

ENVIRONMENTAL PRODUCT DECLARATION

STEEL REINFORCING BAR AND MERCHANT BAR PRODUCTS

NUCOR STEEL FLORIDA, INC.
22 Nucor Drive, FROSTPROOF, FL 33843



NUCOR®

Nucor is North America's largest recycler, turning approximately 21.4 million net tons of scrap steel in 2021 into new steel. Nucor Steel Florida, Inc. (Nucor Frostproof) is a steel micro-mill with the capacity to process approximately half a million tons of scrap metal annually.

Nucor uses Electric Arc Furnace (EAF) technology at all of its steel production facilities. Using EAFs, Nucor Frostproof produced high-quality steel with 98.7% recycled content in 2021. EAFs use post-consumer scrap as its major feedstock, unlike traditional blast furnace steelmaking, which produces more than 70% of the world's steel using mined iron ore and metallurgical coal as feedstock.

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	ASTM INTERNATIONAL 100 BARR HARBOR DRIVE P.O. Box C700 WEST CONSHOHOCKEN, PA 19428-2959, USA HTTPS://WWW.ASTM.ORG/	
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	ASTM Program Operator for Product Category Rules (PCR) and Environmental Product Declarations (EPDs), General Program Instructions, Version: 8.0 , Revised 04/29/20.	
MANUFACTURER NAME AND ADDRESS	Nucor Steel Florida, Inc., 22 Nucor Drive, Frostproof, FL 33843	
DECLARATION NUMBER	EPD 439	
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	Steel Reinforcing Bar and Merchant Bar, 1 metric ton	
REFERENCE PCR AND VERSION NUMBER	- Part A: Life Cycle Assessment Calculation Rules and Report Requirements (UL Environment, V3.2, 12.12.2018) and Part B: Designated Steel Construction Product EPD Requirements (UL Environment, V2.0, 08.26.2020).	
DESCRIPTION OF PRODUCT APPLICATION/USE	Fabricated steel reinforcing bar and merchant bar used in construction	
PRODUCT RSL DESCRIPTION (IF APPL.)	N/A	
MARKETS OF APPLICABILITY	North America	
DATE OF ISSUE	3/10/2023	
PERIOD OF VALIDITY	5 years	
EPD TYPE	Product-Specific	
EPD SCOPE	Cradle to Gate	
YEAR(S) OF REPORTED PRIMARY DATA	2021	
LCA SOFTWARE & VERSION NUMBER	GaBi v10.6.2.9	
LCI DATABASE(S) & VERSION NUMBER	GaBi 2022.2	
LCIA METHODOLOGY & VERSION NUMBER	TRACI 2.1	

The PCR review was conducted by:

Dr. Tom Gloria, Chair, Industrial Ecology Associates

This declaration was independently verified in accordance with ISO 14025: 2006 and ISO 21930:2017.

INTERNAL EXTERNAL

Timothy S. Brooke, ASTM International

This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:

Trinity Consultants

This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:

Lindita Bushi, Ph.D., Athena Sustainable Materials Institute)

ENVIRONMENTAL PRODUCT DECLARATION

NUCOR®



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

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. Environmental declarations from different programs (ISO 14025) may not be comparable.

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

This declaration was independently verified in accordance with ISO 14025: 2006. The UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," v3.2 (December 2018), in conformance with ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017).

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

1. PRODUCT DEFINITION AND INFORMATION

Description of Organization

Nucor aims to lead our industry in embracing environmental responsibility in all aspects of our business. For us, taking care of the environment is more than a corporate policy, it is a cultural responsibility shared by all of our teammates from the front line to management. And while this commitment is good for our business, it is even better for the communities where we live and work.

Nucor Steel Florida operates a steel micro-mill that is located in Frostproof, FL.. It currently produces steel reinforcing bar (steel rebar) and merchant bar quality (MBQ) products. We recognize our role in protecting the environment and have demonstrated a long-standing commitment to its welfare. Using an electric arc furnace (EAF) steel recycling technology, we produce high-quality steel with 98.7% recycled content. In addition, all of the steel produced by Nucor is 100% recyclable at the end of its useful life.

This environmental product declaration (EPD) represents fabricated steel reinforcing bar and merchant bar produced via an EAF from Nucor's mill in Frostproof, Florida.

Product Description

Rebar assemblies are used in building and road/bridge projects where they are embedded in concrete. These products are rolled round deformed bars which are further detailed, cut, bent and/or tied into assemblies to prepare for installation. Additionally, MBQ shapes are angles, flats, rounds, channels and others used in a variety of building, industrial and equipment products. For use in the construction market, they are detailed, cut, drilled, bolted, welded and otherwise processed at the fabricator to be prepared for installation.

