LIFE CYCLE ASSESSMENT

SFIA

Steel Framing Industry Association

Products Included: Industry-Average Cold-Formed Steel Framing

Study Completed: June 2026

Critical Review Completed: August 2026

DOCUMENT SUMMARY

The following table identifies the relevant details of the life cycle assessment (LCA).

MANUFACTURER	Steel Framing Industry Association 513 W. Broad Street Suite 210 Falls Church, VA 22046
PRODUCT	Industry-Average Cold-Formed Steel Framing
DECLARED UNIT	1 metric ton
REFERENCE STANDARDS	☒ ISO 14040 ☒ ISO 14044 ☒ ISO 21930
REFERENCE PCR	Smart EPD Part A Product Category Rules for Building and Construction Product Services, Standard 1000, v1.2 (Smart EPD, 2025) Smart EPD Part B Product Category Rules for Designated Steel Construction Products, Standard 1000-008, v3.0 (Smart EPD, 2025)
LCA SCOPE	Cradle-to-Gate
LCA STUDY DETAILS	Completed: June 2026 LCA Practitioners: Vicki Rybl, WAP Sustainability, LLC Lydia Schreiber, WAP Sustainability, LLC
LCA REVIEW DETAILS	Completed: August 2026 LCA Reviewer: Kun Chen, UL Solutions ☐ INTERNAL ☒ EXTERNAL
PROGRAM OPERATOR	UL Environment https://www.ul.com 333 Pfingsten Rd https://www.spot.ul.com Northbrook, IL 60611
ACLCA PCR GUIDANCE CONFORMANCE LEVEL	Transparency per ACLCA PCR Guidance version 1.0
YEAR OF PRIMARY DATA	2024-2025
LCA SOFTWARE	Microsoft Excel
LCA DATABASE	ecoinvent v3.12
LCIA METHODOLOGY	IPCC AR6, TRACI 2.2
APPLICABLE REGION	North America

Important Note: Results presented in this report are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins, or risks.

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1 EXECUTIVE SUMMARY

Current trends in corporate sustainability emphasize transparency and the evaluation of environmental and social impacts throughout a product's entire value chain. Thus, life cycle assessment (LCA) is considered to be an important delivery tool of transparent market communication and product optimization opportunities. By calculating the industry-average potential environmental impacts of cold-formed steel (CFS) framing products, the Steel Framing Industry Association (SFIA) hopes to better understand areas of high environmental impacts, within and outside direct production processes in their industry, and participate in voluntary reporting of product environmental performance.

According to the international standards that dictate the LCA process, ISO 14040 and ISO 14044, the goal and scope of a study must be clearly defined (ISO, 2006; ISO, 2006). In the case of this assessment, the LCA was conducted for two reasons. First, the LCA is conducted to assess the potential environmental impacts, use of resources, and generation of waste in CFS products from cradle-to-gate, including extraction and processing of raw materials used in the production of steel products. Second, the LCA will be used to develop publicly available environmental product declarations (EPDs) for the industry-average cold-formed steel framing product. This requires a critical review by an independent third party. The critical review ensures that the LCA has met all relevant standards and that the results are plausible. The critical review does not ensure that the results can be compared to the results of other LCA studies.

CFS products includes cold-formed studs, track, joists, rafters, strap, and trusses made from coated steel that meets the requirements of AISI standards S220 and S240 and complies with the SFIA Code Compliance Certification Program.

Key inputs evaluated in the study include sourcing of raw materials, transport of raw materials to the manufacturing site, energy consumption, and generation of steel scrap. Additionally, necessary packaging materials have also been included in the study.

The industry-average LCIA results indicate that raw material input of hot-dip galvanized steel coil (A1) is the main driver of impacts for GWP-total and most other impact categories for industry-average CFS products. Transport of raw materials (A2) also contributes significantly to AP, EP-fresh, EP-marine, and POFP due to fuel combustion. Production (A3) is insignificant to most impact categories except EP-fresh, driven by electricity and plastic packaging. This is highlighted in Figure 1.

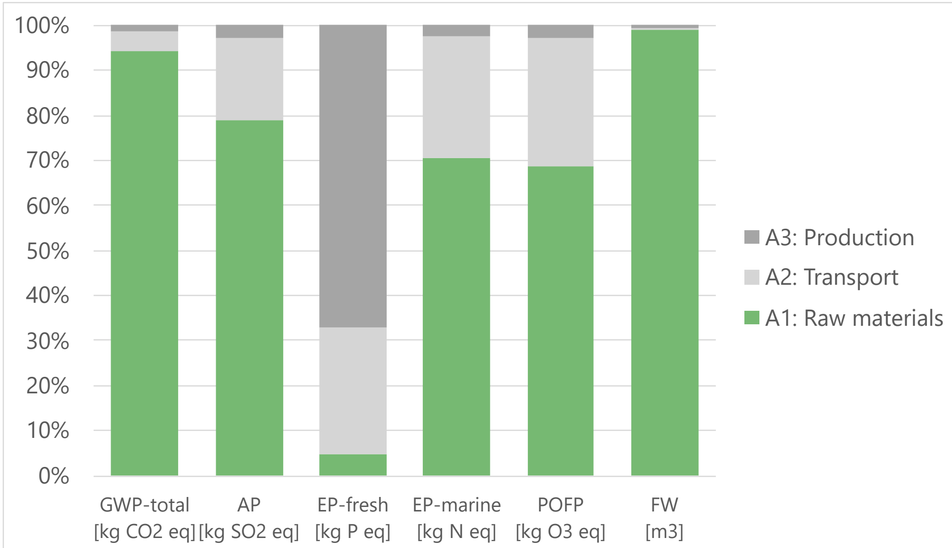

Figure 1. Contribution by life cycle stage to LCIA Results for Industry-Average CFS Products

Results in sensitivity studies indicate that alternative averaging methods and increased international sourcing of hot-dip galvanized steel coil may have significant effects on cradle-to-gate LCIA results across several impact categories; however, the industry-average results presented herein are considered to be representative of actual industry operations while meeting PCR requirements and satisfying the goals of the industry-average LCA.

2 GENERAL INFORMATION

This LCA project report represents the systematic and comprehensive summary of project documentation and showcases any data and information of importance to the results and as required by the product category rules (PCRs) listed below.

2.1 COMPANY PROFILE

The Steel Framing Industry Association (SFIA) consists of manufacturers, designers, suppliers, and construction professionals committed to improving market conditions for and the quality of cold-formed steel in construction, and its members represent 80% of the cold-formed steel (CFS) framing products produced in the US. SFIA and its member companies pursue its goals through programs and initiatives that promote the use of cold-formed steel framing as a sustainable and cost-effective solution, advocate the development and acceptance of appropriate code provisions, educate members with reliable data and other critical information that is essential to effective business planning, and create a positive environment for innovation.

2.2 LCA COMMISSIONERS AND PRACTITIONERS

SFIA commissioned this LCA study. Primary data were provided by participating companies for their facilities in which CFS products are produced. WAP Sustainability was contracted to develop the LCA model and complete this background report. Vicki Rybl of WAP Sustainability served as the project manager. Lydia Schreiber of WAP Sustainability was the lead LCA practitioner. Primary data were collected, and quality assured through efforts of both WAP Sustainability and participating companies.

