



Declaration Owner

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Product:

Low-Embodied Carbon (LEC) Cold formed steel framing and accessory products

Declared Unit

The declared unit is one metric ton of Low-Embodied Carbon (LEC) steel framing product.

EPD Number and Period of Validity

SCS-EPD-10295
EPD Valid December 3, 2024, through December 2, 2029

Product Category Rule

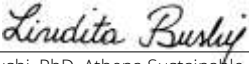
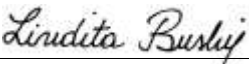
PCR for Building-Related Products and Services - Part A: LCA Calculation Rules and Report Requirements, Version 4.0 UL Environment. March 2022.

PCR Guidance for Building-Related Products and Services. Part B: Designated Steel Construction Product EPD Requirements. UL Environment. August 2020.

Program Operator

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Program Operator:	SCS Global Services														
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide														
LCA Practitioner:	Tess Garvey, Ph.D., SCS Global Services														
LCA Software and LCI database:	OpenLCA 2.20 software and the Ecoinvent v3.10 database														
Product's Intended Application:	Steel framing products used in various construction applications														
Product RSL:	n/a														
Markets of Applicability:	Global														
EPD Type:	Product-Specific														
EPD Scope:	Cradle-to-Gate														
LCIA Method and Version:	IPCC AR5, TRACI 2.1 and CML-IA														
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	<input type="checkbox"/> internal <input checked="" type="checkbox"/> external														
LCA Reviewer:	 Lindita Bushi, PhD, Athena Sustainable Materials Institute														
Part A Product Category Rule:	PCR for Building-Related Products and Services - Part A: LCA Calculation Rules and Report Requirements, UL v.4.0, March 2022.														
Part A PCR Review conducted by:	Lindita Bushi, PhD (Chair); Hugues Imbeault-Tétreault, ing., M.Sc.A.; Jack Geibig														
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services. Part B: Designated Steel Construction Product EPD Requirements. UL Environment. August 2020.														
Part B PCR Review conducted by:	Thomas Gloria, PhD; Brandie Sebastian, James Littlefield														
Independent verification of the declaration and data, according to ISO 14025 and the PCR	<input type="checkbox"/> internal <input checked="" type="checkbox"/> external														
EPD Verifier:	 Lindita Bushi, PhD, Athena Sustainable Materials Institute														
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Disclaimers: This EPD conforms to ISO 14025, 14040, 14044, and ISO 21930.

Scope of Results Reported: The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.

Accuracy of Results: Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.

Comparability: The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

The owner of the declaration shall be liable for the underlying information and evidence; SCS shall not be liable with respect to manufacturer information, life cycle assessment data, and evidence supplied or made available to SCS.

1. CEMCO, LLC.

Since 1974, CEMCO® has taken a leadership role to provide you the most advanced products and systems for steel framing and metal lath construction. Delivering the safest products we can produce, such as the new Safety Edged® steel framing products, gives you safer handling of framing products on your trucks, in your yards, and on your jobsites. CEMCO® also manufactures slotted track for your fire-rated head-of-wall applications. Other innovations such as Sure-Board® for shear-walls, Sure-Span® steel floor joists and the ProX Header® and ProX Rough-Opening framing systems are also available to help complete your environmentally responsible project. CEMCO's four state-of-the-art manufacturing facilities are located in City of Industry, CA (Metropolitan Los Angeles); Denver, CO; Ft. Worth, TX; and Pittsburg, CA (Oakland/San Francisco Bay Area).



2. Products

2.1 PRODUCT DESCRIPTION




The steel framing products in this study are used primarily for structural or non-structural framing in construction products. Descriptions, specifications, and pictures of each product can be found in Table 1. The products conform to the following CSI codes:

- Cold formed steel framing: 05 40 00
- Accessories for Framing (structural & non-structural): 05 40 00
- Non-Structural (ViperStud and Viper-X): 09 22 16
- Metal Lath & Plastering Accessories: 09 24 00

Table 1. Product names, descriptions, intended application, and picture for each of the framing products contained in this study

Product Name	Product Description and Specifications	Picture
Structural Stud and Track	Structural Stud and Track is manufactured for use in curtain wall, load-bearing, rough-opening & ceiling/floor/roof applications. Available in typical c-shaped sections ranging in thickness from 33 mils to 118 mils, in accordance with ICC-ES ESR 3016. Product Specifications: ASTM C645	
ViperStud® Interior Framing	ViperStud® non-load bearing framing system is a proprietary interior framing system using high-strength steel roll-formed into c-shaped studs and tracks in thicknesses ranging from 15 mil to 33 mil and manufactured in accordance with ICC-ES ESR#2620. Product Specifications: ASTM C645	

Product Name	Product Description and Specifications	Picture
<p>Viper-X® Interior Framing</p>	<p>Viper-X® non-load bearing framing system is a proprietary interior framing system using high-strength steel roll-formed into c-shaped studs and tracks in thicknesses ranging from 18 mil to 22 mil and manufactured in accordance with IAPMO UER #0524.</p> <p>Product Specifications: ASTM C645</p>	
<p>ProX Header®</p>	<p>ProX Header® is a proprietary header and rough-opening framing system designed to use less material and increase safety during the installation process. ProX Header components are manufactured in thicknesses ranging from 33 mil to 68 mil. ProX Header products are manufactured in accordance with IAPMO-UER #0286.</p> <p>Product Specifications ASTM C955</p>	
<p>CST Brand Slotted Tracks</p>	<p>CEMCO's CST slotted track products are head-of-wall tracks designed for seismic movement in buildings. These products are manufactured in c-shapes ranging in thicknesses from 33 mil to 68 mil. CST products are manufactured in accordance with ICC-ES ESR#2012.</p> <p>Product Specifications ASTM C645</p>	
<p>Sure-Board for Shear®</p>	<p>Sure-Board for Shear® panels are a composite product manufactured using hot-dipped galvanized steel with a gypsum-based sheathing for wall, roof, and floor applications. All Sure-Board products are produced in accordance with IAPMO UER#0126.</p> <p>Note only the steel portion of this product is represented herein.</p> <p>Product Specifications ASTM C645</p>	
<p>Sure-Span® Floor Joists</p>	<p>Sure-Span® steel floor joists and rim tracks are manufactured from hot-dipped galvanized steel into c-shaped joists with large-openings and pre-spaced/indexed rim-tracks in thicknesses ranging from 43 mil to 97 mil.</p> <p>Product Specifications ASTM C955</p>	

