ENVIRONMENTAL PRODUCT DECLARATION

Concrete Reinforcing Steel

According to ISO 21930 and ISO 14025

ISSUED FEBRUARY 25, 2021
VALID UNTIL FEBRUARY 25, 2026
DECLARATION NUMBER EPD 191
PREPARED FOR COMMERCIAL METALS COMPANY

Declaration Information

Declaration

Program Operator: ASTM International

Company: Commercial Metals Company
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Product Information

Product Name: Rebar

Product Definition: Concrete reinforcing steel

Declaration Type: Business to business

PCR Reference:
- ISO 21930 (ISO, 2017)
- Part A: Product Category Rules for Building Related Products and Services (UL Environment, 2018)
- Part B: Designated Steel Construction Product EPD Requirements (UL Environment, 2020)

Validity / Applicability

Period of Validity: This declaration is valid for a period of 5 years from the date of publication

Geographic Scope: United States

PCR Review was conducted by:
- Thomas P. Gloria, Ph.D., Industrial Ecology Consultants
- Brandie Sebastian, JBE Consultants
- James Littlefield, Independent Consultant

Product Application and / or Characteristics

Carbon steel used as reinforcement in concrete or masonry structures to strengthen and aid the concrete under tension. Structures include concrete roads and bridges, foundations, columns and pillars.

CSI MasterFormat Code 03 21 00: Reinforcing Steel. UNSPSC Commodity Code 30103623 for Reinforcing steel, or rebar.

Technical Drawing or Product Visual

Content of the Declaration

- Product definition and physical building-related data
- Details of raw materials and material origin
- Description of how the product is manufactured
- Data on usage condition, other effects and end-of-life phase
- Life Cycle Assessment results

Verification

Independent verification of the declaration and data, according to ISO 21930:2017 and ISO 14025:2006:

☐ internal ☒ external

This declaration and the rules on which this EPD is based have been examined by an independent verifier in accordance with ISO 14025.

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Limitations

The environmental impact results of steel products in this document are based on a declared unit and therefore do not provide sufficient information to establish comparisons. The results shall not be used for comparisons without knowledge of how the physical properties of the steel product impact the precise function at the construction level. The environmental impact results shall be converted to a functional unit basis before any comparison is attempted. See Section 3.10 For additional EPD comparability guidelines. Environmental declarations from different programs (ISO 14025) may not be comparable.

EPD Summary

This document is a Type III environmental product declaration by Commercial Metals Company that is certified by ASTM International (ASTM) as conforming to the requirements of ISO 21930 and ISO 14025. ASTM has assessed that the Life Cycle Assessment (LCA) information fulfills the requirements of ISO 14040 in accordance with the instructions listed in the referenced product category rules (PCR). The intent of this document is to further the development of environmentally compatible and sustainable construction methods by providing comprehensive environmental information related to potential impacts in accordance with international standards.

No comparisons or benchmarking is included in this EPD. Environmental declarations from different programs based upon differing PCRs may not be comparable (ISO 14025). Comparison of the environmental performance of construction works and construction products using EPD information shall be based on the product's use and impacts at the construction works level. In general, EPDs may not be used for comparability purposes when not considered in a construction works context. Given this PCR ensures products meet the same functional requirements, comparability is permissible provided the information given for such comparison is transparent and the limitations of comparability explained. When comparing EPDs created using this PCR, variations and deviations are possible. Example of variations: Different LCA software and background Life Cycle Inventory (LCI) datasets may lead to different results for upstream or downstream of the life cycle stages declared.

