

ENVIRONMENTAL PRODUCT DECLARATION FABRICATED OPEN-WEB STEEL JOISTS AND JOIST GIRDERS

NUCOR CORPORATION



NUCOR[®]
VULCRAFT

Nucor Corporation's (Nucor) Vulcraft division (Vulcraft) is the nation's largest producer and leading innovator of open-web steel joists and joist girders, which are primarily used in nonresidential building construction. Steel joists and joist girders are produced and marketed throughout North America by seven domestic facilities.

Vulcraft sources its material from Nucor steel mills. Nucor is North America's largest recycler, turning approximately 20 million net tons of scrap steel in 2020 into new steel. Nucor uses Electric Arc Furnace (EAF) technology at each of its steel production facilities.

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. As a result, the recycled content of Vulcraft's joist and joist girders is 98.5%.

ENVIRONMENTAL PRODUCT DECLARATION



Fabricated Open-Web Steel Joists and Joist Girders
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 Corporation, 1915 Rexford Road, Charlotte, North Carolina 28211	
DECLARATION NUMBER	EPD 394	
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	Fabricated open-web steel joists and joist girders, 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	Steel joists and joist girders used in construction	
PRODUCT RSL DESCRIPTION (IF APPL.)	N/A	
MARKETS OF APPLICABILITY	North America	
DATE OF ISSUE	12/21/2022	
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.

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:

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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. 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).

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1. PRODUCT DEFINITION AND INFORMATION

Description of Organization

This environmental product declaration (EPD) represents steel joist products produced by Nucor's Vulcraft facilities located in Brigham City, UT; Chemung, NY; Florence, SC; Fort Payne, AL; Grapeland, TX; Norfolk, NE; and Saint Joe, IN. The overall recycled content of Vulcraft Steel Joists and Girders (% by Total Weight) is 98.5% (based on 2021 reporting). As a vertically integrated company, Nucor controls a large and growing part of its supply chain from scrap recycling to raw steelmaking to steel products and distribution. Vulcraft joist is fabricated and formed from merchant bar, plate, beam, and coil products. All of the steel produced by Nucor is 100% recyclable at the end of its useful life.

For production of the raw steel used in Vulcraft's joists and joist girders, Nucor uses scrap as its primary feedstock, which is largely provided by its wholly-owned subsidiary, the David J. Joseph Company (DJJ). DJJ operates more than 60 scrap recycling facilities within close proximity to Nucor steel mills, processing approximately 5,000,000 tons of ferrous scrap annually and providing an abundant supply of scrap to the steel mills. Having an abundant and reliable supply of recycled scrap with close proximity not only gives Nucor's steel mills a logistical and economic advantage over their competitors, but also a carbon footprint that is a fraction of the average steel producer.

Product Description

Steel joists are welded steel products that are used to frame a building and support the deck (which, in turn, supports a building's roof and floors). They are custom engineered to suit the design of each building. Joists in this EPD represent product manufactured in North America from steel product produced in North America.

Open-Web Steel Joists, which are secondary framing members, range from 0.25 to 3.10 meters deep, and up to 73 meters long. Joist Girders, which are primary framing members, range from 0.50 to 3.10 meters deep and up to 37 meters long. Composite Joists are open web product that are used in the construction of concrete roofs and floors allowing composite action between the joist and the concrete, range from 0.25 to 2.40 meters deep, and up to 37 meters long.

Steel joist and joist girder products are defined by the following standards:

- **ANSI/SJI-100 Standard Specification for K-Series, LH-Series, AND DLH-Series Open Web Steel Joists and for Joist Girders**
- **ANSI/SJI-200 Standard Specification for CJ-Series Composite Steel Joists**

The United Nations Standard Products and Service Code (UNSPSC) and the Construction Specifications Institute (CSI) / Construction Specifications Canadian (CSC) classification identified for steel joist and joist girder products are:

- CSI MasterFormat Code: 05 2000 Metal Joists
- UNSPSC Code: 30103614 Steel plate joist

Product Average

The 2021 production data used in this EPD considers steel joist produced by Nucor during the year. The products are manufactured at seven locations in the US. Results are weighted according to production totals at all locations. Facility-specific global warming potential results are provided in a separate table.

Application

Steel joist products are used as structural supports for building applications.

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).

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Technical Requirement

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

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

Steel joist products can be fabricated (i.e., cut or otherwise modified) by a fabricator or shipped directly to a job site or end user.

Material Composition

Steel joist products are manufactured from recycled scrap; with a small amount of galvanized coating or paint applied. 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. The products do not contain any hazardous substances according to the Resource Conservation and Recovery Act (RCRA), 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.