Product Name	Product Description and Specifications	Picture
<p>CEMCO CT Brand CT Studs</p>	<p>CEMCO's CT shaft wall studs are manufactured from hot-dipped galvanized steel into CT-shaped studs for fire-rated shaft walls and stairwells in 33 mil and 43 mil thicknesses. All CT products are manufactured in accordance with ICC-ES ESR# 4934.</p> <p>Product Specifications ASTM C645</p>	
<p>CH Brand Shaft Studs</p>	<p>CEMCO manufactures USG SHEETROCK® Brand CH shaft wall studs and J-Runners for shaft wall and stairwell applications as well as H-studs and C-runners for area separation walls. These products are manufactured from hot-dipped galvanized steel in accordance with AER #09038.</p> <p>Product Specifications ASTM C645</p>	
<p>Metal Lath and Plastering Accessories</p>	<p>CEMCO's metal lath and plastering accessories are manufactured from hot-dipped galvanized steel in several configurations in accordance with ICC-ES ESR 1623.</p> <p>Product Specifications Metal Lath: ASTM C847 Plastering Accessories: ASTM C1047</p>	

CEMCO manufactures steel framing products with an average density of 7,850 kg/m³.

The products come in various sizes and thicknesses, as described in Table 3.

2.2 PRODUCT FLOW DIAGRAM

A flow diagram illustrating the production processes and life cycle phases included in the scope of the EPD is provided below.

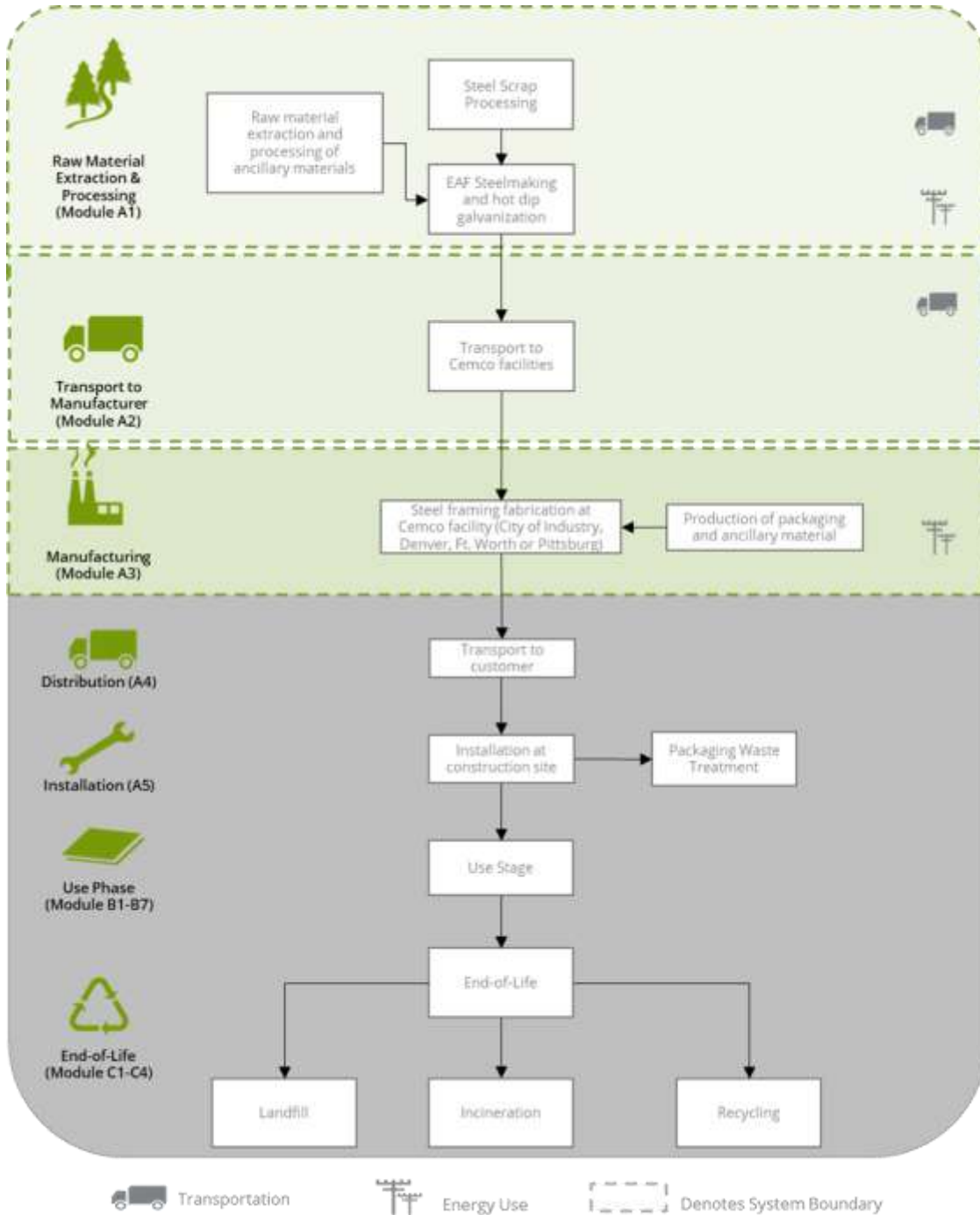


Figure 1. Flow diagram representing the major processes in the production of the steel framing products and accessories.