Steel rebar and MBQ produced by Nucor's Frostproof mill are defined by the following ASTM and CSA standards:

- **ASTM A615/A615M 2022** Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement [Grades 40, 60, 75, 80, 100]
- **ASTM A706/A706M-22A** Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement [Grades 60, 80]
- **CSA G30.18M-09 (R2019)** Carbon steel bars for concrete reinforcement [Grades 400R, 500R, 400W, 500W]
- **ASTM A1035/A1035M-20** Standard Specification For Deformed And Plain, Low-Carbon, Chromium, Steel Bars For Concrete Reinforcement.
- **ASTM A36/A36M-19** Standard Specification for Carbon Structural Steel
- **ASTM A529/A529M-19** Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality [Grades 50, 55]
- **ASTM A588/A588M-19** Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 Ksi [345 Mpa] Minimum Yield Point, with Atmospheric Corrosion Resistance [Grade B]
- **ASTM A572/A572M-18** Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel [Grades 50, 55]
- **ASTM A663/A663M-17** Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties
- **ASTM A709/A709M-18** Standard Specification for Structural Steel for Bridges [Grades 36, 50]
- **ASTM A F1554-20** Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength [Grades 36, 55]
- **ASTM A29/A29M 2020** Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought [Grades 1006, 1008, 1010, 1012, 1015, 1018, 1022, 1045, 1527, 1527 FG, 4140]
- **CSA G40.20-13/G40.21-13 (R2018)** General Requirements for rolled or welded structural quality steel / Structural quality steel [Grades 44W, 50W, 55W]

The United Nations Standard Products and Service Code (UNSPSC) and the Construction Specifications Institute (CSI) / Construction Specifications Canadian (CSC) classification identified for the Steel rebar and MBQ steel produced by Nucor's Frostproof mill are:

- CSI MasterFormat Code: 03 21 00 Reinforcement Bars

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products

Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

- UNSPSC Code: 30103623 Reinforcing Bar or Rebar or Mesh

Product Average

The 2021 production data used in this EPD considers rebar and MBQ products produced by the Nucor Frostproof mill during the year. Product-specific life cycle assessment (LCA) results are provided for the Frostproof facility only.

Application

Rebar and MBQ products are used in a wide variety of applications. These products are rolled into a variety of shapes such as rebar, flats, angles, rounds, square and specialty shapes that are detailed, cut, drilled, bolted, welded, and otherwise processed at the fabricator in order to prepare them for installation.

Declaration of Methodological Framework

The scope of the EPD is cradle-to-gate, including raw material extraction and processing, upstream transportation, and product manufacture (Modules A1, A2, and A3).

Technical Requirement

Technical data for the studied product can be found in the table below.

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

Table 1. Technical data for steel product

NAME	VALUE	UNIT
Density	7,800	kg/m ³
Melting point	1425-1450	°C
Electrical conductivity at 20°C	NA	% of IAC ⁸
Thermal conductivity	NA	W/(m-K)
Coefficient of thermal expansion	NA	m/m-°C
Modulus of elasticity	NA	N/mm ²
Shear modulus	NA	N/mm ²
Specific heat capacity	NA	J/kg-°C
Hardness, Brinell Number	80-100	HB
Yield strength	250-550	N/mm ²
Ultimate tensile strength	410-655	N/mm ²
Breaking elongation	13-20	%
Chemical composition	Varies by ASTM Specification/Grade	% by mass

Properties of Declared Product as Delivered

The reinforcing bar or MBQ can be fabricated (i.e., cut or otherwise modified) by a fabricator or shipped directly to a job site. This EPD addresses fabricated product.

Material Composition

Steel rebar and MBQ products are manufactured from recycled scrap. They do not contain any materials or substances for which there exists a route to exposure that leads to humans or flora/fauna in the environment being exposed to said materials or substances at levels exceeding safe health thresholds.

Manufacturing

The Nucor Frostproof Mill is a steel micro-mill which uses EAF technology to produce steel from recycled scrap metal. Scrap metal is received via rail and truck and is inspected and sorted into piles located within the on-site scrapyards. Scrap is moved from the scrapyards to the Endless Charging System (ECS) conveyor which continuously feeds scrap into the EAF for melting and refining. Typically, the EAF contains a “hot heel,” which is a small amount of molten steel from the previous heat (batch of steel), to assist in the rapid melting of the new scrap additions. Electric current is applied via large electrodes made of graphite or other high carbon material to melt the scrap. The electrodes are consumed in the melting process. The Frostproof Mill EAF is equipped with co-jet burners which introduce natural gas and oxygen for oxyfuel combustion. These burners even out energy imbalances, reduce furnace hot spots, and improve the overall energy efficiency of the process.