Table 1: Impact assessment results for 1 metric ton of rebar

Indicator	Unit	Total (A1-A3)	A1	A2	A3
GWP 100	kg CO_2 eq	707	94.3	23.7	589
ODP	kg CFC-11 eq	2.40E-09	7.71E-12	3.18E-15	2.39E-09
AP	kg SO_2 eq	1.43	0.589	0.133	0.708
EP	kg N eq	0.0662	0.0106	0.0118	0.0438
SFP	kg O_3 eq	21.4	6.10	3.49	11.8
ADP_{fossil}	MJ	704	28.6	46.7	628

Table 2: Impact assessment results for 1 short ton of rebar

Indicator	Unit	Total (A1-A3)	A1	A2	A3
GWP 100	kg CO_2 eq	641	85.5	21.5	534
ODP	kg CFC-11 eq	2.18E-09	6.99E-12	2.88E-15	2.17E-09
AP	kg SO_2 eq	1.3	0.534	0.121	0.642
EP	kg N eq	0.06	0.00961	0.0107	0.0397
SFP	kg O_3 eq	19.4	5.53	3.17	10.7
ADP_{fossil}	MJ	639	25.9	42.4	570

Scope and Boundaries of the Life Cyce Assessment

The Life Cycle Assessment (LCA) was performed according to ISO 14040 (ISO, 2006) and ISO 14044 (ISO, 2006) following the requirements of the ASTM EPD Program Instructions and referenced PCR.

System Boundary: Cradle-to-gate
Allocation Method: Partitioning
Declared Unit: 1 metric ton / 1 short ton

Description of Organization

As one of the leading Electric Arc Furnace (EAF) steel manufacturers in the world, Commercial Metals Company (CMC) is an industry leader in sustainable steelmaking and is committed to producing steel from 100% recycled scrap metal. We began as a metals recycling company in 1915, and today we remain committed to minimizing our impact on the environment and to 'green' steelmaking - collecting recycled steel at our local recycling centers, melting scrap metal into new finished products at our steel mini-mills and micro-mills, and processing steel at our fabrication centers, heat-treating facilities and other metals-related operations.

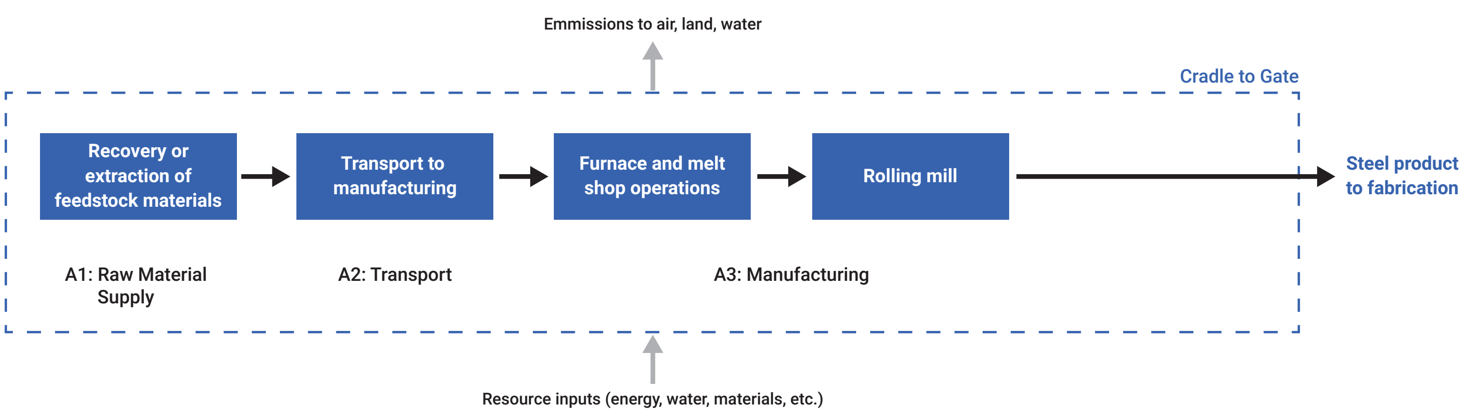
Product Description

Uncoated concrete reinforcement bar (coiled, spooled, straight; deformed or smooth) refers to carbon steel used as reinforcement in concrete. Rebar's surface is often patterned to form a better bond with the concrete, and can be epoxy-coated to mitigate corrosion. This document refers only to uncoated rebar that has not yet undergone fabrication. The reference service life of each product is not specified, as only modules A1-A3 are included.