2.3 DECLARATION OF METHODOLOGICAL FRAMEWORK

The scope of the EPD is cradle-to-gate, the extraction of raw materials and processing, including all activities and transport necessary for the manufacture of steel framing product at the steel mill. The life cycle phases included in the product system boundary are shown in Table 2 below.

Table 2. Life cycle phases included in the CEMCO framing product system boundary.

Product			Construction Process		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B1	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

X = Module Included | MND = Module Not Declared

Cut-off and allocation procedures are described below and conform to the PCR and ISO standards.

2.4 TECHNICAL DATA

All products conform to the material specifications under ASTM A653/A1003 and coating specifications under ASTM A653/A924 for Sure-Board® or A653/A924/A1003 for all other types.

2.5 INTENDED APPLICATION

The LEC steel framing products serve the primary function of providing structural or nonstructural framing in construction applications, including for walls, floors, ceilings, and roofs.

2.6 MATERIAL COMPOSITION

The LEC steel framing products modeled in this study are manufactured from 100% hot dipped galvanized (HDG) steel from electric arc furnace (EAF) steel mills. All products conform to the material specifications under ASTM A653/A1003 and coating specifications under ASTM A653/A924 for Sure-Board® or A653/A924/A1003 for all other types.

Steel products under normal conditions do not present inhalation, ingestion, or contact health hazards. These products are used inside the building envelope, or other structures, and do not include materials or substances which have potential route of exposure to humans or flora/fauna in the environment.

2.7 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

The products come in various sizes and thicknesses, as described in Table 3.

Table 3. *Product sizes and thicknesses, as delivered.*

Product	Sizes	Thicknesses (mils)
Structural Stud and Track	1-5/8" – 12" Stud & Track	33 through 118
ViperStud® Interior Framing	1-5/8" – 6" Stud & Track	15, 18, 30, 33
Viper X® Interior Framing	1-5/8" – 6" Stud & Track	18, 22
ProX Header®	3-5/8" – 8" Headers & Inserts	33, 43, 54, 68
Sure-Board ® for Shear	48" x 96", 108", 120", or 144"	27, 33, 43, 54, 68
Sure-Span ® Floor Joists	7-1/4" – 14" Joists and Rim-Track	43, 54, 68, 97
CST Brand Slotted Tracks	2-1/2" – 8" Slotted Tracks	30, 33, 43, 54, 68
CH Brand Shaft Studs	2-1/2" – 6" CH & H-Studs, J-Runner & C-Runner	33, 34
CT Brand CT Studs and J-Runner	2-1/2"-6"	33, 34, 43
Expanded Metal Lath	27-1/2" x 48" or 96"	16, 23
Plastering Accessories	Various	18 through 33

2.8 MANUFACTURING

The final products are manufactured at four CEMCO facilities in City of Industry, CA; Denver, CO; Ft Worth, TX; and Pittsburg, CA. The manufacture of framing products includes coil slitting, and roll forming of framing products. During the period of review, the CEMCO facilities received hot dipped galvanized steel from EAF steel mills in the US. CEMCO produced CFS products sourced from BOF steel are out of scope of the present EPD.

2.9 PACKAGING

Packaging for the steel framing product includes lumber, plastic banding and metal banding.

2.10 FURTHER INFORMATION

Further information on the product can be found on the manufacturers' website at www.cemcosteel.com

3. LCA: Calculation Rules

3.1 DECLARED UNIT

The declared unit used in the study is defined as one (1) metric ton of LEC light gauge steel framing product, consistent with the PCR.

Table 4. *The modules and unit processes included in the scope for the CEMCO steel framing and accessories.*

Module	Module Description	Unit Processes Included in Scope
A1	Extraction and processing of raw materials; any reuse of products or materials from previous product systems; processing of secondary materials; generation of electricity from primary energy resources; energy, or other, recovery processes from secondary fuels	Raw material extraction and processing, including but not limited to the recovery or extraction and processing of feedstock materials and including all activities necessary for the reprocessing steel scrap; EAF steelmaking, steel rolling, and hot dip galvanization processes
A2	Transport (to the manufacturer)	Transportation from primary production to the CEMCO facility in City of Industry, Denver, Pittsburg and Ft. Worth.
A3	Manufacturing, including ancillary material production	Manufacture of the final framing products at the CEMCO facilities.
A4	Transport (to the building site)	Module Not Declared
A5	Construction-installation process	Module Not Declared
B1	Product use	Module Not Declared
B2	Product maintenance	Module Not Declared
B3	Product repair	Module Not Declared
B4	Product replacement	Module Not Declared
B5	Product refurbishment	Module Not Declared
B6	Operational energy use by technical building systems	Module Not Declared
B7	Operational water uses by technical building systems	Module Not Declared
C1	Deconstruction, demolition	Module Not Declared
C2	Transport (to waste processing)	Module Not Declared
C3	Waste processing for reuse, recovery and/or recycling	Module Not Declared
C4	Disposal	Module Not Declared
D	Reuse-recovery-recycling potential	Module Not Declared

3.2 UNITS

All data and results are presented using SI units.