Manufacturing

The Vulcraft Facilities are steel finishing facilities that fabricate and form steel joists and joist girders from merchant bar, plate, beam, and coil products procured from Nucor steel mills and external mills. Steel mill products are received via truck and rail and added to onsite material inventory. The mill products are moved from inventory via crane to a staging table to be cut into the desired chord and web lengths. The chords and webs are transferred to a rigging table fitted with a roller bed to be tack welded into the desired product shape. The welds and product shape are inspected and repaired, if necessary. The inspected joists and girders are lifted via crane, dipped into a paint tank, and set aside to dry. In addition to the steel inputs, welding gases, welding wire, paint, and energy are needed to produce the joist and joist girder products. Metal scrap generated during manufacturing is recycled externally.

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The life cycle phases included in this study are illustrated in Figure 1.

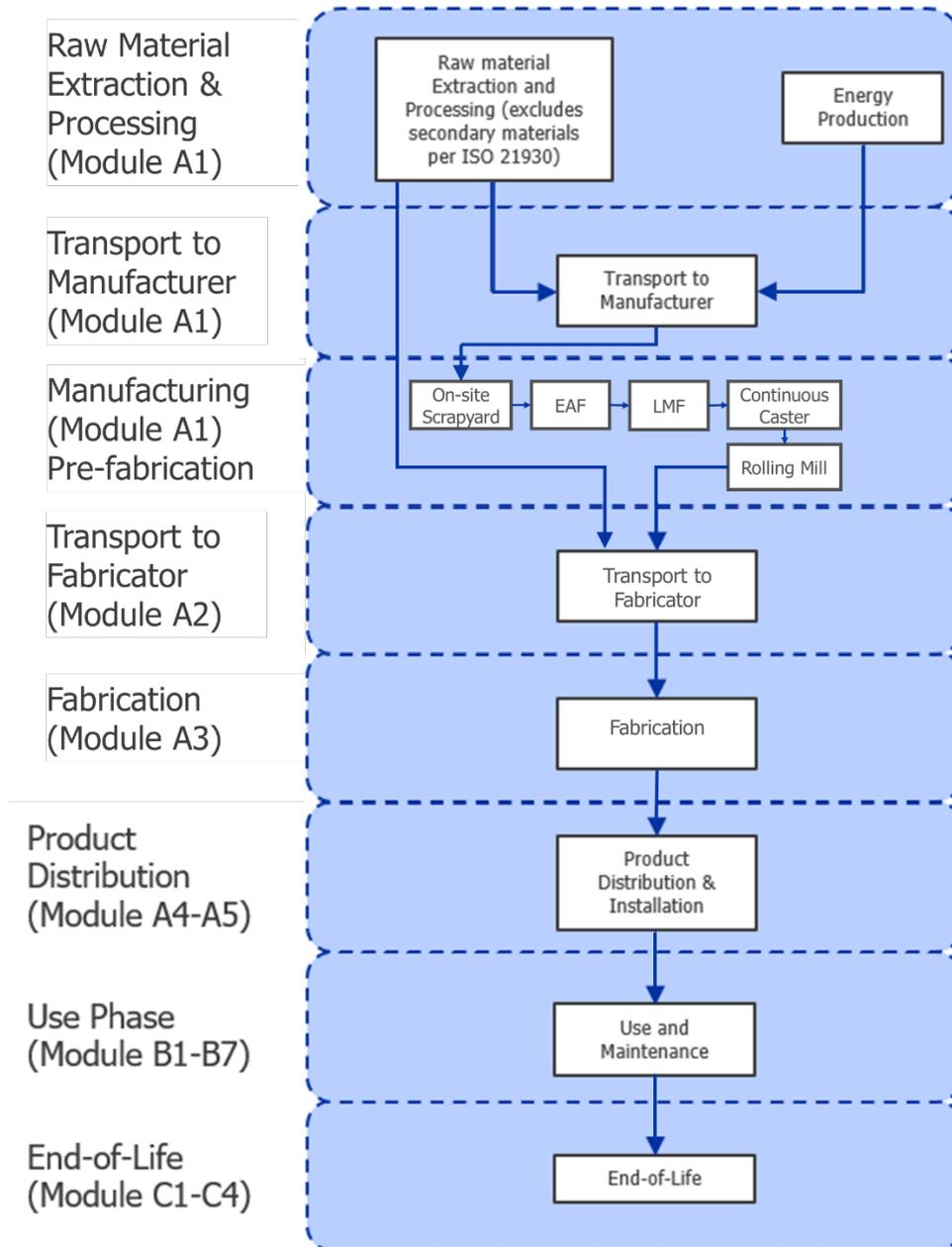


Figure 1: Flow chart for product system

Packaging

Packaging at the Vulcraft facilities falls below the cut-off criteria and therefore it is not included in the LCA for this EPD.