Additives are introduced during the melting process to maintain the optimal steel melting conditions and to achieve the desired steel grade. Lime is added as a fluxing agent to assist in the removal of unwanted constituents. Carbon can be added with the initial charge or injected with oxygen. Charge carbon carburizes the steel and provides additional energy to the melting process by the chemical oxidation of the carbon. Injection carbon and oxygen forms carbon monoxide bubbles which agitate and convert the slag to a frothy consistency. This practice enhances the removal of impurities in the steel and also provides faster heat times,

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products

Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

thereby improving energy efficiency.

Once the ideal melt conditions have been reached, a ladle is placed at the tapping side of the EAF, the furnace is de-energized, and the molten steel is poured into the ladle. The ladle transports the molten steel to the LMF for final chemistry additions, along with stirring which promotes a more homogeneous mixture. Additional additives may include various metal alloys to achieve the desired composition of the final steel product. Once the desired chemistry and temperature is met, the ladle is lifted to the continuous caster. The ladle is opened, and the molten steel enters the tundish which feeds the steel to a continuous casting process using water-cooled copper molds. In the caster, the steel begins to cool and solidify into billets.

The EAF is equipped with a baghouse to control particulate matter emissions from the process. This baghouse also captures emissions from other processes in the melt shop such as natural gas combustion for preheating of the ladle, tundish, etc.

The billet from the melt shop then enters the rolling mill where it is rolled into final products. Steel products include concrete reinforcing bars or merchant bar products. The final products are packaged and transported off-site via rail or truck.

Steel is transported via rail or truck from Nucor Frostproof to various types of customers, including downstream fabrication facilities. At these facilities, the steel is cut, rolled, or bent before being sold to consumers. Finished steel is also sold to distributors for consumer use. In Figure 1, fabrication is shown as its own process step. All other portions of the manufacturing process are considered as part of pre-fabrication.