3.3 ESTIMATES AND ASSUMPTIONS

- Steel suppliers were modeled based on a subset of steel sourced by each CEMCO facility, representing the amount of EAF-produced steel purchased in the past 2.5 years to account for fluctuations between suppliers. Only steel purchased by CEMCO from its EAF steelmaking suppliers is considered as Low Embodied Carbon (LEC) and would be represented by this EPD.
- Supplier EPDs were used to model the impacts within A1.
- Some supplier EPDs distinguish results between different HDG products. CEMCO's purchasing department provided the breakdown of purchases over this period for each of these products, and this breakdown was used to model results based on HDG product type.
- Representative inventory data for raw materials and ancillary materials were modeled with unit process data taken from Ecoinvent. Representative inventory data were used to reflect the energy mix for electricity use at each of the manufacturing facilities, CAMX for City of Industry and Pittsburg, RMPA for Denver, and ERCT for Ft. Worth.
- Disposal of manufacturing waste is modeled based for solid and hazardous waste generation and disposal in the United States, as specified in the PCR. Specifically, where the disposal was done by a third party, 80% of non-hazardous wastes are disposed in landfill and 20% incinerated. Transportation for end-of-life scenarios was modeled using the EPA WARM model assumption of 20 miles (~32 km), from the point of product use to a landfill, material recovery center, or waste incinerator. Ecoinvent datasets are used to model the impacts associated with incineration and landfilling, which does not include energy recovery from landfill gas.

3.4 CUT-OFF RULES

The cut-off criteria for including or excluding materials, energy, and emissions data from the study are in accordance with the PCR and are listed below.

- All inputs and outputs to a unit process are included in the LCA calculation for which data are available. Any data gaps are filled with representative data. Assumptions used for filling data gaps are documented in the LCA report.
- Where there is a data gap or insufficient data, criteria for exclusion of inputs and outputs is 1% of primary energy usage (renewable and non-renewable energy) and 1% on a mass basis for the specific unit process. The maximum criteria for exclusion of inputs and outputs is 5% of primary energy usage and mass across all modules included in the LCA.
- If a flow meets the above criteria for exclusion but is considered to have a significant potential environmental impact, it is included.

3.5 DATA SOURCES

Unit processes were developed within openLCA 2.2 software. For manufacture within the CEMCO facilities, confidential primary data were provided by CEMCO. For upstream steelmaking and HDG production, impact results were taken from supplier EPDs. The principal source of secondary LCI data is Ecoinvent v3.10 database. Detailed descriptions of unit processes can be found in the accompanying documentation. The LCI datasets used in the LCA model to represent unit processes in the cradle-to-gate LCA are provided in Table 5 below.

Table 5. Data sources for the CEMCO steel framing products.

Flow	Dataset	Data Source	Publication Date
Raw Materials/ Steel Suppliers			
Hot dip galvanized steel	Galvanized steel sheet	Facility specific EPDs	2023 and 2024
Ancillary			
Lubricating oil	market for lubricating oil lubricating oil Cutoff, U - RER	Ecoinvent 3.10	2023
Packaging			
Lumber	market for sawnwood, board, softwood, raw, dried (u=20%) sawnwood, board, softwood, raw, dried (u=20%) Cutoff, U - Europe without Switzerland	Ecoinvent 3.10	2023
Plastic banding	market for polyethylene, high density, granulate polyethylene, high density, granulate Cutoff, U - GLO	Ecoinvent 3.10	2023
Metal banding	market for steel, low-alloyed, hot rolled steel, low-alloyed, hot rolled Cutoff, U - GLO	Ecoinvent 3.10	2023
Electricity Use			
Electricity	electricity voltage transformation from high to medium voltage electricity, medium voltage Cutoff, U - US-WECC * modified for CAMX and RMPA	Ecoinvent 3.10	2023
	electricity voltage transformation from high to medium voltage electricity, medium voltage Cutoff, U - US-TRE *modified for ERCT	Egrid2021	2023
Propane	market for propane propane Cutoff, U - GLO	Ecoinvent 3.10	2023
Transportation			
Rail	transport, freight train, diesel transport, freight train Cutoff, U - US	Ecoinvent 3.10	2023
Road	transport, freight, lorry 16-32 metric ton, EURO4 transport, freight, lorry 16-32 metric ton, EURO4 Cutoff, U - RoW	Ecoinvent 3.10	2023

3.6 DATA QUALITY

The data quality assessment addressed the following parameters: time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty.

Table 6. Data quality assessment for the CEMCO steel framing product system.

Data Quality Parameter	Data Quality Discussion
<p>Time-Related Coverage: Age of data and the minimum length of time over which data is collected</p>	<p>The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 10 years old. All of the data used represented an average of at least one year's worth of data collection. Manufacturer-supplied data (primary data) are based on annual production for 2021 at each of the four CEMCO, LLC facilities. Materials data is based on actual supplier EPDs, based on primary data from January 01, 2022 through August 30, 2024. Supplier EPDs were published in 2023 and 2024.</p>
<p>Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study</p>	<p>The data used in the analysis provide the best possible representation available with current data. Actual processes for upstream operations are primarily North American. Surrogate data used in the assessment are representative of North American operations. Data representative of European operations are considered sufficiently similar to actual processes.</p>
<p>Technology Coverage: Specific technology or technology mix</p>	<p>For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations.</p>
<p>Precision: Measure of the variability of the data values for each data expressed</p>	<p>Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.</p>
<p>Completeness: Percentage of flow that is measured or estimated</p>	<p>The LCA model included all known mass and energy flows for production of steel framing product. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.</p>
<p>Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest</p>	<p>Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction. For supplier information, the most representative source of data possible was chosen or modeled.</p>
<p>Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis</p>	<p>The consistency of the assessment is considered to be moderate to high. Data sources of similar quality and age are used with a bias towards Ecoinvent v3.10 data. Different portions of the product life cycle are equally considered.</p>
<p>Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study</p>	<p>Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.</p>
<p>Sources of the Data: Description of all primary and secondary data sources</p>	<p>Data representing energy use at the CEMCO facilities represent an annual average and are considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. The Ecoinvent database is used for secondary LCI datasets. Steel supplier data was accounted for using supplier, mill-specific EPDs for hot dipped galvanized sheet.</p>
<p>Uncertainty of the Information: Uncertainty related to data, models, and assumptions</p>	<p>Uncertainty related to materials in the steel framing product is low. Actual supplier data for upstream operations was not available for all suppliers and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.</p>