Table 3: Technical Characteristics

Name	Value	Unit
Density	7,833	kg/m^3
Modulus of elasticity	199,900	N/mm^2
Coefficient of thermal expansion	11.8	$10^{-6}K^{-1}$
Thermal conductivity	80.4	W/(mK)
Melting point	1,504	°C
Electrical conductivity at 20°C	10,000,000	$\Omega^{-1}m^{-1}$
Minimum yield strength	By grade	N/mm^2
Minimum tensile strength	By grade	N/mm^2
Minimum elongation	By grade	%
Tensile strength	By grade	N/mm^2
ASTM Specification	ASTM A615/A615M, A706/A706M, A1035 CL, A1035 CM, A1035 CS	-

Figure 1: Production Flow Diagram



Product Average

The 2019 production data used in this EPD considers all concrete reinforcing steel produced by CMC during the year. The products are manufactured at seven facilities across the United States. Results are weighted according to production totals at the locations for the 2019 calendar year.

Product Application

Carbon steel rebar is used as reinforcement in concrete or masonry, including concrete roads, bridges, foundations, columns and pillars. It may be installed as-is, or fabricated to specific lengths and shapes per project specifications.

Material Composition

The exact chemical composition of CMC's steel is declared on a mill test report, which is provided with each shipment and for each heat. In general, the steel will be >97% recycled iron and a total of 2% or less of the following elements: Carbon, Manganese, Silicon, Chromium, Nickel, Molybdenum, Vanadium, Copper, Tin, Sulfur and Phosphorus. The combined total of Molybdenum, Sulfur and Phosphorus is generally less than 0.1%. Elements exist in steel in their natural, unoxidized states, so any concerns over elements that are toxic only in certain valence states are mitigated.

All CMC rebar is manufactured from 100% recycled scrap steel sourced within the United States.

Properties of Declared Product as Delivered

Concrete reinforcing steel produced by Commercial Metals Company are defined by the following ASTM standards:

- **ASTM A615/A615M-20** Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- **ASTM A706/A706M-16** Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
- **ASTM A1035/A1035M-20** Standard Specification For Deformed And Plain, Low-Carbon, Chromium, Steel Bars For Concrete Reinforcement

Methodological Framework

Declared Unit

As can be seen in Table 4, both a declared unit of 1 metric ton and the optional unit of 1 short ton are used.

Table 4: Declared Unit

Name	Quantity	Required Unit	Quantity	Optional Unit
Declared Unit	1	metric ton	1	short ton
Density	7,833	kg/m^3	489	lb/ft^3

System Boundaries

The LCA was conducted for the product stage, A1-A3. Construction, use and end-of-life are excluded from the scope of the LCA.

Table 5: System Boundaries

Product Stage			Construction Stage		Use Stage					End-of-Life Stage				Benefits and loads beyond system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
Raw materials supply	Transport	Manufacturing	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	De-construction	Transport	Waste processing	Disposal	Reuse, recovery and recycling potential
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

MND = module not declared

Allocation

Steel scrap: Steel scrap from the melt shop, rolling and other operations is internally recycled by steel mills. While whether a product is associated with a net consumption or generation of internal scrap is calculated by the model, this particular flow is not reported as part of the final LCIs as, from a mill-level perspective, all internal scrap is fed back into the melt shop.

Multi-product output: Where multiple finished products are produced, allocation sometimes had to be applied. While the melt shop knows exact formulations and energy requirements for each billet produced, the data for the rolling mill had to be allocated by total production time. In cases where melt shop and rolling mill water, waste and emissions could not be separated, impacts were allocated by product mass.

Co-products: Co-products during steel mill operations are allocated using a method used developed by the World Steel Association and EUROFER (worldsteel and EUROFER, 2014) to be in line with CEN EN 15804 (CEN, 2019). The methodology takes into the account of the manner in which changes in inputs and outputs affect the production of co-products. The method also takes account of material flows that carry specific inherent properties.

This approach is consistent with the PCR and ISO 21930. ISO 21930 takes precedence over EN15804, per the PCR Part A and Part B (UL Environment, 2020; UL Environment, 2018).

Table 6: Co-product allocation

Flow	% to Steel	% to Slag
Steel inputs	100.0	0.0
Slag	0.0	100
Steel scrap outputs	86.4	13.6
All other inputs/outputs	86.4	13.6

Cut-off Criteria

The cut-off rules, as specified in the PCR, did not have to be applied as none of the reported data was excluded.