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2. LCA CALCULATION RULES

Declared Unit

The declared unit is one (1) metric ton of fabricated steel 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 10.6.2.9, developed by Sphera (Sphera, 2021). Background life cycle inventory data for raw materials and processes were obtained from the GaBi 2022.2 database. Primary manufacturing data and fabrication data were provided by Nucor.

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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.

Production data has been collected by Nucor directly from the production sites and are average values for the year 2021 (12 consecutive months of averaged data as required for manufacturer specific data sets). The data has been measured and verified internally. The data is assumed to be the most relevant according to current conditions and production practices. Based on availability of data, natural gas and electricity usage for the operation of administrative offices was included in the system boundary for some facilities.

Time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty have each been analyzed as part of this LCA. All inputs and data sources meet the requirements set forth in the PCR and there is no reason to believe that any of the employed material, data, or inputs are not representative of the product under study.

Geographical Coverage

Primary data represents production in the United States at the following Nucor facilities:

- Vulcraft – Brigham City, UT
- Vulcraft – Chemung, NY
- Vulcraft – Florence, SC
- Vulcraft – Fort Payne, AL
- Vulcraft – Grapeland, TX
- Vulcraft – Norfolk, NE
- Vulcraft – Saint Joe, IN

Regionally specific datasets, where available, were used to represent each manufacturing location'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/>. No multi-output allocation was required in the foreground system of the study.

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 Vulcraft facilities 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 Maps. Distances by ship were estimated using sea-distances.org.¹ In some cases, the Vulcraft facilities sourced 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).

¹ <https://sea-distances.org/>

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3. LCA RESULTS

North American life cycle impact assessment (LCIA) results are declared using TRACI 2.1 methodology, with the exception of GWP which uses the IPCC AR5 methodology. LCIA results are relative expressions and do not predict actual impacts, the exceeding 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.

Table 2. LCIA results, per 1 metric ton of fabricated product ^a

PARAMETER	UNIT	A1	A2	A3	TOTAL
GWP 100	kg CO ₂ eq.	7.98E+02	1.32E+01	2.81E+01	8.39E+02
ODP	kg CFC 11 eq.	2.21E-06	2.44E-13	5.43E-10	2.21E-06
AP	kg SO ₂ eq.	2.44E+00	3.97E-02	2.43E-01	2.73E+00
EP	kg N eq.	1.37E-01	3.90E-03	1.86E-02	1.59E-01
SFP	kg O ₃ eq.	3.49E+01	9.58E-01	8.90E+00	4.47E+01
ADP _{FOSSIL}	MJ surplus	8.60E+02	2.32E+01	6.53E+01	9.49E+02

a. Results represent a production-weighted average of the seven Vulcraft facilities.

Table 3. Resource use results, per 1 metric ton of fabricated product ^{a,b}

PARAMETER	UNIT	A1	A2	A3	TOTAL
RPR _E	MJ LHV	1.37E+03	1.42E+01	1.71E+02	1.56E+03
RPR _M	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPR _E	MJ LHV	1.07E+04	1.91E+02	7.83E+02	1.17E+04
NRPR _M	MJ LHV	2.57E+02	0.00E+00	0.00E+00	2.57E+02
SM	kg	1.07E+03	0.00E+00	0.00E+00	1.07E+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	-2.23E-01	-2.23E-01
RE	MJ LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³	3.76E+00	3.53E-02	2.28E-01	4.02E+00

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

b. Results represent a production-weighted average of the seven Vulcraft facilities.

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Table 4. Output flows and waste categories results, per 1 metric ton of fabricated product ^{a,b}

PARAMETER	UNIT	A1	A2	A3	Total
HWD	kg	3.10E+00	2.11E-09	3.27E-08	3.10E+00
NHWD	kg	3.28E+01	2.16E-02	1.16E+00	3.40E+01
HLRW	kg	8.81E-04	4.65E-06	8.30E-05	9.68E-04
ILLRW	kg	7.40E-01	3.89E-03	6.94E-02	8.13E-01
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	1.77E+01	0.00E+00	1.81E+01	3.58E+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.
- b. Results represent a production-weighted average of the seven Vulcraft facilities.

Any comparison of EPDs shall be subject to the requirements of ISO 21930. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. 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.

