Products Canada. Secondary data were obtained from recognized databases (ecoinvent 3.4 and USLCI) as well as published EPDs. Module D was modeled with World Steel data.
Uncertainty of the information: Uncertainty related to data, models and assumptions	Assumptions were made to close the water balance of the primary data processes and proxies were used for some of the alloys since appropriate datasets were missing in the ecoinvent database. The choice of the proxies can affect the results of abiotic depletion potential for non-fossil resources. Selected data to calculate module D can vary; hence the credit or burden for steel recycling as well.

5 LIFE CYCLE IMPACT ASSESSMENT RESULTS

Life cycle impact assessment (LCIA) results, parameters describing resource use, as well as other environmental information describing different waste categories and output flows are reported according to three tables: 1) the North American LCA Environmental Impact Assessment Results for 1 MT of steel product; 2) the LCA Results: Resource Use for 1 MT of steel product; 3) the LCA Results: Output Flows and Waste Categories for 1 MT of steel product.

It should be noted that LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

5.1 Disclaimer

This Environmental Product Declaration (EPD) conforms to ISO 14025, ISO 14040, ISO 14044 and ISO 21930 [10]–[13].

Scope of Results Reported: The PCR requires the reporting of a limited set of LCA metrics; therefore, there may be relevant environmental impacts beyond those disclosed by this EPD. The EPD does not indicate that any environmental or social performance benchmarks are met nor thresholds exceeded.

Accuracy of Results: This EPD has been developed in accordance with the PCR applicable for the identified product following the principles, requirements and guidelines of the ISO 14040, ISO 14044, ISO 14025 and ISO 21930 standards. The results in this EPD are estimations of potential impacts. The accuracy of results in different EPDs may vary as a result of value choices, background data assumptions and quality of data collected.

Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. Such comparisons can be inaccurate, and could lead to the erroneous selection of materials or products which are higher impact, at least in some impact categories. Any comparison of EPDs shall be subject to the requirements of ISO 21930. For comparison of EPDs which report different module scopes such that one EPD includes Module D and the other does not, the comparison shall only be made on the basis of Modules A1, A2, and A3. Additionally, when Module D is included in the EPDs being compared, all EPDs must use the same methodology for calculation of Module D values.

Interpreting the Results in Module D: The values in Module D include recognition of the benefits or impacts related to steel recycling which occur at the end of the product's service life. The rate of steel recycling and related processes will evolve over time. The results included in Module D attempt to capture future benefits or impacts, but are based on a methodology that uses current industry average data reflecting current processes.

5.2 Rebar

Table 6: LCIA Results for 1 MT of Fabricated Rebar

Environmental indicator		Unit[a]	Rebar				
			Unfabricated REBAR steel Production A1 (per MT)	Transport to the Fabricator A2 (per MT)	Fabrication A3 (per MT)	Product Stage A (total) (per MT)	Benefits and loads beyond the system boundary D (per MT)
TRACI 2.1							
AP	Acidification potential	MT SO_2 eq.	9.25E-03	2.79E-04	5.55E-05	9.58E-03	-1.18E-03
EP	Eutrophication potential	MT N eq	1.26E-03	1.75E-05	4.39E-06	1.28E-03	-4.40E-05
GWP	Global warming potential	MT CO_2 eq.	1.22E+00	4.37E-02	2.18E-02	1.29E+00	-5.91E-01
ODP	Stratospheric ozone layer depletion potential	MT CFC-11 eq.	3.02E-08	1.70E-12	1.34E-11	3.03E-08	4.02E-09
POCP	Photochemical ozone creation potential	MT O_3 eq.	5.21E-02	9.13E-03	5.25E-04	6.17E-02	-1.17E-02
CML 4.1							
ADP fossil fuels	Abiotic depletion potential for fossil resources	MJ, LHV	1.69E+04	5.81E+02	2.58E+02	1.77E+04	-7.39E+03
ADP elements	Abiotic depletion potential for non-fossil resources[b]	MT Sb eq.	6.82E-06	1.87E-11	4.96E-09	6.83E-06	-1.53E-06

a: MT stands for metric ton
b: This indicator is based on assumptions regarding current reserves estimates. Users should use caution when interpreting results because there is insufficient information on which indicator is best for assessing the depletion of abiotic resources.