Data Sources

All primary data were collected by CMC for annual production during the 2019 calendar year. All secondary data were obtained from the 2020 GaBi database (service pack 40). Where appropriate LCI data was not available proxy datasets were used, as documented in the background report.

Data Quality

Representativeness:

Temporal: All primary data were collected for the year 2019. All secondary data come from the GaBi 2020 databases and are representative of the years 2013-2020. As the study intended to represent the product systems for the reference year 2019, temporal representativeness is considered to be high.

Geographical: All primary and secondary data were collected specific to the regions under study. Where country- or region-specific data were unavailable, proxy data were used. Geographical representativeness is considered to be high.

Technological: All primary and secondary data were modeled to be specific to the technologies under study. Where technology-specific data were unavailable, proxy data were used. Technological representativeness is considered to be high.

Consistency: To ensure data consistence, all primary data were collected with the same level of detail, while all background data were sourced from the GaBi databases.

Reproducibility: Reproducibility is supported as much as possible through the disclosure of input-output data, dataset choices, and modeling approaches in this report. Based on this information, any third party should be able to approximate the results of this study using the same data and modeling approaches.

Uncertainty: Given the consistency within the data and the representativeness of the data, uncertainty associated with the model and results is low.

Data quality meets the requirements set forth in the PCR.

Estimates and Assumptions

One of the drivers of impacts associated with alloying elements is silicomanganese, for which no LCI data is available. Ferromanganese was used as a proxy, which is typically a precursor to silicomanganese production. As such, the impacts of silicomanganese use are likely underestimated. While the majority of CMC's rolling mills use steel billets produced at CMC's facilities, a small percentage of billets are purchased from other steel producers.
Engineering steel is used as a proxy for purchased steel billets, which likely overestimates the impacts of purchased billets.

Where insufficient data were available for inbound transportation of steel scrap, alloy elements and process materials, this study assumed an inbound transportation distance of 500 miles by truck.

Manufacturing

Scrap steel is melted in an electric arc furnace (EAF) which uses a combination of electrical energy and chemical energy in the form of carbon and oxygen injected into the steel. When the scrap has melted and reached approximately 3,000°F, the molten steel is poured (tapped) into a vessel called a ladle. During tapping, the majority of the alloys and fluxes are added to the steel to serve as deoxidizers and strengthening agents. The ladle is transported to the ladle metallurgical station (LMS), where the steel chemistry is refined to meet the chemical specifications. The ladle is then transported to a continuous caster where the steel is solidified into a solid, basic shape called a billet.

In the minimill process, billets then pass through a reheat furnace and travel into the rolling mill for processing. In the micromill process, the caster produces one continuous strand that is run directly into the rolling mill for processing. There is minimal reheating from an induction furnace in the micromill process, unlike the minimill process where billets are reheated in a gas furnace either from ambient temperature or hot/warm temperature after traveling from the caster.

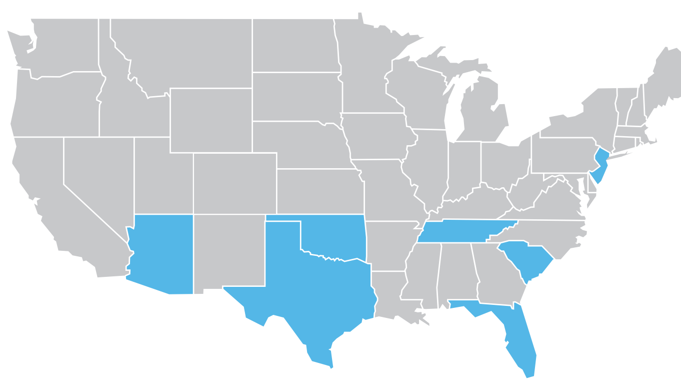
In the rolling mill, billets are passed through several mill stands which reduce the billet size and shape down to meet the final bar product specifications and emerge onto a cooling bed. The mill markings for source mill, material grade and specification are rolled into the rebar products on the final finishing stand.