3.7 PERIOD UNDER REVIEW

The period of review for the steel framing produced at each of the four CEMCO facilities is from January 1, 2021 through December 31, 2021. Primary data for January 01, 2022 through August 30, 2024 were collected for product materials data in order to reflect the current supply chain for the CEMCO products.

3.8 ALLOCATION

This study follows the allocation guidelines of ISO 14044 and allocation rules specified in the PCR and minimized the use of allocation wherever possible.

Mass allocation was deemed the most accurate and reproducible way of calculating the energy and material requirements for the manufacture of steel framing product and its useful byproducts. Primary data for resource use (e.g., electricity, natural gas, water), waste/byproducts, and emissions released, are allocated on a mass-basis as a fraction of total annual production.

Per ISO 21930, 2.8.4.1.2, useable output flows such as steel scrap are not considered as co-products but are considered waste, and no allocation to secondary material, secondary fuels, or recovered energy is applied.

The transportation from primary producer of material components to the CEMCO facilities are based on primary data provided by CEMCO, including modes, distances, and amount of steel transported. Transportation was allocated based on the mass and distance the material was transported.

3.9 COMPARABILITY

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When comparing EPDs created using this PCR, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to different results for upstream or downstream of the life cycle stages declared.

4. LCA: Scenarios and Additional Technical Information

Manufacturing

The HDG steel received at each CEMCO facility is sourced from mills in the US. Hot dip galvanization requires several steel processing steps including rolling, pickling, cold rolling and adding a layer of zinc coating during hot dip galvanization.

The manufacture of framing products includes coil slitting and roll forming of framing product shapes. Primary data for calendar year 2021 were collected from CEMCO for each of its four manufacturing facilities. Electricity and resource use at each facility are allocated to the steel framing products based on product mass. Electricity was modeled using the ecoinvent datasets for the eGRID region and modified for the US EPA eGRID subregions in which each facility is located.

Transportation of waste materials at manufacturing assumes a 20 mile (~32 km) average distance to disposal, consistent with assumptions used in the US EPA WARM model. Assumed disposal rates for nonhazardous wastes are based on US EPA SMM rates of 20% incineration and 80% landfilled. Hazardous wastes are disposed by incineration.

5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

The following environmental impact category indicators are reported using characterization factors based on the U.S. EPA's Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts – TRACI 2.1 and CML-IA.

TRACI 2.1 Impact Category	Unit
Global Warming Potential (GWP)*	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
Fossil Fuel Depletion Potential (FFD)	MJ Surplus, LHV
CMLI-A Impact Category	Unit
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ, LHV

* GWP is based on IPCC AR5

These six impact categories 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.

The following inventory parameters, specified by the PCR, are also reported.

Resources	Unit	Waste and Outflows	Unit
RPR _E : Renewable primary resources used as energy carrier (fuel)	MJ, LHV	HWD: Hazardous waste disposed	kg
RPR _M : Renewable primary resources with energy content used as material	MJ, LHV	NHWD: Non-hazardous waste disposed	kg
NRPR _E : Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	HLRW: High-level radioactive waste, conditioned, to final repository	kg
NRPR _M : Non-renewable primary resources with energy content used as material	MJ, LHV	ILLRW: Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
SM: Secondary materials	kg	CRU: Components for re-use	kg
RSF: Renewable secondary fuels	MJ, LHV	MR: Materials for recycling	kg
NRSF: Non-renewable secondary fuels	MJ, LHV	MER: Materials for energy recovery	kg
RE: Recovered energy	MJ, LHV	EE: Recovered energy exported from the product system	MJ, LHV
FW: Use of net freshwater resources	m ³	-	-

Table 7. LCIA results for the declared unit of LEC steel framing products produced at the City of Industry facility. All values are rounded to three significant digits. Values below indicator results show the percent contribution of each life cycle module to the result for each impact category.

Impact Category (Units)	A1	A2	A3	Total (A1-A3)
	Upstream Material (HDG) Production	Transport to Manufacturer	Framing Products Manufacture	
IPCC AR5				
Global Warming Potential (kg CO2 eq)	1,530	220	20.9	1,770
	86%	12%	1.2%	100%
TRACI 2.1				
Global Warming Potential (kg CO2 eq)	1,530	217	20.5	1,760
	87%	12%	1.2%	100%
Acidification Potential (kg SO2 eq)	5.52	1.91	5.53x10 ⁻²	7.49
	74%	25%	0.74%	100%
Eutrophication Potential (kg N eq)	0.226	0.355	6.88x10 ⁻²	0.650
	35%	55%	11%	100%
Ozone Depletion Potential (kg CFC-11 eq)	1.08x10 ⁻⁵	2.80x10 ⁻⁶	3.59x10 ⁻⁷	1.40x10 ⁻⁵
	77%	20%	2.6%	100%
Smog Formation Potential (kg O3 eq)	100	57.9	0.976	159
	63%	36%	0.61%	100%
Fossil Fuel Depletion (MJ Surplus)	1,460	356	41.1	1,860
	79%	19%	2.2%	100%
CML-IA				
Abiotic Depletion of Resources, Fossil (MJ, LHV)	11,700	2,660	314	14,700
	80%	18%	2.1%	100%

Table 8. LCIA results for the declared unit of LEC steel framing products produced at the Denver facility. All values are rounded to three significant digits. Values below indicator results show the percent contribution of each life cycle module to the result for each impact category.