Table 7: Resource Use Results for 1 MT of Fabricated Rebar

Environmental indicator		Unit	Rebar				
			Unfabricated REBAR steel Production A1 (per MT)	Transport to the Fabricator A2 (per MT)	Fabrication A3 (per MT)	Product Stage A (total) (per MT)	Benefits and loads beyond the system boundary D (per MT)
Resource use							
PERE	Renewable primary energy as energy carrier	MJ, LHV	5.37E+03	-	4.64E+01	5.41E+03	-3.84E+02
PERM	Renewable primary energy as material utilization	MJ, LHV	-	-	-	-	-
PERT	Total use of renewable primary energy resources	MJ, LHV	5.37E+03	-	4.64E+01	5.41E+03	-3.84E+02
PENRE	Non-renewable primary energy as energy carrier	MJ, LHV	1.81E+04	5.74E+02	3.73E+02	1.91E+04	-7.55E+03
PENRM	Non-renewable primary energy as material utilization	MJ, LHV	7.55E-01	-	-	7.55E-01	-
PENRT	Total use of non-renewable primary energy resources	MJ, LHV	1.81E+04	5.74E+02	3.73E+02	1.91E+04	-7.55E+03
SM	Use of secondary material	MT	3.74E-01	-	-	3.74E-01	-
RSF	Use of renewable secondary fuels	MJ, LHV	-	-	-	-	-
NRSF	Use of non-renewable secondary fuels	MJ, LHV	-	-	-	-	-
FW	Use of net fresh water	m^3	3.22E+00	-	1.81E-01	3.40E+00	-1.17E+00

Table 8: Output Flows and Waste Categories Results for 1 MT of Fabricated Rebar

Environmental indicator		Unit	Rebar				
			Unfabricated REBAR steel Production A1 (per MT)	Transport to the Fabricator A2 (per MT)	Fabrication A3 (per MT)	Product Stage A (total) (per MT)	Benefits and loads beyond the system boundary D (per MT)
Output flows and waste categories							
HWD	Hazardous waste disposed	MT	3.46E-04	-	-	3.46E-04	-7.10E-04
NHWD	Non-hazardous waste disposed	MT	8.88E-01	-	-	8.88E-01	-6.52E+01
RWD	Radioactive waste disposed	MT	1.15E-07	-	-	1.15E-07	-1.89E-04
CRU	Components for re-use	MT	-	-	-	-	-
MFR	Materials for recycling	MT	7.48E-02	-	3.30E-02	1.08E-01	-
MER	Materials for energy recovery	MT	-	-	-	-	-
EE	Exported energy	MJ, LHV	-	-	-	-	-

5.3 Merchant Bar Quality Steel

Table 9: LCIA Results for 1 MT of Fabricated Merchant Bar Quality Steel

Environmental indicator		Unit[a]	MBQ				
			Unfabricated MBQ steel Production A1 (per MT)	Transport to the Fabricator A2 (per MT)	Fabrication A3 (per MT)	Product Stage A (total) (per MT)	Benefits and loads beyond the system boundary D (per MT)
TRACI 2.1 (with the exception of ADP elements)							
AP	Acidification potential	MT SO_2 eq.	9.31E-03	1.52E-04	3.43E-04	9.80E-03	-2.14E-03
EP	Eutrophication potential	MT N eq.	1.08E-03	9.58E-06	5.52E-05	1.14E-03	-7.97E-05
GWP	Global warming potential	MT CO_2 eq.	1.20E+00	2.91E-02	1.16E-01	1.34E+00	-1.07E-00
ODP	Stratospheric ozone layer depletion potential	MT CFC-11 eq.	2.82E-08	1.13E-12	1.37E-10	2.83E-08	7.28-09
POCP	Photochemical ozone creation potential	MT O_3 eq.	5.11E-02	4.91E-03	3.95E-03	6.00E-02	-2.11E-02
CML 4.1							
ADP fossil fuels	Abiotic depletion potential for fossil resources	MJ, LHV	1.69E+04	3.88E+02	1.41E+03	1.87E+04	-1.34E+04
ADP elements	Abiotic depletion potential for non-fossil resources[b]	MT Sb eq.	6.68E-07	1.25E-11	2.23E-08	6.91E-07	-2.76E-06

a: MT stands for metric ton
b: This indicator is based on assumptions regarding current reserves estimates. Users should use caution when interpreting results because there is insufficient information on which indicator is best for assessing the depletion of abiotic resources