2.3 REPORTING DATE

This LCA study was commenced in November 2025 and a draft was submitted for critical review in June 2026.

2.4 INTENDED APPLICATION AND REASONS FOR THE STUDY

This LCA was conducted for the development and release of Environmental Product Declarations (EPDs) based on the following product category rules:

- Smart EPD PCR Part A Product Category Rules for Building and Construction Products and Services, v1.2 (Smart EPD, 2025)
- Smart EPD PCR Part B Product Category Rules for Designated Steel Construction Products v3.0 (Smart EPD, 2025)

The study complies with ISO 21930 (ISO, 2017).

2.5 TARGET GROUP/AUDIENCE

The intended audience of this report includes SFIA, external LCA critical reviewers, and other LCA practitioners or technical audiences with which SFIA chooses to share the report. The EPDs created from this report may be used for business-to-business communication.

2.6 COMPARATIVE ASSERTIONS AND PUBLIC DISCLOSURE

This study was not completed with the intent that comparative assertions with external objects or public disclosures (i.e., comparative marketing claims) would be made. However, the results from the report will be used to develop EPDs, which will be disclosed to the public.

2.7 STANDARDS AND PCR COMPLIANCE

This LCA has been critically reviewed for compliance with ISO 14025, 14040, 14044, 21930, and the PCRs mentioned in section 2.4 (ISO, 2006; ISO, 2006; ISO, 2006; ISO, 2017). The critical review confirmed that this LCA meets the requirements of these standards, and the verification statement and checklist are included in Appendix B.

2.8 PRODUCT DESCRIPTION

2.8.1 Product Classification and Description

This life cycle assessment report covers Cold-Formed Steel (CFS) Framing Products from CSI division 05 40 00 Cold-Formed Metal Framing and 09 22 16 Nonstructural Metal Framing.

Figure 2: Cold Formed Steel Framing

2.8.2 Averaging

This LCA is an industry-average. Results are reported separately for A1, A2, and A3. The following information is reported and justified per Part A PCR requirements on industry-average EPDs: goal of developing an average EPD, participating manufacturers, sample size, reference year, technological representativeness, production scale, geographical representativeness, and industry representativeness.

Statistical information will be provided for weighted mean, weighted standard deviation, median value, minimum value, maximum value, and sample size per the part B PCR.

2.8.2.1 Goal of Developing an Average EPD

The goals of the study include two primary objectives:

1. To assess the potential environmental impacts, use of resources, and generation of waste for the CFS products from cradle-to-gate – extraction of raw materials and processing, including all activities necessary for the production of steel products.
2. To serve as the basis for preparing an industry-average EPD conformant with the standards in sections 2.4 and 2.7.

2.8.2.2 Participating Manufacturers

This industry-average LCA includes 12 CFS framing product manufacturers in North America, listed below.

Participation is voluntary. SFIA conducted open solicitation for participation in EPD development through industry association meetings and outreach campaigns. All listed participants are SFIA members except Klover and Marino\WARE:

Recognized participants in the Industry Wide EPD include the following cold-formed steel framing product producers.

SFIA Members:

- CEMCO
- ClarkDietrich
- Ironline
- JN Linrose
- MBA Building Supplies
- Panel Rey
- State Building Products
- Steeler
- Super Stud Building Products
- The Steel Network

SFIA Nonmembers:

- Klover
- Marino\WARE

2.8.2.3 Sample Size

The sample size includes 12 facilities in total. One manufacturing facility per participating manufacturer was selected for the LCA to maximize technological, geographical, and industry representativeness while considering time and budgetary constraints. This meets PCR requirements for industry-average LCAs and the goal of the study.

2.8.2.4 Averaging

Results are calculated as a production-weighted average based on the production volume of the facilities included in the sample. The influence of this decision is assessed in a sensitivity analysis in section 5.2.1.

2.8.3 Applicability

The intended use of products is for structural and non-structural framing of interior and exterior walls, roof, floors, and ceilings.

2.8.4 Technical Data

Technical specifications for the steel framing products include AISI S220 and AISI S240.

2.9 ADDITIONAL ENVIRONMENTAL INFORMATION

2.9.1 Additional Environmental Information Not Derived from the LCA

Purchased CO_2 offsets are not used to reduce the declared impact of a product in this LCA.

2.9.2 Regulated Hazardous Substances

No substances required to be reported as hazardous per the EPA's Resource Conservation and Recovery Act (RCRA) were identified during the LCA associated with the production or disposal of this product. Product SDSs may be obtained directly from participating company websites or upon request.

2.10 LCA METHODOLOGICAL FRAMEWORK

The LCA follows an attributional approach.

2.11 DECLARED UNIT

The declared unit according to the part B PCR is 1 metric ton of product. Table shows additional details related to the declared unit. Comparability of EPDs is limited to those applying a functional unit.

Table 1: Declared Unit Details

	CFS Framing	Unit
Mass per declared unit	1,000	kg
Density	7,769–7,849	kg/m^3

Product specifications required by the part B PCR section 9.3.2 are reported in Table 2.

Table 2: Product Specifications

Parameter	Value	
System Boundary Option	Option 2. Manufactured product	
Form Factor	Cold-formed steel framing	
Production Route Representation	Route	Is Represented
	BOF	TRUE
	EAF	TRUE
	OHF	FALSE
	Unknown	TRUE
Steel Type	Carbon/alloy	
Options	Galvanized (Mill Process)	

2.12 SYSTEM BOUNDARY

This LCA is a Cradle-to-Gate study. Data were not available from a sufficient portion of the industry for distribution (A4) and installation (A5), and therefore were not included. An overview of the system boundary is shown in Figure 3 and a summary of the life cycle stages included in this LCA is presented in Table 3.