Impact Category (Units)	A1	A2	A3	Total (A1-A3)
	Upstream Material (HDG) Production	Transport to Manufacturer	Framing Products Manufacture	
IPCC AR5				
Global Warming Potential (kg CO2 eq)	1,430	135	32.2	1,600
	89%	8.5%	2%	100%
TRACI 2.1				
Global Warming Potential (kg CO2 eq)	1,430	133	31.6	1,590
	90%	8.4%	2%	100%
Acidification Potential (kg SO2 eq)	5.43	1.17	8.24x10 ⁻²	6.69
	81%	18%	1.2%	100%
Eutrophication Potential (kg N eq)	1.43	0.218	0.107	1.76
	81%	12%	6.1%	100%
Ozone Depletion Potential (kg CFC-11 eq)	4.04x10 ⁻⁵	1.72x10 ⁻⁶	6.32x10 ⁻⁷	4.27x10 ⁻⁵
	94%	4%	1.5%	100%
Smog Formation Potential (kg O3 eq)	88.8	35.6	1.48	126
	71%	28%	1.2%	100%
Fossil Fuel Depletion (MJ Surplus)	1,290	219	64.5	1,570
	82%	14%	4.1%	100%
CML-IA				
Abiotic Depletion of Resources, Fossil (MJ, LHV)	11,700	1,640	489	13,800
	85%	12%	3.5%	100%

Table 9. LCIA results for the declared unit of LEC steel framing product produced at the Ft. Worth facility. All values are rounded to three significant digits. Values below indicator results show the percent contribution of each life cycle module to the result for each impact category.

Impact Category (Units)	A1	A2	A3	Total (A1-A3)
	Upstream Material (HDG) Production	Transport to Manufacturer	Framing Products Manufacture	
IPCC AR5				
Global Warming Potential (kg CO2 eq)	1,520	83.8	33.2	1,630
	93%	5.1%	2%	100%
TRACI 2.1				
Global Warming Potential (kg CO2 eq)	1,520	82.5	32.6	1,630
	93%	5.1%	2%	100%
Acidification Potential (kg SO2 eq)	6.14	0.726	8.29x10 ⁻²	6.95
	88%	10%	1.2%	100%
Eutrophication Potential (kg N eq)	3.40	0.135	0.178	3.72
	92%	3.6%	4.8%	100%
Ozone Depletion Potential (kg CFC-11 eq)	2.91x10 ⁻⁵	1.07x10 ⁻⁶	4.46x10 ⁻⁷	3.06x10 ⁻⁵
	95%	3.5%	1.5%	100%
Smog Formation Potential (kg O3 eq)	92.6	22.0	1.08	116
	80%	19%	0.94%	100%
Fossil Fuel Depletion (MJ Surplus)	1,410	135	53.2	1,600
	88%	8.5%	3.3%	100%
CML-IA				
Abiotic Depletion of Resources, Fossil (MJ, LHV)	11,700	1,010	461	13,200
	89%	7.7%	3.5%	100%

Table 10. LCIA results for the declared unit of LEC steel framing product produced at the Pittsburg facility. All values are rounded to three significant digits. Values below indicator results show the percent contribution of each life cycle module to the result for each impact category.

Impact Category (Units)	A1	A2	A3	Total (A1-A3)
	Upstream Material (HDG) Production	Transport to Manufacturer	Framing Products Manufacture	
IPCC AR5				
Global Warming Potential (kg CO2 eq)	1,460	242	22.8	1,730
	85%	14%	1.3%	100%
TRACI 2.1				
Global Warming Potential (kg CO2 eq)	1,460	239	22.3	1,720
	85%	14%	1.3%	100%
Acidification Potential (kg SO2 eq)	5.46	2.10	5.52x10 ⁻²	7.62
	72%	28%	0.72%	100%
Eutrophication Potential (kg N eq)	1.00	0.390	7.67x10 ⁻²	1.47
	68%	27%	5.2%	100%
Ozone Depletion Potential (kg CFC-11 eq)	2.98x10 ⁻⁵	3.08x10 ⁻⁶	3.54x10 ⁻⁷	3.33x10 ⁻⁵
	90%	9.3%	1.1%	100%
Smog Formation Potential (kg O3 eq)	93.0	63.6	0.949	157
	59%	40%	0.6%	100%
Fossil Fuel Depletion (MJ Surplus)	1,350	391	45.5	1,790
	76%	22%	2.5%	100%
CML-IA				
Abiotic Depletion of Resources, Fossil (MJ, LHV)	11,700	2,920	344	15,000
	78%	20%	2.3%	100%

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.

Table 11. Resource use and waste flows per metric ton of LEC steel framing product manufactured by CEMCO, LLC in City of Industry, and percent contribution by life cycle stage. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.