To align with the PCR, “product specific EPDs which include averaging shall report the range of results for all IPCC AR5 and TRACI indicators for products included in the average.” Averaging across manufacturing facilities was used in this EPD, so Table 5 reports the range of results for the six impact categories included in Table 2.

Table 5. LCIA results, variation per 1 metric ton of fabricated product ^a

PARAMETER	UNIT	A1 (MIN)	A1 (MAX)	A2 (MIN)	A2 (MAX)	A3 (MIN)	A3 (MAX)	TOTAL (MIN)	TOTAL (MAX)
GWP 100	kg CO ₂ eq.	5.82E+02	9.20E+02	5.40E+00	2.50E+01	1.28E+01	4.26E+01	6.15E+02	9.58E+02
ODP	kg CFC 11 eq.	2.10E-10	1.06E-05	1.02E-14	7.41E-13	4.53E-11	2.56E-09	3.70E-10	1.06E-05
AP	kg SO ₂ eq.	1.69E+00	4.25E+00	1.78E-02	7.32E-02	5.81E-02	9.38E-01	1.81E+00	4.74E+00
EP	kg N eq.	8.93E-02	1.90E-01	1.76E-03	7.29E-03	6.09E-03	5.74E-02	1.06E-01	2.05E-01
SFP	kg O ₃ eq.	2.66E+01	3.99E+01	4.07E-01	1.76E+00	1.94E+00	2.95E+01	3.47E+01	5.99E+01
ADP _{FOSSIL}	MJ surplus	5.88E+02	1.01E+03	1.00E+01	4.42E+01	3.94E+01	1.92E+02	6.39E+02	1.10E+03

- a. Results compared based on 1 metric ton of fabricated product produced by each facility.

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4. LCA INTERPRETATION

To facilitate a more detailed understanding of the contributions from different mill and fabrication processes, an analysis is included in this section which details the contribution from Modules A1, A2, and A3. The results in Figure 3 are shown below for steel joists and joist girders to facilitate a better understanding of which categories contribute most to which impacts.

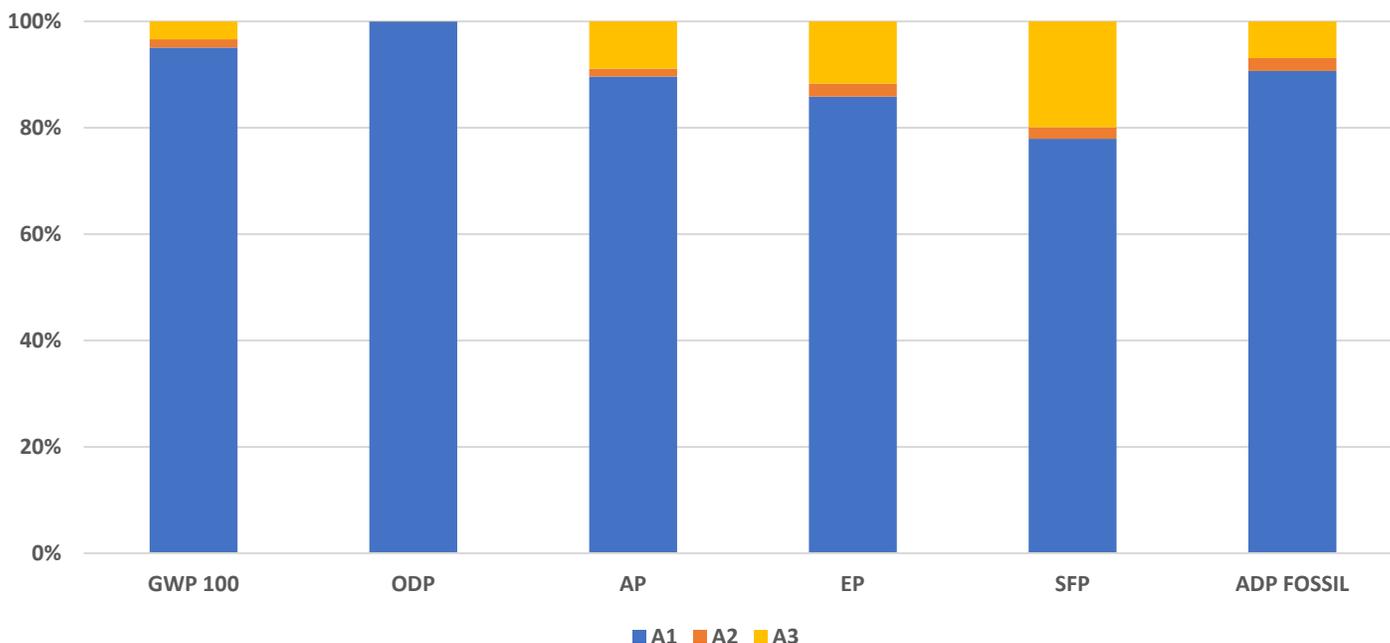


Figure 3: Relative contributions by module, IPCC AR5 + TRACI 2.1 impact categories

Overall, Module A1, i.e., manufacturing of steel merchant bar, plate, beam, and coil products, 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.