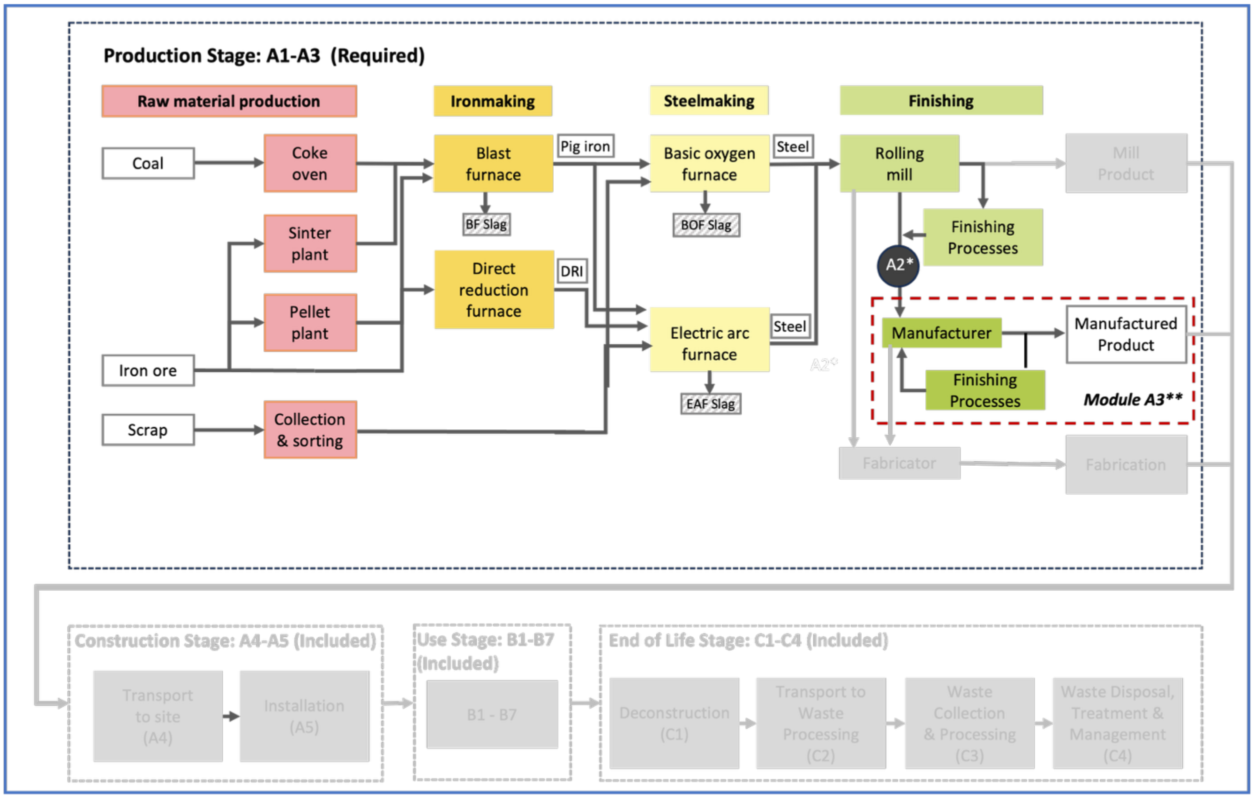

Figure 3: System Boundary Diagram

Table 3: Life Cycle Stages Included in the Study

Production			Construction		Use							End of Life				Benefits & Loads Beyond System Boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw Material Supply	Transport	Manufacturing	Transport to Site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction	Transport	Waste Processing	Disposal	Reuse, Recovery, Recycling Potential
X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

X = Module Included in LCA Report, ND = Module not Declared

Table 4 details inclusions and exclusions from the system boundary.

Table 4: Inclusions and Exclusions from the System Boundary

Included	Excluded
Extraction and processing of raw materials and packaging	Construction of manufacturing facility
Processing of recycled raw materials from previous product system	Manufacturing of operational and capital equipment
Transportation of materials and packaging to the manufacturing location	Upstream impacts of packaging of raw materials, unless specified as included in upstream dataset.
Manufacturing of products, including energy, water, and material usage and waste and water disposal	
Waste generation from manufacturing and disposal	

This study follows the modularity principle; all environmental aspects and potential impacts are declared in the life cycle stage where they occur. Additionally, the polluter pays principle applies, by which impacts from the treatment of waste generated within the system boundary are assigned to the product under study.

In primary data collected from the manufacturer, impacts from infrastructure and capital goods are excluded per the part B PCR requirements. By default, ecoinvent datasets include impacts due to infrastructure, but they are negligible compared to process impacts.

2.13 CUT-OFF CRITERIA

Cumulative excluded material inputs, energy inputs, and environmental impacts must not exceed 5% based on total weight, energy use, or environmental impact of the declared unit. A minimum of 99% of total inflows of mass and energy per unit process were included within the scope of analysis. Inflows less than 1% were included if sufficient data were available to warrant inclusion and/or the inflow was thought to have significant environmental impact. Cumulative excluded material inputs, energy inputs, and environmental impacts are less than 5% based on total weight, energy requirements, and impact of the functional/declared unit, by life cycle stage (A1-A3). No flows were intentionally omitted from the scope of the study.

The list of excluded inputs include:

- Items like labels, inks, stickers, adhesives, etc. may have been excluded from the product and packaging BOMs due to their small mass compared to the total product and packaging.
- Some material and energy inputs may have been excluded within the ecoinvent datasets used for this project. All ecoinvent datasets have been critically reviewed and conform to the exclusion requirements of the PCR.

2.14 ALLOCATION PROCEDURES

General principles of allocation were based on ISO 14040/44. For most manufacturers, there are no products other than the product under study that are produced as part of the specific manufacturing processes under study. One manufacturer reported other products produced at the manufacturing facility. In all cases, to derive a per-unit value for manufacturing inputs such as electricity, thermal energy and water, allocation based on total production by mass of the included facilities was adopted.

Secondary ecoinvent datasets use a mix of economic and physical bases for allocation, depending on the dataset. Secondary datasets for hot-dip galvanized coil from worldsteel also uses a physical basis for allocation. While the secondary dataset for hot-dip galvanized coil from AISI uses system expansion for co-product allocation, this dataset is the best data available for representing industry-average impacts for production of hot-dip galvanized coil in North America. Furthermore, these industry average datasets from AISI and worldsteel are prescribed as default background datasets in the part B PCR, Annex D.

Of relevance to the defined system boundary is the method in which recycled materials were handled. Throughout the study recycled materials were accounted for via the cut-off method. Under this method, impacts and benefits associated with the previous life of a raw material from recycled stock are excluded from the system boundary. Additionally, impacts and benefits associated with secondary functions of materials at end of life are also excluded (i.e., production into a third life or energy generation from the incineration plant). The study does include the impacts associated with reprocessing and preparation of recycled materials that are part of the bill of materials of the products under study.

2.15 DATA QUALITY REQUIREMENTS

Secondary datasets utilized in the model are disclosed in Appendix A along with data quality indicators related to the geographic, temporal, and technological coverage of the dataset. Additionally, details on proxies are provided, if applicable. As a general rule, generic or proxy data is only used for processes that individually contribute less than 10% to the disclosed GWP-100 impact in any reported information module, based on the impact calculated using the generic or proxy data.

Data quality follows the schema defined by the guidance for "Assessing Data Quality of Background Life Cycle Inventory (LCI) Datasets" published by the ACLCA (ACLCA, 2022), with uncertainty methods following the enhanced pedigree matrix required (Mukherjee & Bhat, 2022). Scores are weighted evenly across criterion categories, i.e., reliability has the same importance as geography, despite having more questions.