The micromill and minimill technology is the cleanest and most energy efficient steelmaking process available today. By using recycled scrap as raw material rather than virgin natural resources, CMC is reducing the need for mining of natural resources and reducing CO_2 emissions by 58%. For every ton of steel produced, CMC conserves 2,500 pounds of iron ore, 1,400 pounds of coal, and 120 pounds of limestone.

After cooling, finished steel products are placed in storage bays before being transported to their final destination. Steel is packaged in bundles, which range from 1.5 to 3 tons. The bundles are secured with steel banding that is wrapped around the bundles. The piece count, length, weight, size, heat and grade information are declared on a tag that is stud-welded or wire-tied to one of the pieces in the bundle.

Geographic Relevance

CMC's rebar is manufactured in Mesa, AZ; Jacksonville, FL; Sayreville, NJ; Durant, OK; Cayce, SC; Knoxville, TN and Seguin, TX.



Temporal Relevance

Data was collected for the 2019 calendar year.

Technological Relevance

Rebar is manufactured using an electric arc furnace (EAF).

Life Cycle Assesment Results

Selection of LCIA Methodology and Impact Categories

The impact assessment categories and other metrics required by the PCR are shown in Table 8. GWP excludes biogenic carbon as the scope of the study is cradle-to-gate and there are no relevant bio-based raw materials present.

Table 8: Required declaration of environmental impacts, use of resources, and generation of waste

Indicator	Unit
Life Cycle Impact Assessment Results	
Global warming potential, excluding biogenic carbon (GWP 100)	kg CO_2 eq
Ozone depletion potential (ODP)	kg CFC-11 eq
Acidification potential (AP)	kg SO_2 eq
Eutrophication potential (EP)	kg N eq
Smog formation potential (SFP)	kg O_3 eq
Abiotic resource depletion potential of non-renewable (fossil) energy resources (ADP_{fossil})	MJ
Resource Use	
Renewable primary resources used as energy carrier (fuel) (RPR_E)	MJ LHV
Renewable primary resources with energy content used as material (RPR_M)	MJ LHV
Non-renewable primary resources used as an energy carrier (fuel) ($NRPR_E$)	MJ LHV
Non-renewable primary resources with energy content used as material ($NRPR_M$)	MJ LHV
Secondary materials (SM)	kg
Renewable secondary fuels (RSF)	MJ LHV
Non-renewable secondary fuels (NRSF)	MJ LHV
Recovered energy (RE)	MJ LHV
Use of net fresh water resources (FW)	m^3
Output Flows and Waste Categories	
Hazardous waste disposed (HWD)	kg
Non-hazardous waste disposed (NHWD)	kg
High-level radioactive waste, conditioned, to final repository (HLRW)	kg
Intermediate- and low-level radioactive waste, conditioned, to final repository (ILLRW)	kg
Components for re-use (CRU)	kg
Materials for recycling (MR)	kg
Materials for energy recovery (MER)	kg
Recovered energy exported from the product system (EE)	MJ LHV

It shall be noted that the above impact categories represent impact potentials, i.e., they are approximations of environmental impacts that could occur if the emissions would (a) actually follow the underlying impact pathway and (b) meet certain conditions in the receiving environment while doing so. In addition, the inventory only captures that fraction of the total environmental load that corresponds to the functional unit (relative approach). LCIA results are therefore relative expressions only and do not predict actual impacts, the exceed-ing of thresholds, safety margins or risks.

Comparability: Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted.

Any comparison of EPDs shall be subject to the requirements of ISO 21930. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparisons can be inaccurate and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Table 9: Resource use for 1 metric ton of rebar

Indicator	Unit	Total (A1-A3)	A1	A2	A3
RPR_E	MJ LHV	635	61.8	14.6	559
RPR_M	MJ LHV	-	-	-	-
$NRPR_E$	MJ LHV	7,850	948	351	6,560
$NRPR_M$	MJ LHV	894	-	-	894
SM	kg	1,140	1,140	-	0.121
RSF	MJ LHV	-	-	-	-
NRSF	MJ LHV	-	-	-	-
RE	MJ LHV	-	-	-	-
FW	m^3	3.33	1.33	0.0648	1.94