Facility-Specific GWP 100 Results

Vulcraft steel joist products are manufactured at seven different facilities. The results presented in the LCA Results section above represent a production-weighted average of these facilities. To understand how the GWP may vary between sites, facility specific GWP 100 results are presented below, per metric ton, in Table 6.

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Table 6. Facility-specific GWP 100 results, per 1 metric ton of fabricated product

GWP 100 (kg CO ₂ eq.)	A1	A2	A3	TOTAL
Brigham City, UT	582.00	5.40	27.39	614.80
Chemung, NY	672.90	11.22	12.82	696.95
Florence, SC	920.25	9.62	28.56	958.43
Fort Payne, AL	904.32	22.38	23.79	950.50
Grapeland, TX	887.38	7.93	20.24	915.54
Norfolk, NE	691.98	9.81	40.94	742.74
Saint Joe, IN	878.49	24.99	42.56	946.05

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5. ADDITIONAL ENVIRONMENTAL INFORMATION

Health and Safety

Health: Refer to the Vulcraft Steel Joist SDS² for additional environmental and health protection during the product manufacturing process.

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. Vulcraft Alabama, Vulcraft Indiana, Vulcraft Nebraska, and Vulcraft Texas are recognized by VPP.

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. OHSAS 45001 is an international safety and health system that provides a framework to promote better safety and health systems.

Lastly, Nucor has been awarded the President's Safety Award (PSA) since 1998 for divisions that record Injury and Illness and DART (Days Away, Restricted or Transferred) rates below 2/3 the national average for comparable facilities. High-performing divisions that are VPP-certified are given CEO Recognition. Vulcraft South Carolina and Vulcraft Utah have been awarded the PSA. Vulcraft Nebraska, Vulcraft Alabama, Vulcraft Texas and Vulcraft Indiana have been recognized by the CEO.

Environmental Activities and Certifications

ISO 14001:2015 Environmental Management System: The environmental performance of Nucor's steel mills and facilities 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). Nucor Steel South Carolina, Nucor Steel Nebraska, Vulcraft Alabama, Vulcraft Nebraska, Vulcraft Utah, Vulcraft South Carolina, Vulcraft Texas, Vulcraft Indiana, and Vulcraft New York are certified to ISO 14001.

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

² <https://vulcraft.com/files/SDS/SDS-joists%2012.21.15.pdf>

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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 remaining Scope 2 emissions (by using 100% renewable energy certificates) and by offsetting all Scope 1 emissions (through the purchase of carbon offsets). Per the requirements of the Product Category Rule for Building-Related Products and Services in North America, Part A, results with Renewable Energy Certificates are included separately in this LCA. 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 nearly 100% recycled content. Nucor South Carolina used 87.6% recycled scrap and Nucor Nebraska used 92.5% recycled scrap to produce new steel bar products that are 100% recyclable at the end of their useful life.³ Vulcraft facilities use Nucor steel products for over 99% of their steel raw materials.

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.

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% 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 and Vulcraft facilities. Currently there are no Nucor steel mill divisions 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.

Clean Energy: As America's cleanest and most efficient steel company Nucor is extending beyond its fence line to lower its carbon footprint by investing in the development of new clean wind and solar power generation capacity. Nucor is currently supporting the development of more than 350MW, of new clean energy infrastructure, making us the 7th largest corporate buyer of renewable energy in America in 2020. Since November 2019, Nucor has entered two Virtual Power Purchase Agreements, which will enable the construction of 250MW of new solar energy and 100MW of new wind energy in Texas. Together, these two projects are equal to the electricity usage of nearly 70,000 Texas homes and have the potential to supply renewable power to the regional electric grid 24-hours a day.

Vulcraft UT and Vulcraft NY have onsite solar fields to aid their communities and lower their carbon footprint. In 2021, Vulcraft UT generated 3% of their electricity usage through onsite solar and Vulcraft NY generated 27% of their electricity usage through onsite solar.

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

³ 2021 Recycled Content Averages for Nucor Steel Mill Products

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

ENVIRONMENTAL PRODUCT DECLARATION

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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.

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