Table 5: Enhanced Pedigree Matrix (Mukherjee & Bhat, 2022)

Criterion		Data Quality Score				
		1	2	3	4	5
Reliability	Is the inventory data checked for mass/ energy balance, recalculation etc.?	Verified data based on measurements	Verified data based on a calculation or non-verified data based on measurements	Non-verified data based on a calculation	Documented estimate	Undocumented estimate
	What is the status quo for the ownership and continuous support of data?	Hosts and Owns	Owns but does not host	Hosts but does not own	Hosts and owns partially	Does not host or own
	Is the data regularly updated?	Regular updates	Less frequent updates	No updates	N/A	N/A
	Is the data of deterministic nature or are there statistically established confidence intervals stated for the data?	Confidence Intervals developed considering parameter, scenario and model uncertainty based on directly measured or calculated data	Confidence Intervals developed considering either of parameter, scenario and model uncertainty based on assumed probability distribution	Deterministic value provided	N/A	N/A
Data Collection Methods	How representative is the data of the market?	Representative data from >80% of the relevant market, over an adequate period	Representative data from 60-79% of the relevant market, over an adequate period OR representative data from >80% of the relevant market, over a shorter period	Representative data from 40-59% of the relevant market, over an adequate period OR representative data from 60-79% of the relevant market, over a shorter period	Representative data from <40% of the relevant market, over an adequate period OR representative data from 40-59% of the relevant market, over a shorter period	Unknown OR data from a small number of sites and from shorter periods
	How compatible is the life-cycle inventory data with TRACI 2.1 impact assessment method from LCA Commons?	Life-cycle inventory data is enough to calculate all the 9 mid-point indicators as per TRACI 2.1 impact assessment method	Life-cycle inventory data is enough to calculate only 6 out of 9 mid-point indicators as per TRACI 2.1 impact assessment method	Life-cycle inventory data is enough to calculate only 3 out of 9 mid-point indicators as per TRACI 2.1 impact assessment method	Life-cycle inventory data is not compatible with TRACI 2.1 impact assessment method from LCA Commons	N/A
Time period	Does the data capture seasonal variations?	All three (fall, spring and summer) seasons are covered	Only two out of three seasons are covered	Only one season is covered	Not Specified	N/A
	How well is the time period the data	Less than 3 years of difference	Less than 6 years of difference	Less than 10 years of difference	Less than 15 years of difference	Age of data unknown or more than 15 years

Criterion		Data Quality Score				
		1	2	3	4	5
	correlated with the data quality objective?					
	How old is the data at the time of data quality assessment?	Less than 3 years old	Less than 6 years old	Less than 10 years old	Less than 12 years old	Age of data unknown or more than 15 years
Geography	How well is the geography of the data correlated with the data quality objective?	Data from same resolution AND same area of study	Within one level of resolution AND a related area of study	Within two levels of resolution AND a related area of study	Outside of two levels of resolution BUT a related area of study	From a different or unknown area of study
	What is the regional granularity associated with the data?	State level	Country level	Continental level	Global level	Data granularity unknown
Technology	How well is the technology of the data correlated with the data quality objective?	All technology categories are equivalent	Three of the technology categories are equivalent	Two of the technology categories are equivalent	One of the technology categories are equivalent	None of the technology categories are equivalent
	How well is the technology of the data described?	Specified	Not Specified	N/A	N/A	N/A
Process Review	How well is the process reviewed?	The process has documented reviews by a minimum of two types of third-party reviewers	The process has documented reviews by a minimum of two types of reviewers, with one being a third party	The process has documented review by a third-party reviewer	The process has documented review by an internal reviewer	The process has no documented review
Process Completeness	How complete is the process?	>80% of determined flows within the process have been evaluated and given a value	60-79% of determined flows within the process have been evaluated and given a value	40-59% of determined flows within the process have been evaluated and given a value	<40% of determined flows within the process have been evaluated and given a value	Process completeness not scored

2.15.1 Geographic Coverage

The geographical scope of the manufacturing portion of the life cycle is North America. Manufacturing takes place in the participating companies' facilities across the United States and Mexico.

The geographical scope of the raw material acquisition is North America, Europe, Asia, Oceania, and South America.

2.15.2 Time Coverage

This temporal scope is production from January 2024–December 2025 and varies by manufacturer depending on the most recent 12 months of data available when data collection began. Two participants provided data for a fiscal year starting in 2024 and ending in 2025. Of the remaining participants, half provided data for calendar year 2024, half provided data for calendar year 2025.

2.15.3 Technological Coverage

The technological scope is the specific technology participating companies use in manufacturing CFS framing products.

2.15.4 Treatment of Missing Data

Primary data shall be used where available. When primary data do not exist, secondary data for raw material production are obtained from industry-average LCAs for hot-dip galvanized steel coil, as shown in Appendix A. Any proxies used for raw materials have been detailed in Appendix A.

3 LIFE CYCLE INVENTORY ANALYSIS

Primary data were collected from SFIA participating companies. All calculation procedures adhere to ISO14044. Collection and processing of major data points is described below.

- Electrical Energy, Thermal Energy and Water Consumption
  - Data were collected for 12 consecutive months from each participating company through yearly utility bills and consumption was divided by production mass during this period to derive an energy use-per-production unit for use in the LCA.
- Raw Materials Purchasing and Transport
  - Steel coil supply data were obtained from each participating company. Participating companies provided details on surface finishes for steel coils.
  - Participants provided transportation distance and mode for steel coils purchased.
- Waste
  - Facility waste records for waste composition and fate from for 12 consecutive months from each participating company were assessed.
  - Waste amounts were divided by production mass during this period to derive a waste generation amount-per-production unit for use in the LCA.

Data were reviewed for accuracy during collection by first calculating the per-unit values and comparing them against published studies. Any inconsistencies in data were resolved through email and telephone communication with technical associates at the manufacturer.

When transforming the inputs and outputs of combustible materials into inputs and outputs of energy, the net calorific value (i.e., Lower Heating Value, LHV) of fuels was applied according to scientifically based and accepted values specific to the combustible material.

According to the part A PCR, where facility-specific data are not available for the upstream unit processes, and such a facility is required to report to the EPA Greenhouse Gas Reporting Program (GHGRP), the carbon intensity of the manufacturing plant and/or the quartile in which the manufacturing plant resides is reported. International suppliers are not required to report to the GHGRP and domestic suppliers do not report plant-specific production data publicly. The US International Trade Commission reported carbon intensity for semifinished carbon/alloy steel as 1,020 kg CO_2e/metric ton (USITC, 2025).

3.1.1 Product Stage (A1-A3)

This stage includes an aggregation of raw material extraction and supplier processing, delivery of the materials to the manufacturing facility, and impacts from manufacturing.

The products were modeled in Microsoft Excel to calculate the potential environmental impacts over their lifecycle using datasets from ecoinvent, AISI, and worldsteel. For any materials unavailable in the ecoinvent database, appropriate proxies were used. Details on these proxies are mentioned in Appendix A. Specific descriptions of secondary unit processes can be viewed through the ecoinvent dataset documentation online at https://ecoquery.ecoinvent.org.

3.1.1.1 Raw Material Supply (A1)

Cold-formed steel framing is produced from hot-dip galvanized cold rolled steel coil. Coil production takes place at domestic and international mills using EAF and BOF steelmaking technologies. A majority of the supply uses 100% zinc coatings, with less than 5% of the supply using Galvalume (55% aluminum, 43.4% zinc, and 1.6% silicon) or Galfan (95% zinc and 5% aluminum) coatings. A majority of raw materials are received as coils, but may be cut to sheets, strip, or strap by the steel producer upstream.

The raw materials for the product were obtained from North America, Europe, Asia, Oceania, and South America. Industry average datasets for hot-dip galvanized coil from the American Iron and Steel Institute (AISI, 2020) and hot-dip galvanized coil from worldsteel (worldsteel, 2022) are used for raw materials impacts. Worldsteel datasets for hot-dip galvanized coil are available for production in Europe and Asia. For other regions, the global dataset for hot-dip galvanized coil from Worldsteel is used. Over two thirds of the steel coil supply is sourced from North America, with the rest sourced internationally.