Table 10: Resource use for 1 short ton of rebar

Indicator	Unit	Total (A1-A3)	A1	A2	A3
RPR_E	MJ LHV	576	56.1	13.2	507
RPR_M	MJ LHV	-	-	-	-
$NRPR_E$	MJ LHV	7,120	860	318	5,950
$NRPR_M$	MJ LHV	811	-	-	811
SM	kg	1,030	1,030	-	0.11
RSF	MJ LHV	-	-	-	-
NRSF	MJ LHV	-	-	-	-
RE	MJ LHV	-	-	-	-
FW	m^3	3.02	1.21	0.0588	1.76

Table 11: Wastes and outputs for 1 metric ton of rebar

Indicator	Unit	Total (A1-A3)	A1	A2	A3
HWD	kg	0.705	-	-	0.705
NHWD	kg	11.5	-	-	11.5
HLRW	kg	0.000511	0.0000176	9.43E-07	0.000493
ILLRW	kg	0.428	0.0155	0.000783	0.412
CRU	kg	-	-	-	-
MR	kg	60.4	-	-	60.4
MER	kg	-	-	-	-
EE	MJ LHV	0.0435	-	-	0.0435

Table 12: Wastes and outputs for 1 short ton of rebar

Indicator	Unit	Total (A1-A3)	A1	A2	A3
HWD	kg	0.639	-	-	0.639
NHWD	kg	10.4	-	-	10.4
HLRW	kg	0.000463	0.000016	8.55E-07	0.000447
ILLRW	kg	0.388	0.0141	0.00071	0.374
CRU	kg	-	-	-	-
MR	kg	54.8	-	-	54.8
MER	kg	-	-	-	-
EE	MJ LHV	0.0395	-	-	0.0395

Table 13: Impact assessment results for 1 metric ton of rebar

Indicator	Unit	Total (A1-A3)	A1	A2	A3
GWP 100	kg CO_2 eq	707	94.3	23.7	589
ODP	kg CFC-11 eq	2.40E-09	7.71E-12	3.18E-15	2.39E-09
AP	kg SO_2 eq	1.43	0.589	0.133	0.708
EP	kg N eq	0.0662	0.0106	0.0118	0.0438
SFP	kg O_3 eq	21.4	6.10	3.49	11.8
ADP_{fossil}	MJ	704	28.6	46.7	628

Table 14: Impact assessment results for 1 short ton of rebar

Indicator	Unit	Total (A1-A3)	A1	A2	A3
GWP 100	kg CO_2 eq	641	85.5	21.5	534
ODP	kg CFC-11 eq	2.18E-09	6.99E-12	2.88E-15	2.17E-09
AP	kg SO_2 eq	1.3	0.534	0.121	0.642
EP	kg N eq	0.06	0.00961	0.0107	0.0397
SFP	kg O_3 eq	19.4	5.53	3.17	10.7
ADP_{fossil}	MJ	639	25.9	42.4	570

To align with the PCR, "product specific EPDs which include averaging shall report the range of results for all TRACI indicators for products included in the average."

Table 15: Range of impact assessment results for 1 metric ton of rebar

Indicator	Unit	A1-A3 (min)	A1-A3 (max)
GWP 100	kg CO_2 eq	598	789
ODP	kg CFC-11 eq	8.07E-13	8.63E-09
AP	kg SO_2 eq	1.19	1.78
EP	kg N eq	0.0489	0.0801
SFP	kg O_3 eq	19.0	23.8
ADP_{fossil}	MJ	467	1180

Table 16: Range of impact assessment results for 1 short ton of rebar

Indicator	Unit	A1-A3 (min)	A1-A3 (max)
GWP 100	kg CO_2 eq	542	716
ODP	kg CFC-11 eq	7.32E-13	7.83E-09
AP	kg SO_2 eq	1.08	1.61
EP	kg N eq	0.0444	0.0727
SFP	kg O_3 eq	17.2	21.6
ADP_{fossil}	MJ	424	1070

To support the reporting of mill-specific GWP100 results, Table 17 and Table 18 present GWP100 results by site.