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

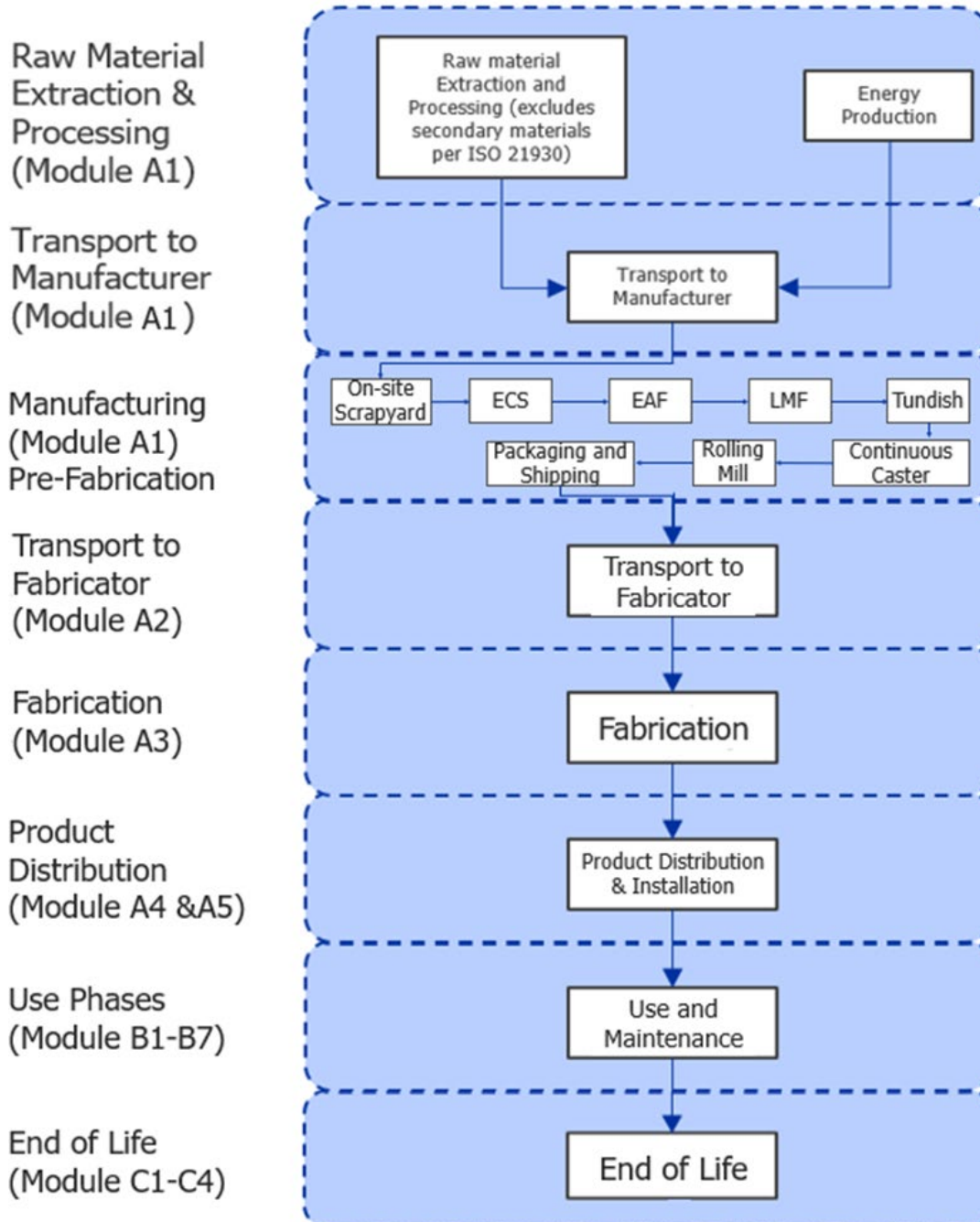


Figure 1: Flow chart for product system

Packaging

Packaging at the Nucor Frostproof mill falls below the cut-off criteria and therefore it is not included in the LCA for this EPD. Packaging at the fabrication facility includes the use of bags, tags, dunnage, and pallets and is included.

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

2. LCA CALCULATION RULES

Declared Unit

The declared unit is one (1) metric ton of fabricated steel reinforcing bar and merchant bar product.

System Boundary

Per the PCR, this cradle-to-gate analysis provides information on the Product Stage of the steel product life cycle, including modules A1, A2, and A3. Product delivery, installation and use, and product disposal (modules A4 – A5, B1 – B7, C1 – C4, and D) have not been included.

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

X = Module declared
MND = Module not declared

Cut-off Rules

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact are included in the inventory. In cases where no matching life cycle inventories were available to represent a flow, proxy data were applied based on conservative assumptions regarding environmental impacts. No data gaps were allowed which were expected to significantly affect the outcome of the indicator results. No other known flows are deliberately excluded from this EPD.

The mass input of each omitted stream is less than 1% of the total mass input streams into the system and the cumulative mass input of all omitted streams is less than 5% of the total mass input streams. Therefore, no data gaps were allowed which were expected to significantly affect the outcome of the indicator results.

Data Sources

The LCA model was created using the GaBi Software system for life cycle engineering, version 10.5.1.124, developed by Sphera (Sphera, 2021). Background life cycle inventory data for raw materials and processes were obtained from the GaBi 2021.2 database. Primary manufacturing data and fabrication data were provided by Nucor.

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

Data Quality

A variety of tests and checks were performed by the LCA practitioner throughout the project to ensure high quality of the completed LCA. Checks included an extensive review of project specific LCA models as well as the background data used.

Primary data represents production in the United States at the Nucor Steel Frostproof mill. Fabrication data represents production in the United States at two representative downstream fabrication facilities. An electricity provider specific dataset, via Duke Energy, was used to represent the Frostproof mill's energy consumption. Proxy datasets were used as needed for raw material inputs to address lack of data for a specific material or for a specific geographical region. These proxy datasets were chosen for their technological representativeness of the actual materials.

Period under Review

Primary data collected represent production during the 2021 calendar year. This analysis is intended to represent production in 2021.

Allocation

Per ISO 21930 and the PCR, this is an attributional LCA and as such, no allocation using system expansion was performed. Allocation of background data (energy and materials) taken from the GaBi 2021 databases is documented online at <http://www.gabi-software.com/international/support/gabi/>.

The Nucor Frostproof mill melt shop produces steel billet and slag. All slag is sold as-is. All steel billet continues onto the rolling mill to be rolled into steel reinforcing bar and merchant bar products ("steel"). The slag and steel product are considered co-products of the product system resulting from a joint co-production process. The Frostproof mill also produces mill scale which is sold as a co-product from the facility. However, since allocation for mill scale will require system expansion, it is not considered in this LCA. Therefore, this study allocated the environmental burden upstream of the rolling mill between the slag and steel only.