Industry-average datasets for hot-dip galvanized coil represent steel coated with 100% zinc and are used as a proxy for steel with Galfan and Galvalume coatings. Galfan and Galvalume coatings are technologically similar since they contain significant portions of zinc and are applied via the hot-dip process. This limitation in background data is not expected to influence industry-average results significantly because coatings represent a small portion of the mass in CFS framing products (<1%).

Recycled content is calculated as a weighted average by production mass across participating companies using primary data, where available. Where recycled content for a manufacturer's supply is unknown, region-specific recycled content data in industry-average LCAs from AISI and Worldsteel corresponding to the geography of the manufacturer's supply chain are used as a proxy. For most manufacturers and industry-average LCAs, the source of recycled content is unknown; therefore, recycled content is reported as an aggregated value of pre-consumer and post-consumer recycled content. Mass of coatings per declared unit varies with thickness of the steel and is excluded from the material composition tables.

The material composition of the product is represented in Table 6.

Table 6: Material Composition per Declared Unit

Material	SFIA Average
Total Alloys and Other Iron Units	57.6%
Recycled Content	42.4%

3.1.1.2 Raw Material Transport (A2)

The materials are delivered to the manufacturing facility via truck, train, and ship, and are accounted for in the model. Transport distances and mode are based on primary data provided by participating companies. Primary data are not available for about 10% of the industry-average supply; for this portion the steel is confirmed to be sourced domestically and is assumed to travel 500 miles by truck from the supplier to the manufacturing facility. Primary data for short and long backhauls are not available, so any short-haul supplier transport distances (<200 miles, or 322 km) are multiplied by 2 to model impacts related to backhauls per the part B PCR. Transportation data are shown in Table 7 as a production-weighted average.

Table 7: A2 Transportation Data

Parameter	Unit	Global Truck	North American Train	Global Ship
Vehicle Type	-	Freight lorry, unspecified size	Freight train	Freight container ship, sea-going
Fuel Type	-	100% Diesel	74% Diesel, 26% Electric	100% Heavy fuel oil
Distance	km	258	600	4,150

3.1.1.3 Manufacturing (A3)

Galvanized steel coil is unloaded onto an uncoiler and slit to size. Sheet steel, strip, and straps are cut to size. The sized steel is rollformed into different shapes. Depending on customer and product specifications, CFS products may also be punched, stamped, and pressed to form precise shapes.

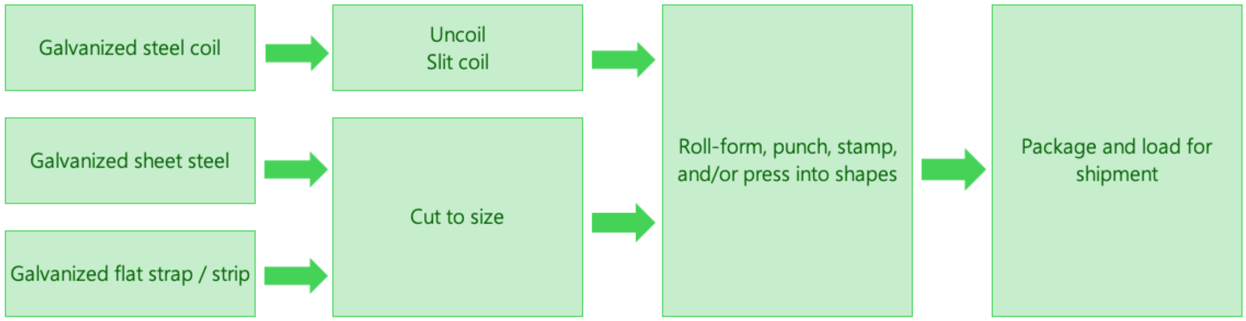

Figure 4: Process Flow Diagram

Energy resources used in the manufacturing process are accounted for in the model. The electricity is sourced from the power grid, and no onsite electricity generation is used. The actual consumption mix as supplied by the utility to each facility is not available. Electricity is modeled using ecoinvent datasets for the electricity consumption mix at the user, i.e., the manufacturing facility, (including generation, distribution, and transmission of electricity) in the appropriate NERC region for manufacturers in the United States or the national grid for manufacturers in Mexico. NERC regions are the most region-specific datasets available in ecoinvent for consumption mixes in the United States.

Secondary datasets for other fuels, packaging, and waste were utilized from ecoinvent, as shown in Appendix A. Manufacturing inputs and outputs per declared unit were calculated by using annual figures and dividing them by annual production. Wastes are listed by fate and classification is based on the EPA RCRA per the part A PCR.

Manufacturing data are summarized in Table 8.

Assumptions and data estimations for manufacturing include:

- Manufacturing Utilities
  - Data are not available on wastewater disposal, so it is conservatively assumed that no water loss occurs in the manufacturing process and wastewater is equal to water inputs.
  - Natural gas consumption at all participating member facilities is confirmed to be used for non-production processes such as building heat and is therefore excluded from the scope of the LCA.
  - One manufacturer manufactures CFS and metal panels in the same facility with electricity metered at the plant level. The manufacturer estimated electricity consumption for CFS machinery as 1% of the plant electricity based on machinery power ratings. This manufacturer represents less than 1% of the total production volume in the sample, so this assumption is not expected to influence the overall production impacts significantly.

- Ancillary Materials
  - Where region of sourcing is unknown for ancillary materials, it is assumed these inputs are sourced from the same nation as the participating manufacturer.
  - Where transportation information is not provided for ancillary materials, it is assumed these inputs are transported 500 miles by truck from the supplier to the manufacturing facility.
- Wastes
  - Steel scrap to recycling occurring in manufacturing is accounted for in A1 (raw materials) and A2 (transportation of raw materials), where impacts are modeled for sourcing and transporting the materials that are lost in production.
  - Primary data for generation of non-steel waste generated in production was not available for two participating companies. In absence of primary data, the average waste per-production-unit from other participating companies is used as a proxy.
  - Where primary data for waste fate are unknown, it is assumed wastes are landfilled.
  - Transportation to waste treatment is assumed to be 20 miles by truck.

Table 8: Manufacturing Inputs and Outputs per Declared Unit

Manufacturing Input/Output	Unit	Value
Utilities		
Electricity	kWh	4.91E+01
Propane	MJ	5.48E+01
Gasoline	MJ	1.85E-01
Diesel	MJ	5.49E+00
Water (Municipal Supply)	mt	1.25E-02
Ancillary Materials		
Lubricant	mt	3.72E-04
Coolant	mt	6.93E-05
Hydraulic Fluid	mt	3.44E-05
Solvent	mt	7.12E-07
Ink	mt	6.20E-08
Waste		
Steel Scrap to Recycling	mt	4.38E-02
Hazardous Waste to Recycling	mt	4.50E-05
Hazardous Waste to Landfill	mt	1.84E-06
Non-hazardous Waste to Recycling	mt	6.57E-04
Non-hazardous Waste to Landfill	mt	1.74E-04
Wastewater to Municipal Treatment	mt	1.25E-02

Packaging materials are included in the model in this stage with the values being calculated via direct measurement. In the case of three manufacturers, data are provided for the number of packaging units and mass is calculated using packaging dimensions and density per unit of packaging.