Parameter	A1	A2	A3	Total
Resources				
RPRE (MJ)	629	73.9	146	849
	74%	9%	17%	100%
RPRM (MJ)	0.0	0.0	186	186
	0%	0%	100%	100%
NRPRE (MJ)	16,800	2,730	284	19,800
	85%	14%	1%	100%
NRPRM (MJ)	702	0.0	57.0	759
	92%	0%	8%	100%
SM (kg)	708	0.0	0.0	708
	100%	0%	0%	100%
RSF (MJ)	0.0	0.0	0.0	0.0
NRSF (MJ)	0.0	0.0	0.0	0.0
RE (MJ)	0.0	0.0	0.0	0.0
FW (m3)	13.9	0.515	0.119	14.6
	96%	3.5%	0.82%	100%
Wastes				
HWD (kg)	6.67	0.00	7.72x10 ⁻³	6.67
	100%	0%	0%	100%
NHWD (kg)	3.74	0.0	1.79x10 ⁻²	3.75
	100%	0%	0%	100%
HLRW (kg)	8.72x10 ⁻⁵	0.0	0.0	8.72x10 ⁻⁵
	100%	0%	0%	100%
ILLRW (kg)	7.83x10 ⁻⁴	0.0	0.0	7.83x10 ⁻⁴
	100%	0%	0%	100%
CRU (kg)	0.0	0.0	0.0	0.0
MR (kg)	0	0.0	6.02	6.02
	0%	0%	100%	100%
MER (kg)	0.0	0.0	0.0	0.0
EE (MJ)	0.0	0.0	0.0	0.0

Table 12. Resource use and waste flows per metric ton of LEC steel framing product manufactured by CEMCO, LLC in Denver, and percent contribution by life cycle stage. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.

Parameter	A1	A2	A3	Total
Resources				
RPRE (MJ)	794	45.4	127	966
	82%	5%	13%	100%
RPRM (MJ)	0.00	0.0	186	186
	0%	0%	100%	100%
NRPRE (MJ)	17,700	1,680	445	19,800
	89%	8%	2%	100%
NRPRM (MJ)	386	0.0	57.0	443
	87%	0%	13%	100%
SM (kg)	699	0.0	0.0	699
	100%	0%	0%	100%
RSF (MJ)	0.0	0.0	0.0	0.0
NRSF (MJ)	0.0	0.0	0.0	0.0
RE (MJ)	0.0	0.0	0.0	0.0
FW (m ³)	18.8	0.317	0.136	19.2
	98%	1.6%	0.71%	100%
Wastes				
HWD (kg)	5.27	0.00	3.04x10 ⁻²	5.30
	99%	0%	1%	100%
NHWD (kg)	2.75	0.0	4.50x10 ⁻²	2.80
	98%	0%	2%	100%
HLRW (kg)	4.79x10 ⁻⁵	0.00	0.00	4.79x10 ⁻⁵
	100%	0%	0%	100%
ILLRW (kg)	4.31x10 ⁻⁴	0.0	0.00	4.31x10 ⁻⁴
	100%	0%	0%	100%
CRU (kg)	0.0	0.0	0.0	0.0
MR (kg)	59.6	0.0	6.06	65.6
	91%	0%	9%	100%
MER (kg)	0.0	0.0	0.0	0.0
EE (MJ)	0.0	0.0	0.0	0.0

Table 13. Resource use and waste flows per metric ton of LEC steel framing product manufactured by CEMCO, LLC in Ft. Worth, and percent contribution by life cycle stage. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.

Parameter	A1	A2	A3	Total
Resources				
RPRE (MJ)	763	28.1	159	950
	80%	3%	17%	100%
RPRM (MJ)	0.0	0.0	186.4	186.4
	0%	0%	100%	100%
NRPRE (MJ)	18,500	1,040	473	20,000
	92%	5%	2%	100%
NRPRM (MJ)	400	0.0	57.0	457
	88%	0%	12%	100%
SM (kg)	844	0.0	0.0	844
	100%	0%	0%	100%
RSF (MJ)	0.0	0.0	0.0	0.0
NRSF (MJ)	0.0	0.0	0.0	0.0
RE (MJ)	0.0	0.0	0.0	0.0
FW (m3)	18.3	0.196	0.150	18.7
	98%	1%	0.8%	100%
Wastes				
HWD (kg)	6.33	0.00	5.73x10 ⁻²	6.39
	99%	0%	1%	100%
NHWD (kg)	2.90	0.00	6.95x10 ⁻²	2.96
	98%	0%	2%	100%
HLRW (kg)	4.97x10 ⁻⁵	0.00	0.00	4.97x10 ⁻⁵
	100%	0%	0%	100%
ILLRW (kg)	4.46x10 ⁻⁴	0.00	0.00	4.46x10 ⁻⁴
	100%	0%	0%	100%
CRU (kg)	0.0	0.0	0.0	0.0
MR (kg)	64.9	0.0	6.07	71.0
	91%	0%	9%	100%
MER (kg)	0.0	0.0	0.0	0.0
EE (MJ)	0.0	0.0	0.0	0.0

Table 14. Resource use and waste flows per metric ton of LEC steel framing product manufactured by CEMCO, LLC in Pittsburg, and percent contribution by life cycle stage. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.

Parameter	A1	A2	A3	Total
Resources				
RPRE (MJ)	735	81.2	371	1,190
	62%	7%	31%	100%
RPRM (MJ)	0.0000	0.0	186	186
	0%	0%	100%	100%
NRPRE (MJ)	17,300	3,000	337	20,600
	84%	15%	2%	100%
NRPRM (MJ)	498	0.0	57.0	555
	90%	0%	10%	100%
SM (kg)	702	0.0	0.0	702
	100%	0%	0%	100%
RSF (MJ)	0.0	0.0	0.0	0.0
NRSF (MJ)	0.0	0.0	0.0	0.0
RE (MJ)	0.0	0.0	0.0	0.0
FW (m ³)	17.1	0.566	0.146	17.8
	96%	3%	1%	100%
Wastes				
HWD (kg)	5.77	0.0	6.23x10 ⁻²	5.83
	99%	0%	1%	100%
NHWD (kg)	3.10	0.0	0.0323	3.13
	99%	0%	1%	100%
HLRW (kg)	6.19x10 ⁻⁵	0.0	0.00	6.19x10 ⁻⁵
	100%	0%	0%	100%
ILLRW (kg)	5.56x10 ⁻⁴	0.0	0.00	5.56x10 ⁻⁴
	100%	0%	0%	100%
CRU (kg)	0.0	0.0	0.0	0.0
MR (kg)	38.4	0.0	6.07	44.5
	86%	0%	14%	100%
MER (kg)	0.0	0.0	0.0	0.0
EE (MJ)	0.0	0.0	0.0	0.0