Estimates and Assumptions

The underlying study was conducted in accordance with the PCR. While this EPD has been developed by industry experts to best represent the product system, real life environmental impacts of fabricated steel products may extend beyond those defined in this document.

All of the raw materials and energy inputs have been modeled using processes and flows that closely follow actual production data on raw materials and processes. All of the reported material and energy flows have been accounted for.

Raw Material procurement and upstream transport to Nucor's Frostproof mill is included for all raw materials above the cut-off thresholds. For each raw material, a representative dataset was selected to represent the geographic region of origin. Distances by truck and rail were estimated using Google Earth. Distances by ship were estimated using sea-distances.org.¹ In some cases, the mill sources a single raw material from multiple distributors, in which case the transport from every distributor was modeled. Only travel to the facility is accounted for (i.e., return truck and rail trips are considered out of scope).

Steel produced at Nucor Frostproof is transported via rail or truck to downstream fabrication sites. Emissions from transport to the fabricator were included by calculating a weighted average distance for each mode of transport.

¹ <https://sea-distances.org/>

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

3. LCA RESULTS

Life Cycle Impact Assessment (LCIA) results are relative expressions and do not predict actual impacts, the exceeding of thresholds, safety margins or risks.

Legislation, such as the Buy Clean California Act (BCCA),² allows for the exclusion of emissions that occur during the fabrication stages in reporting total Global Warming Potential (GWP) results. Therefore, this section provides separate, pre-fabrication GWP results for Buy Clean legislation compliance.

The LCIA results below are relative expressions and do not predict impacts on category endpoints, the exceedance of thresholds, safety margins, or risks.

The six impact categories reported in the LCIA tables below are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.

Unfabricated Bar Results

Table 2. LCIA Results, per 1 metric ton of unfabricated product

PARAMETER	UNIT	TOTAL
GWP 100	kg CO ₂ eq.	6.78E+02

Fabricated Bar Results

Fabrication requires 1.08 metric tons of bar per 1 metric ton of fabricated product. Module A1 includes production of all 1.08 metric tons of bar.

Table 3. LCIA results, per 1 metric ton of fabricated product

PARAMETER	UNIT	A1	A2	A3	Total
GWP 100	kg CO ₂ eq.	7.32E+02	1.68E+01	2.33E+01	7.72E+02
ODP	kg CFC 11 eq.	9.15E-06	3.16E-14	2.03E-10	9.15E-06
AP	kg SO ₂ eq.	2.07E+00	4.72E-02	2.69E-01	2.39E+00
EP	kg N eq.	7.27E-02	4.97E-03	1.66E-02	9.43E-02
SFP	kg O ₃ eq.	2.46E+01	1.08E+00	8.08E+00	3.38E+01
ADP _{FOSSIL}	MJ surplus	8.63E+02	3.11E+01	3.49E+01	9.29E+02

² Per the Buy Clean California Act Legislative Report, fabrication refers to the processing of materials in preparation for use at the construction jobsite (e.g., bending, cutting, drilling, and painting). DGS General Services. "Buy Clean California Act – Legislative Report". January 1, 2022. <https://www.dgs.ca.gov/Resources/Legislative-Reports>

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

Table 4. Resource use results, per 1 metric ton of fabricated product ^a

PARAMETER	UNIT	A1	A2	A3	TOTAL
RPR _E	MJ LHV	5.10E+02	9.15E+00	1.28E+02	6.46E+02
RPR _M	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPR _E	MJ LHV	8.69E+03	2.35E+02	3.99E+02	9.33E+03
NRPR _M	MJ LHV	7.20E+02	0.00E+00	0.00E+00	7.20E+02
SM	kg	1.19E+03	0.00E+00	0.00E+00	1.19E+03
RSF	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³	2.26E+00	3.29E-02	6.30E-02	2.35E+00

a. Lower calorific values (LHV) of fuels are used for energy parameters.

Table 5. Output flows and waste categories results, per 1 metric ton of fabricated product ^a

PARAMETER	UNIT	A1	A2	A3	Total
HWD	kg	3.02E-02	9.78E-10	9.00E-09	3.02E-02
NHWD	kg	1.03E+01	2.02E-02	1.79E-01	1.05E+01
HLRW	kg	3.91E-05	7.73E-07	1.67E-05	5.66E-05
ILLRW	kg	3.45E-02	6.51E-04	1.40E-02	4.91E-02
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	1.41E+01	0.00E+00	0.00E+00	1.41E+01
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00

a. Lower calorific values (LHV) of fuels are used for energy parameters.