Where region of sourcing is unknown for packaging, it is assumed these inputs are sourced from the same nation as the participating manufacturer. Where transportation information is not provided for packaging, it is assumed these inputs are transported 500 miles by truck from the supplier to the manufacturing facility. If polymer type is unknown for plastic packaging, PET is used as a proxy. Among secondary ecoinvent datasets for known polymers used by participating manufacturers (Table 9), PET had the highest impacts per kg in all impact categories in scope except GWP-bio and EP-fresh.

Table 9: Packaging Inputs per Declared Unit

Manufacturing Input/Output	Mass [mt]	Biogenic Carbon [kg C]
Wood	1.54E-02	6.33E+00
Cardboard	1.56E-03	6.73E-01
Steel banding	6.56E-04	0
Plastic strapping (PP)	7.45E-06	0
Plastic strapping (unknown polymer)	1.31E-04	0
Plastic film (unknown polymer)	1.54E-05	0
Plastic strapping (PET)	1.60E-04	0
Plastic Film (LLDPE)	9.88E-06	0
Paper	1.97E-05	8.48E-03
Plastic buckets/lids (HDPE)	3.81E-05	0

As required per ISO 21930 and the part A PCR, information on packaging is provided to specify the end of life scenarios used for packaging or to support development of the end of life scenarios for packaging at the construction works level where the A5 module is not declared.

Table 10: Packaging Waste Details for A5 Scenario Development, per Declared Unit

Parameter	Unit	Value
Plastic Packaging Waste to Landfill	kg	4.38E-03
Plastic Packaging Waste to Incineration	kg	8.70E-04
Plastic Packaging Waste to Recycling	kg	5.51E-04
Biogenic carbon content of Plastic Packaging	kg CO2	0.00E+00
Metal Packaging Waste to Landfill	kg	2.23E-04

Parameter	Unit	Value
Metal Packaging Waste to Incineration	kg	5.90E-05
Metal Packaging Waste to Recycling	kg	3.74E-04
Biogenic carbon content of Metal Packaging	kg CO2	0.00E+00
Pulp Packaging Waste to Landfill	kg	4.84E-03
Pulp Packaging Waste to Incineration	kg	1.17E-03
Pulp Packaging Waste to Recycling	kg	1.10E-02
Biogenic carbon content of Pulp Packaging	kg CO2	2.57E+01

4 LIFE CYCLE IMPACT ASSESSMENT

4.1 SELECTION OF IMPACT PARAMETERS

Environmental Impacts were calculated using Microsoft Excel. Impact results have been calculated using IPCC AR6 and TRACI 2.2 characterization factors (IPCC, 2021; US EPA, 2021). Results presented in this report are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins, or risks.

Table 11: LCIA Indicators

Abbreviation	Parameter	Unit
IPCC AR6		
GWP-total	Global warming potential total	kg CO_2 eq
GWP-fossil	Global warming potential fossil fuels	kg CO_2 eq
GWP-biogenic	Global warming potential biogenic	kg CO_2 eq
GWP-luluc	Global warming potential land use and land use change	kg CO_2 eq
TRACI 2.2		
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq
AP	Acidification potential of soil and water	kg SO_2 eq
EP-fresh	Eutrophication potential of freshwater systems	kg P eq
EP-marine	Eutrophication potential of marine systems	kg N eq
POFP	Photochemical ozone formation potential	kg O_3 eq

In addition, the following indicators on the uptake and emissions of CO_2 are reported as they are included in the global warming potential figures above.

Table 12: Carbon Emissions and Removals

Abbreviation	Parameter	Unit
BCRP	Biogenic Carbon Removal from Product	kg CO_2
BCEP	Biogenic Carbon Emission from Product	kg CO_2
BCRK	Biogenic Carbon Removal from Packaging	kg CO_2
BCEK	Biogenic Carbon Emission from Packaging	kg CO_2
BCEW	Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO_2
CCE	Calcination Carbon Emissions	kg CO_2
CCR	Carbonation Carbon Removals	kg CO_2
CWNR	Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes	kg CO_2

In addition to the environmental parameters described in the previous section, the following resource use and waste categories are also disclosed. The indicators are calculated using a combination of the inventory indicators available in LCA FE and manual modification of the model to ensure flows are being tracked correctly. RPR_M and $NRPR_M$ are calculated by multiplying the mass (kg) of each material of the product and packaging content, with the lower calorific value (MJ/kg) of this material. RPR_E and $NRPR_E$ are calculated within the LCA software. RPR_T is the sum of RPR_M and RPR_E, and $NRPR_T$ is the sum of $NRPR_M$ and $NRPR_E$.

Table 13: Resource Use, Waste, and Output Flow Indicators

Abbreviation	Parameter	Unit
Resource Use Parameters		
RPR_E	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value (LHV)
RPR_M	Use of renewable primary energy resources used as raw materials	MJ, net calorific value (LHV)
RPR_T	Total use of renewable primary energy resources	MJ, net calorific value (LHV)
$NRPR_E$	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value (LHV)
$NRPR_M$	Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value (LHV)
$NRPR_T$	Total use of non-renewable primary energy resources	MJ, net calorific value (LHV)
SM	Use of secondary materials	kg
RSF	Use of renewable secondary fuels	MJ, net calorific value (LHV)
NRSF	Use of non-renewable secondary fuels	MJ, net calorific value (LHV)
RE	Recovered energy	MJ, net calorific value (LHV)
ADP-fossil	Abiotic depletion potential for fossil resources	MJ, net calorific value (LHV)
FW	Net use of fresh water	m^3
Waste Parameters and Output Flows		
HWD	Disposed-of-hazardous waste	kg
NHWD	Disposed-of non-hazardous waste	kg
HLRW	High-level radioactive waste, conditioned, to final repository	kg
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	kg

Abbreviation	Parameter	Unit
CRU	Components for reuse	kg
MR	Materials for recycling	kg
MER	Materials for energy recovery	kg
EEE	Exported electrical energy	MJ, net calorific value (LHV)
EET	Exported thermal energy	MJ, net calorific value (LHV)

4.2 LCA RESULTS

All results are given per declared unit, as shown in Section 2.11, and reported separately by life cycle stage according to part A PCR requirements for industry-average LCAs.

Results tables in the EPD will include the following statements as required by the part A PCR: Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building or construction works has been specified. Comparisons may be made between product-specific or industry average. EPDs at the time of product purchase only when product or construction works 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 or EN 15804. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparisons can be inaccurate and could lead to erroneous selection of materials or products that are higher-impact, at least in some impact categories.

4.2.1 Industry-Average Cold-Formed Steel Framing

The LCIA results are presented below.