Table 10: Resource Use Results for 1 MT of Fabricated Merchant Bar Quality Steel

Environmental indicator		Unit	MBQ				
			Unfabricated MBQ steel Production A1 (per MT)	Transport to the Fabricator A2 (per MT)	Fabrication A3 (per MT)	Product Stage A (total) (per MT)	Benefits and loads beyond the system boundary D (per MT)
Resource use							
PERE	Renewable primary energy as energy carrier	MJ, LHV	5.72E+03	-	1.04E+02	5.83E+03	-6.95E+02
PERM	Renewable primary energy as material utilization	MJ, LHV	-	-	-	-	-
PERT	Total use of renewable primary energy resources	MJ, LHV	5.72E+03	9.91E-01	1.04E+02	5.83E+03	-6.95E+02
PENRE	Non-renewable primary energy as energy carrier	MJ, LHV	1.81E+04	3.83E+02	1.70E+03	2.02E+04	-1.37E+04
PENRM	Non-renewable primary energy as material utilization	MJ, LHV	7.91E-01	-	-	7.91E-01	-
PENRT	Total use of non-renewable primary energy resources	MJ, LHV	1.81E+04	3.83E+02	1.70E+03	2.02E+04	-1.37E+04
SM	Use of secondary material	MT	3.71E-01	-	-	3.71E-01	-
RSF	Use of renewable secondary fuels	MJ, LHV	-	-	-	-	-
NRSF	Use of non-renewable secondary fuels	MJ, LHV	-	-	-	-	-
FW	Use of net fresh water	m^3	2.99E+00	-	6.59E-01	3.65E+00	-2.12E+00

Table 11: Output Flows and Waste Categories Results for 1 MT of Fabricated Merchant Bar Quality Steel

Environmental indicator		Unit	MBQ				
			Unfabricated REBAR steel Production A1 (per MT)	Transport to the Fabricator A2 (per MT)	Fabrication A3 (per MT)	Product Stage A (total) (per MT)	Benefits and loads beyond the system boundary D (per MT)
Output flows and waste categories							
HWD	Hazardous waste disposed	MT	3.62E-04	-	-	3.62E-04	-1.28E-03
NHWD	Non-hazardous waste disposed	MT	8.88E-01	-	-	8.88E-01	-1.18E+02
RWD	Radioactive waste disposed	MT	1.15E-07	-	-	1.15E-07	-3.42E-04
CRU	Components for re-use	MT	-	-	-	-	-
MFR	Materials for recycling	MT	9.27E-01	-	7.00E-02	1.63E-01	-
MER	Materials for energy recovery	MT	-	-	-	-	-
EE	Exported energy	MJ, LHV	-	-	-	-	-

6 ADDITIONAL ENVIRONMENTAL INFORMATION

ArcelorMittal has undergone a third-party verification process with Vertima Inc. where ArcelorMittal products and its entire supply chain were assessed. At the end of the process, they received a Validated Eco-Declaration® summarizing verified environmental claims, as well as Vertima's Environmental Data Sheet©.

ArcelorMittal has also published a Health Product Declaration® for rebar and merchant bar quality (MBQ) steel. More details are available on the HPDC public repository: https://www.hpd-collaborative.org/hpd-public-repository/.

7 REFERENCES

[1] Canadian Standards Association, "CSA-G30.18-09 Carbon Steel Bars for Concrete Reinforcement," 2009

[2] ASTM International, "ASTM A615 / A615M-18e1, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement," West Conshohocken, PA, 2018.

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