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 comparison can be inaccurate and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

4. LCA INTERPRETATION

To facilitate a more detailed understanding of the contributions from different mill processes, an analysis is included in this section which details the contribution from Modules A1, A2, and A3. The results in Figure 2 are shown below for steel reinforcing bar and merchant bar products – these facilitate a better understanding of which categories contribute most to which impacts.

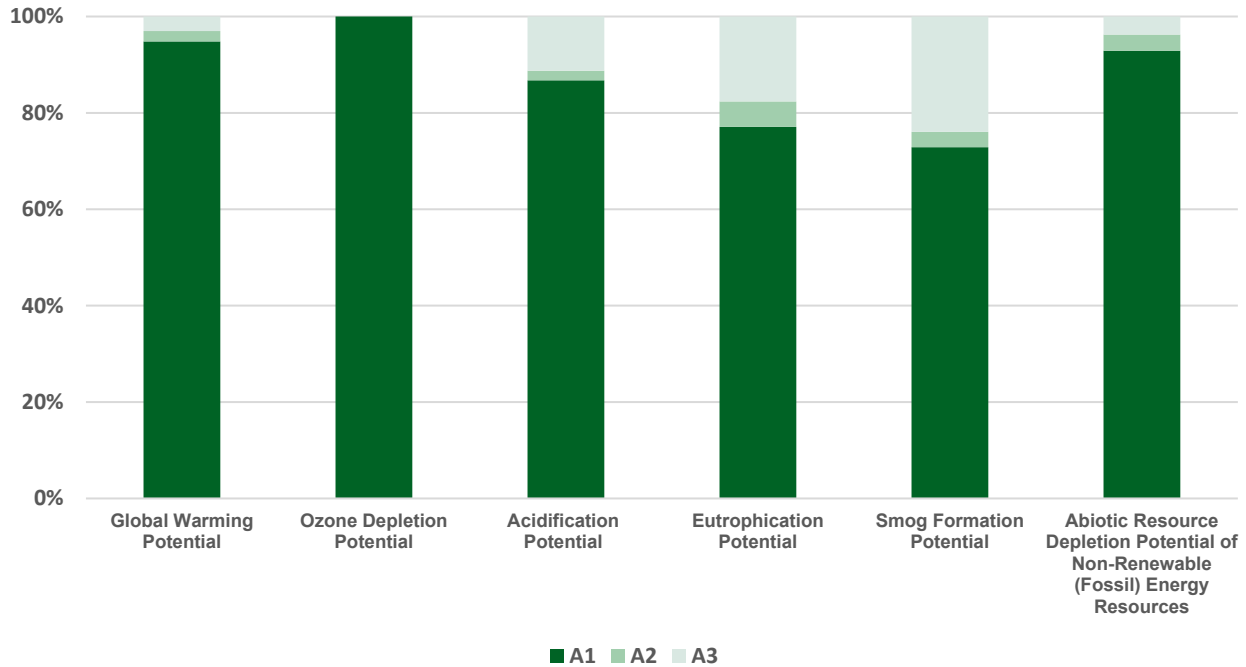


Figure 2: Relative contributions by module, IPCC AR5 + TRACI 2.1 impact categories

The impact assessment results indicate overall, Module A1, i.e. manufacturing of rebar and MBQ, which includes purchased electricity generation, on-site natural gas, diesel, gasoline, and LPG combustion, and facility emissions is the key contributor to all potential environmental impacts, including global warming potential, ozone depletion potential, acidification potential, smog formation potential, and abiotic resource depletion potential of fossil energy resources. Module A3, i.e. fabrication, contributes more significantly to smog formation potential, but is not the most significant contributor to any impact category. Module A2, i.e. transport to fabricator, is not the most significant contributor in any impact category .

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

5. ADDITIONAL ENVIRONMENTAL INFORMATION

Health and Safety

Health: Refer to the Nucor Bar SDS³ for additional environmental and health protection during the product manufacturing process. Be sure to follow all recommended handling and product manufacturing guidance.