Table 14: LCIA results for Industry-Average Cold-Formed Steel Framing, per metric ton

Impact	Unit	A1	A2	A3	A1-A3
IPCC					
GWP-total	kg CO_2 eq	2.46E+03	1.18E+02	3.51E+01	**2.62E+03**
GWP-fossil	kg CO_2 eq	2.47E+03	1.18E+02	5.97E+01	**2.65E+03**
GWP-biogenic	kg CO_2 eq	-4.24E+00	8.70E-02	-2.47E+01	**-2.88E+01**
GWP-luluc	kg CO_2 eq	6.04E-01	1.81E-01	5.68E-02	**8.42E-01**
TRACI					
ODP	kg CFC 11 eq	4.17E-10	1.78E-06	5.32E-06	**7.10E-06**
AP	kg SO_2 eq	4.98E+00	1.14E+00	1.87E-01	**6.30E+00**
EP-fresh	kg P eq	8.29E-04	4.69E-03	1.12E-02	**1.67E-02**
EP-marine	kg N eq	2.27E+00	8.68E-01	8.11E-02	**3.21E+00**
SFP	kg O_3 eq	8.16E+01	3.37E+01	3.31E+00	**1.19E+02**

The LCI results are presented below.

Table 15: Carbon emissions and removals for Industry-Average Cold-Formed Steel Framing, per metric ton

Impact	Unit	A1	A2	A3	A1-A3
BCRP	kg CO_2	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
BCEP	kg CO_2	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
BCRK	kg CO_2	0.00E+00	0.00E+00	2.57E+01	**2.57E+01**
BCEK	kg CO_2	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
BCEW	kg CO_2	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CCE	kg CO_2	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CCR	kg CO_2	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
CWNR	kg CO_2	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

Table 16: Resource use, waste, and output flow results for Industry-Average Cold-Formed Steel Framing, per metric ton

Impact	Unit	A1	A2	A3	A1-A3
Resource Use					
RPR_E	MJ	1.72E+03	2.70E+01	5.24E+02	**2.27E+03**
RPR_M	MJ	0.00E+00	0.00E+00	2.61E+01	**2.61E+01**
RPR_T	MJ	1.72E+03	2.70E+01	5.50E+02	**2.29E+03**
$NRPR_E$	MJ	2.94E+04	1.55E+03	1.07E+03	**3.20E+04**
$NRPR_M$	MJ	0.00E+00	0.00E+00	2.49E+02	**2.49E+02**

Impact	Unit	A1	A2	A3	A1-A3
$NRPR_T$	MJ	2.94E+04	1.55E+03	1.32E+03	**3.23E+04**
SM	kg	3.00E+02	0.00E+00	0.00E+00	**3.00E+02**
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
RE	MJ	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
ADP-fossil	MJ	2.77E+04	1.53E+03	1.13E+03	**3.04E+04**
FW	m^3	5.57E+01	1.96E-01	3.88E-01	**5.63E+01**
Output Flows and Waste		0	0	0	
HWD	kg	8.53E-04	1.20E+01	1.28E+01	**2.48E+01**
NHWD	kg	7.96E+01	1.24E+02	2.28E+02	**4.31E+02**
HLRW	kg	7.19E-04	0.00E+00	0.00E+00	**7.19E-04**
ILLRW	kg	6.01E-01	0.00E+00	0.00E+00	**6.01E-01**
CRU	kg	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
MR	kg	0.00E+00	0.00E+00	4.45E+01	**4.45E+01**
MER	kg	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**
EET	MJ	0.00E+00	0.00E+00	0.00E+00	**0.00E+00**

4.2.2 Statistical Information for Industry-Average Cold-Formed Steel Framing

Statistical Information and Distribution for Life Cycle Impact Assessment (LCIA) results per metric ton of CFS product across manufacturers, including weighted mean, weighted standard deviation, median value, minimum value, maximum value, and sample size per the part B PCR. Weighting is based on production mass.

The sample size (number of facilities represented in the statistics) for all statistics in Table 17 is 12 facilities.

Table 17: Statistical Information for Industry-Average Cold-Formed Steel Framing (A1-A3), per metric ton

Impact	Unit	Weighted Mean	Weighted Standard Deviation	Median	Minimum	Maximum
IPCC						
GWP-total	kg CO_2 eq	2.62E+03	2.97E+02	2.43E+03	2.30E+03	2.95E+03
GWP-fossil	kg CO_2 eq	2.65E+03	3.03E+02	2.50E+03	2.31E+03	2.99E+03
GWP-biogenic	kg CO_2 eq	-2.88E+01	2.07E+01	-1.31E+01	-7.85E+01	3.83E+00
GWP-luluc	kg CO_2 eq	8.42E-01	1.55E-01	9.36E-01	6.71E-01	1.18E+00
TRACI						
ODP	kg CFC 11 eq	7.10E-06	1.77E-05	6.26E-06	3.82E-07	1.53E-04
AP	kg SO_2 eq	6.30E+00	1.46E+00	5.35E+00	4.64E+00	7.96E+00
EP-fresh	kg P eq	1.67E-02	6.27E-03	1.66E-02	5.74E-03	4.06E-02
EP-marine	kg N eq	3.21E+00	7.64E-01	2.68E+00	2.25E+00	4.04E+00
SFP	kg O_3 eq	1.19E+02	3.12E+01	9.68E+01	8.03E+01	1.53E+02

5 INTERPRETATION

Within this section, the results of the life cycle assessment are interpreted according to the goal and scope of the study. This interpretation includes a dominance analysis, a sensitivity check, and a data quality check, before providing conclusions based on the LCA.

5.1 DOMINANCE ANALYSIS

A dominance analysis was performed to show which of the life cycle modules contributes to the majority of the impacts. Due to the relevance of these impact categories to the product type and the industry's interests, this dominance analysis is provided for IPCC AR6 GWP and TRACI AP, EP, and POFP results.

Over the product life cycle the greatest contributor to GWP and most other impact categories for industry-average CFS products is raw materials (A1). Transport contributes significantly to AP, EP-fresh, EP-marine, and POFP due to fuel combustion. Production is insignificant to most impact categories, except EP-fresh. EP-fresh impacts in production are driven by electricity and plastic packaging. This is illustrated in Figure 5.

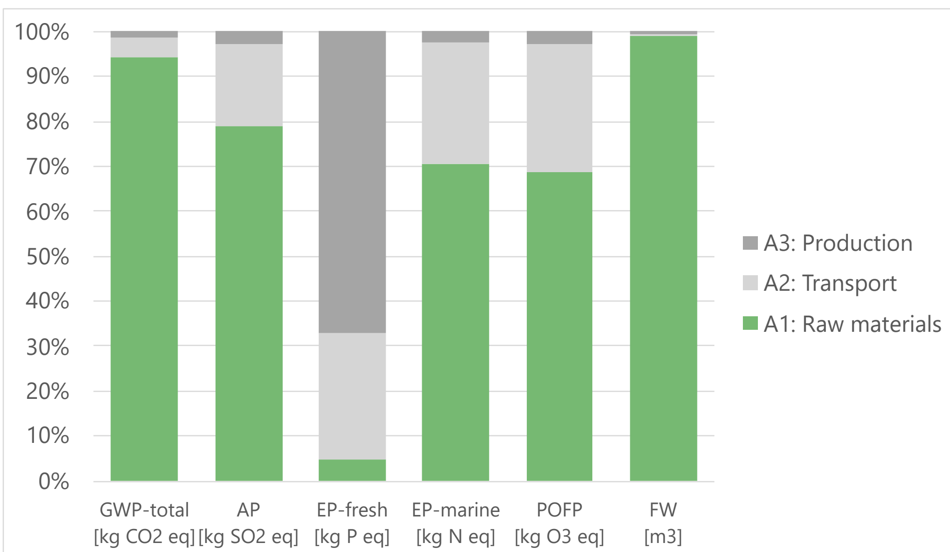

Figure 5. Contribution by life cycle stage to LCIA Results for Industry-Average CFS Products

The contributions of material inputs, transport, and production to cradle-to-gate results are summarized in Figure 6. Contribution of steel supply by region generally trends with the relative mass of steel coming from each region, except freshwater consumption. Freshwater consumption for the global HDG dataset from worldsteel, used to represent "other regions", is high relative to other industry-average HDG datasets.