Table 17: Facility-specific GWP100 results for 1 metric ton of rebar

GWP 100 (kg CO_2 eq)	Total (A1-A3)	A1	A2	A3
Mesa, AZ	598	107	9.59	481
Jacksonville, FL	789	106	23.2	659
Sayreville, NJ	783	90.3	20.1	672
Durant, OK	725	95.7	17.0	612
Cayce, SC	614	96.4	39	478
Knoxville, TN	686	65.2	17.5	603
Seguin, TX	734	100	31.7	602

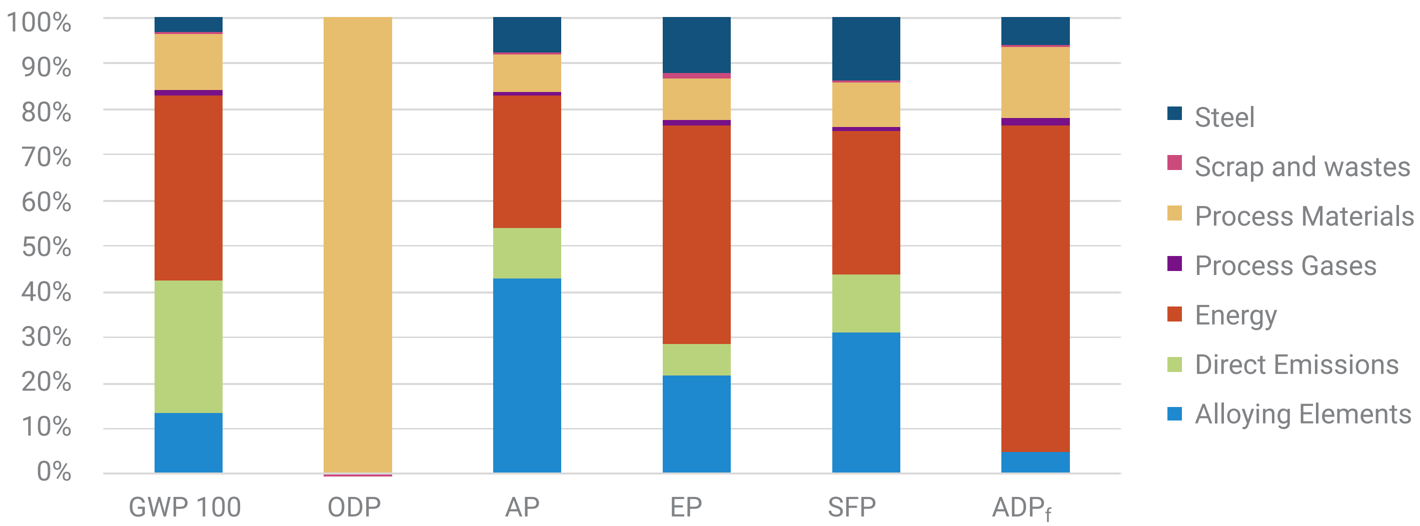
Table 18: Facility-specific GWP100 results for 1 short ton of rebar

GWP 100 (kg CO_2 eq)	Total (A1-A3)	A1	A2	A3
Mesa, AZ	542	97	8.7	436
Jacksonville, FL	716	96.1	21	598
Sayreville, NJ	710	81.9	18.2	610
Durant, OK	658	86.8	15.4	555
Cayce, SC	557	87.4	35.4	434
Knoxville, TN	622	59.1	15.9	547
Seguin, TX	666	90.7	28.8	546

Interpretation

Environmental impacts for rebar production are driven by electricity use, direct emissions from the EAF, and alloying elements. Direct emissions and energy use are the largest contributors to GWP100, while energy use is the dominant contributor to ADP_{fossil}. ODP is driven by use of cardboard samplers due to the background dataset used.

Figure 2: Relative results by category, rebar



Additional Environmental Information

The products do not contain any hazardous substances according to the Resource Conservation and Recovery Act, Subtitle 3. The products do not release dangerous substances to the environment, including indoor air emissions, gamma or ionizing radiation, or chemicals released to air or leached to water and soil.

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