Safety: Since 2005, Nucor has partnered with the Occupational Safety and Health Administration (OSHA) through its Voluntary Protection Program (VPP), which recognizes companies that voluntarily go the extra mile to meet rigorous safety standards. The Voluntary Protection Program (VPP) recognizes employers and workers in private industry and federal agencies who have implemented effective safety and health management systems and maintain injury and illness rates below national Bureau of Labor Statistics averages for their respective industries. An important aspect of VPP is the Special Government Employee (SGE) Program, which allows industry employees to work alongside OSHA and of which approximately 640 Nucor employees are active participants as of September 2018.

Four Nucor divisions employ the American National Standards Institute (ANSI) Z-10 Occupational Health and Safety Management System. And four others participate in the OSHA Series (OSHAS) 45001 Divisions. ANSI Z-10 is audited to best practices and in safety and health. OSHAS 45001 is an international safety and health system that provides a framework to promote better safety and health systems.

Environmental Activities and Certifications

ISO 14001:2015 Environmental Management System: The environmental performance of Nucor's steel mills focuses on continuous improvement through internal and external training, application of new technologies and how data and results are communicated. To provide a framework for Nucor teammates to follow, Nucor utilizes ISO 14001, which is the international standard that establishes specific requirements for an effective environmental management system (EMS). As the Frostproof facility is relatively new, Nucor Steel Frostproof's environmental management system is still in the process of gaining accreditation to the ISO 14001 standard.

Sustainability: Through recycling, Nucor has made the United States the cleanest place in the world to make steel. We are producing the sustainable steel that will build our modern 21st century economy. For more than 50 years, Nucor has been making steel using an electric arc furnace (EAF) that melts recycled scrap and turns it into new steel. EAFs are far less energy intensive and more energy efficient than traditional blast furnace steel making. Electric arc furnaces allow Nucor to produce less emissions than competitors who often make steel by melting iron ore and coking coal.

By recycling scrap in EAFs, Nucor's energy intensity (average gigajoules per metric ton of steel produced) is 74% lower than the global average, and its greenhouse gas intensity (metric tons CO₂ per ton of steel produced) is less than one-fourth the global average, and nearly one-fifth of the average integrated (BF/BOF) steel producer. Today, Nucor's greenhouse gas emissions intensity is less than one-third of the Paris Climate Agreement's most aggressive 2030 target for the global steel sector, the below 2 degrees Celsius benchmark compared to pre-industrial levels.

Today, Nucor accounts for more than 25% of the United States' steel production, but only accounts for 8% of the domestic steel industry's greenhouse gas emissions. However, Nucor realizes that being one of America's cleanest and most efficient steelmakers is not enough. That is why Nucor is committing to a 35% combined reduction in its steel mill Scope 1 and Scope 2 greenhouse gas intensity by 2030, measured against a 2015 baseline. This goal will take Nucor's steel mill CO₂ emissions down to 77% less than today's global steelmaking average, and 82% less than today's integrated steelmaking average. Beyond 2030, Nucor is committed to further reducing its greenhouse emissions to a goal of net zero emission steel at scale.

Nucor also recently launched its Econiq™ product line, which is the world's first net-zero steel available at scale. Econiq is not a single product; it is a net-zero certification, which can be applied to any product from Nucor's steel mills by balancing the CO₂ produced by our activities by an equivalent amount being removed. We achieve net-zero on Econiq products by eliminating all

³ https://assets.ctfassets.net/aax1cfbwhqog/UcLHwfmcrVoyrpxb15vZl/c73a00f2a213af726e2ef74584c79517/SDS-Bar_Steel.pdf

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products

Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

remaining Scope 2 emissions (by using 100% renewable energy certificates) and by offsetting all Scope 1 emissions (through the purchase of carbon offsets). Nucor shipped its first Econiq steel to a commercial customer in January 2022.

Recycled Materials Content: Nucor proudly uses recycled scrap to make high-quality steel with low emissions, using one of the cleanest and most energy efficient steel-making processes available. Steel can be infinitely recycled and reused without any quality loss. Nationwide, in 2021, Nucor steel products were made from an average of 75.4% recycled content, with some products containing as almost 100% recycled content. The Frostproof facility used 98.7% recycled scrap to produce new steel bar products that are 100% recyclable at the end of their useful life.⁴

Globally, only 26.3% of the more than 2 billion net tons of steel produced in 2020 was made by recycling scrap in EAFs – and EAFs only accounted 9.2% of the 1.17 billion net tons of steel made in China. Scrap inputs for the total crude steel production globally have remained at around 35% since 2013. To effectively address the goals set by the Paris Climate Agreement, the International Energy Agency recommends that the global market share needs to reach over 40% by 2030 – less than half the percentage that Nucor Steel Frostproof uses in its day-to-day production today.