The PCR requires the calculation of carbon emissions and removals. Biogenic carbon removals are included in the packaging, while emissions are not included in the A1-A3 modules as no biogenic materials are used in the product and packaging end of life is outside the scope.

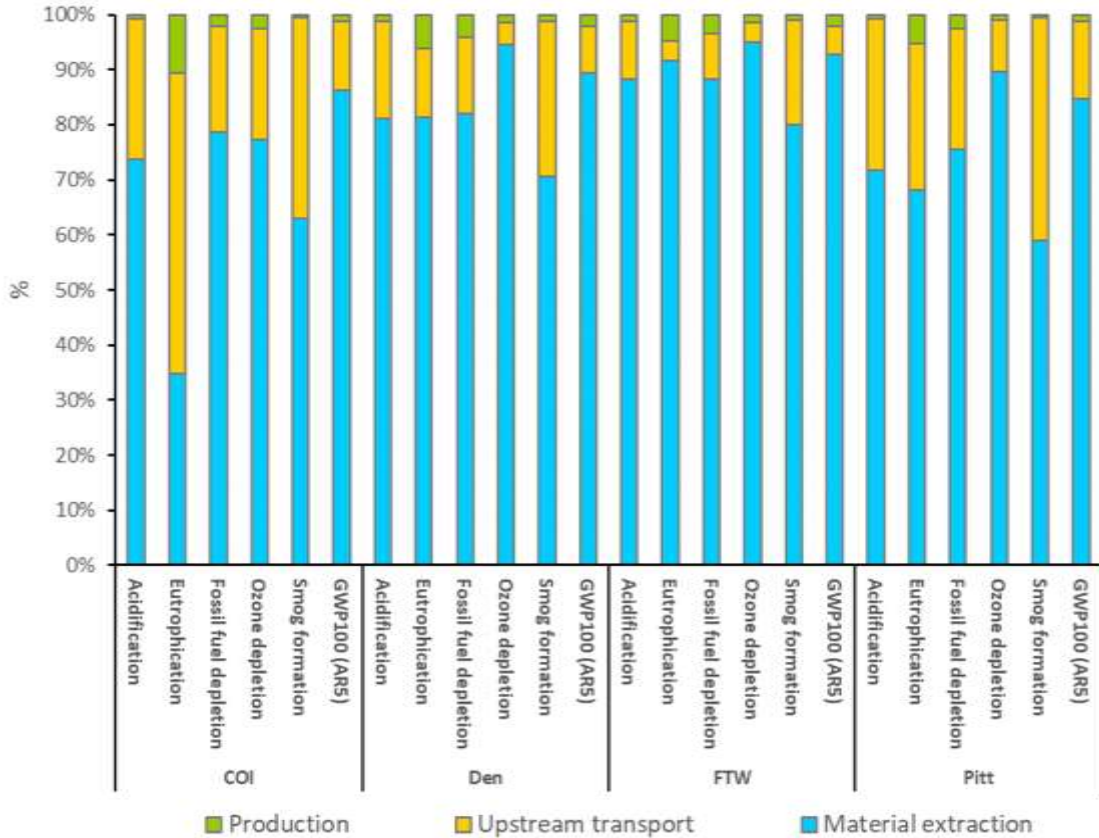
- Biogenic carbon emissions and removals in product: 0.
- Biogenic carbon removal in packaging materials: 22.9 kg per declared unit (metric ton of LEC steel framing product) for each facility.

6. LCA: Interpretation

Life cycle modeling of the CEMCO, LLC steel framing product was divided into distinct life cycle phases, including raw material extraction and processing, product manufacturing, and delivery. A detailed examination of the potential environmental impacts provides some insight into the relative contributions from each of the product's life cycle phases.

The following life cycle phases were included in the contribution analysis:

- *Raw Materials and Processing (Sourcing/Extraction) stage (A1)* – This stage includes extraction of virgin materials and reclamation of non-virgin feedstock. This includes the extraction of all raw materials, transportation to the steel mill, electric arc furnace steelmaking, and hot dip galvanization.
- *Transport stage (A2)* –The impacts associated with the transport of the hot dip galvanized steel to the CEMCO facilities in City of Industry, Denver, Ft. Worth and Pittsburg are included in this stage.
- *Manufacturing stage (A3)* – This stage includes all the relevant manufacturing processes and flows, including the impacts from energy use and emissions at the CEMCO facilities in City of Industry, Denver, Ft. Worth and Pittsburg. Production of capital goods, infrastructure, manufacturing equipment, and personnel-related activities are not included. Additionally, this stage includes the upstream production and transport of packaging and ancillary materials.



COI - City of Industry; Den - Denver; FTW - Fort Worth; Pitt - Pittsburg, CA

Figure 2. Contribution analysis for the production of the CEMCO, LLC LEC steel framing products and accessories.

The main contributions to indicator results for the steel framing product are the Raw Material Extraction and Processing (A1) stage, contributing 60-95% of the impact for most indicators.

7. References

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