Waste and Water Recycling: Nucor's EAFs, including the ones at its bar steel mills, emit less than 1% of the particulate matter of a traditional steel blast furnace – and the company recycles 99 percent of the EAF dust it collects in its baghouses. Nucor also recognizes that water is a critical natural resource and is essential to our business and the communities in which it operates. Nucor has worked extensively to improve water use efficiency in its processes. One hundred percent of the process water from Nucor's steelmaking operations is recycled multiple times at its bar steel mills. Currently there are no Nucor steel mill division located in a High or Extremely High Water Stress Area.

Nucor also participates in the Network for Business Innovation and Sustainability (NBIS) By-Product Synergy Group. This NBIS group brings together environmental experts from a wide variety of industries to allow them to compare waste streams and find ways to divert materials from landfills.

Environmental Training: In 2015, Nucor established Nucor Environmental University (NEU), an online training platform for Nucor teammates with environmental responsibilities and others looking to expand their involvement with the environmental team. From the beginning, Nucor designed this program to help teammates develop a thorough and meaningful understanding of environmental compliance. NEU has had over 1,000 active users since its inception and Nucor teammates have completed at least 10,000 environmental training courses, passed over 6,600 training exams, and helped develop dozens of courses. Because of NEU, Nucor's teammates are better prepared to meet the demands of environmental compliance and achieve Nucor's goal of being a sustainable organization.

Living Building Challenge: Nucor Frostproof is compliant with the Living Building Challenge (LBC)'s I-13 Red List. LBC is a green building standard with a goal to create "Living Buildings" that incorporate sustainable design solutions that actually improve the local environment rather than focusing on environmental impact reduction. LBC's I-13 Red List represents the "worst in class" materials, chemicals, and elements known to pose serious risks to human health ecosystems that are common in the building products industry.⁵ The International Living Future Institute (ILFI) believes that these materials should be phased out of production due to human and/or environmental health and toxicity concerns.⁶ ILFI, based in Seattle and Portland, is an environmental NGO committed to catalyzing the transformation toward communities that are socially just, culturally rich and ecologically restorative.

⁴ 2021 Recycled Content Averages for Nucor Steel Mill Products

https://assets.cfassets.net/aax1cfbwhqog/7Ma2avTxQFdBEwFCITrHkC/2b03d763f3695dc9a77ff17187edbf6c/Recycled_Content_Letter_Mill_Products_CY2021.pdf

⁵ <https://materiallybetter.com/living-building-challenge/>

⁶ <https://living-future.org/declare/declare-about/red-list/>

ENVIRONMENTAL PRODUCT DECLARATION



Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product

According to ISO 14025, and ISO 21930:2017

6. REFERENCES

- ASTM International. (2020). *ASTM Program Operator for Product Category Rule (PCR) and Environmental Product Declarations (EPDs), General Program Instructions, v8.0.*
- ISO. (2006). *ISO 14044:2006/Amd.1:2017/Amd.2:2020: Environmental management - Life cycle assessment - Requirements and guidelines.*
- ISO. (2006). *ISO 14040/Amd.1:2020: Environmental management - Life cycle assessment - principles and frameworks.*
- ISO. (2006). *ISO 14025: Environmental labels and declarations - Type III environmental declarations - principles and procedures.*
- ISO. (2017). *ISO 21930: Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services.*
- Sphera. (2021). *GaBi LCA Database Documentation.* Retrieved from Sphera Solutions, Inc.: <http://www.gabi-software.com/america/support/gabi/>
- UL Environment. (2018). *Product Category Rules for Building-Related Products and Services - Part A: Life Cycle Assessment Calculation Rules and Report Requirements, v3.2.*
- UL Environment. (2020). *Part B: Designated Steel Construction Product EPD Requirements, v2.0.*
- World Steel Association. (2014). *A methodology to determine the LCI of steel industry co-products.*

ENVIRONMENTAL PRODUCT DECLARATION

NUCOR®

Steel Reinforcing Bar and Merchant Bar Products
Designated Steel Construction Product



According to ISO 14025, and ISO 21930:2017

6. CONTACT INFORMATION

Study Commissioner

NUCOR®

NUCOR CORPORATION
1915 Rexford Road
Charlotte, NC 28211
Ph: 704.366.7000
www.nucor.com

LCA Practitioner



TRINITY CONSULTANTS, INC.
12700 Park Central Drive, Suite 2100
Dallas, TX 75251
<https://www.trinityconsultants.com/>