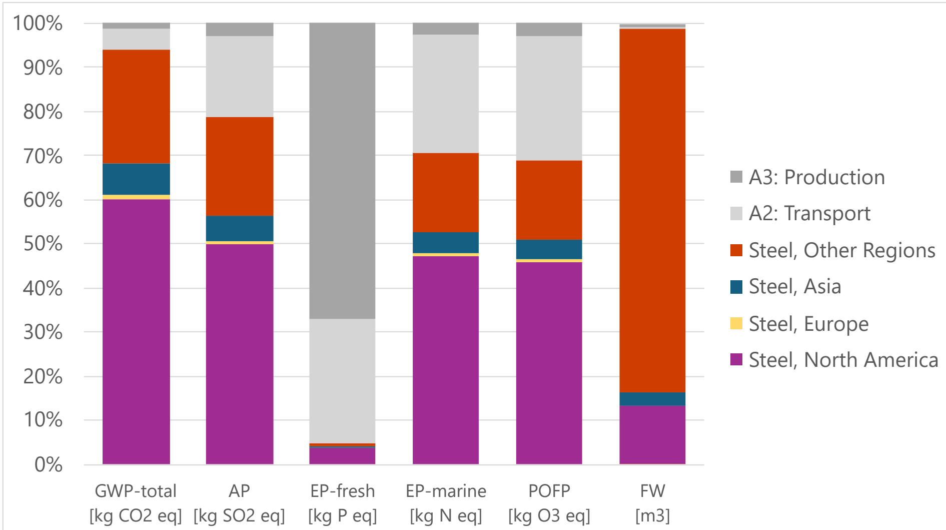

Figure 6: Contribution of manufacturing components to cradle-to-gate LCIA results for Industry-Average CFS Products

5.2 SENSITIVITY ANALYSIS

A sensitivity analysis is performed within life cycle assessment to determine how the results of an LCA are affected by the assumptions the LCA practitioner made during the course of the study. Of relevance to this model are the method of averaging and the region of sourcing for the steel supply.

Throughout the sensitivities in this report, a difference of ±10% is considered the threshold for significance.

5.2.1 Method of Averaging for Industry-Average Results

The industry-average LCA results in this report are a weighted average based on the production volume of each facility in the sample. An alternative method for production-weighted averaging could instead utilize annual production volume for each company, but these data were not available for the study. In this sensitivity analysis, the influence of averaging method on the industry-average results is assessed, where an arithmetic average result for each impact category is calculated. In other words, this is a simple average where each manufacturer's input/output data and therefore LCIA results have the same contribution to the average.

In the table below, the arithmetic average results by module and the A1-A3 total are calculated. The Difference from Baseline is the calculated percent difference of the cradle-to-gate sensitivity results relative to the baseline cradle-to-gate results in Table 14.

Table 18: LCIA Sensitivity Results of Averaging Method for Industry-Average CFS Products

Impact	Unit	A1	A2	A3	A1-A3	A1-A3 Difference from Baseline
GWP-total	kg CO_2 eq	2.34E+03	1.04E+02	3.71E+01	**2.48E+03**	-5%
ODP	kg CFC 11 eq	1.24E-10	1.69E-06	1.72E-05	**1.89E-05**	166%
AP	kg SO_2 eq	4.69E+00	6.55E-01	2.05E-01	**5.55E+00**	-12%
EP-fresh	kg P eq	8.90E-04	4.85E-03	1.16E-02	**1.74E-02**	4%
EP-marine	kg N eq	2.23E+00	4.96E-01	8.74E-02	**2.81E+00**	-13%
POFP	kg O_3 eq	7.96E+01	1.90E+01	3.45E+00	**1.02E+02**	-14%

The results of this analysis indicate the results are sensitive to an arithmetic averaging method for most impact categories. Compared with the baseline results, the arithmetic average results increase by a maximum of 166% (ODP); increases in other impact categories (EP-fresh) are not significant.

Results decrease by a maximum of 12-14% (AP, EP-marine, POFP); decreases in other impact categories are not significant (GWP-total).

The driver of differences for ODP is PET packaging. In the baseline scenario, PET packaging makes up about 1% of the total average mass of packaging. In the arithmetic average scenario, PET packaging makes up about 5% of the total average mass of packaging. In both scenarios, PET packaging contributes to over half of cradle-to-gate ODP impacts because, among the secondary datasets used for modeling plastic packaging in this LCA, ODP impacts for PET are very high[1]. In the arithmetic average, many manufacturers with relatively small production volumes source PET packaging or packaging of unknown polymer–conservatively assumed to be PET–compared with the production-weighted average packaging materials.

The main driver of differences in AP, EP-marine, and POFP impacts is transportation of raw materials, with a smaller portion of the difference driven by production of steel coil. In the arithmetic average, many manufacturers with relatively small production volumes source raw materials from a shorter distance compared with the production-weighted average.

Insignificant differences in GWP-total are due to the dominance of steel raw materials in the baseline cradle-to-gate GWP-total results and low variation in the steel supply source between most participating manufacturers. An additional sensitivity is conducted on steel supply sourcing in section 5.2.2.

[1] Among the secondary datasets used for modeling plastic packaging, ODP impacts per 1 kg of PET are 1-2 orders of magnitude higher. According to dataset documentation from ecoinvent, ODP contributions for PET are overwhelmingly dominated by raw materials of terephthalic acid used in PET production. For all other LCIA impacts, impacts of PET per 1 kg compared with other plastics are in the same order of magnitude.

Based on the results of this sensitivity, alternative averaging methods may have significant effects on cradle-to-gate LCIA results for all impact categories other than GWP and EP-fresh. For ODP, differences from averaging methods are compounded by conservative assumptions used for packaging materials and high ODP impacts in secondary ecoinvent datasets related to these assumptions. Significant differences in other impact categories are mainly driven by raw material transport. In conclusion, averaging by production volume of facilities included in the sample is conservative relative to an arithmetic average for most cradle-to-gate impacts, is more representative of actual industry operations than an arithmetic average, meets PCR requirements, and satisfies the goals of the industry-average LCA.

5.2.2 Steel Supply Source

Because of the dominance of HDG raw materials on most LCIA impact categories and because many factors (cost, lead time, environmental impacts, etc.) may drive material purchasing decisions, this sensitivity analysis assesses the influence of sourcing region on the industry-average results. This sensitivity considers a theoretical minimum supply chain scenario (100% of HDG sourced from North America) and a theoretical maximum (100% of HDG sourced from Asia), and compares these scenario results as a percent difference from the baseline scenario results presented in Table 14.

Table 19: LCIA Sensitivity Results of Steel Supply Source for Industry-Average CFS Products

Impact	Unit	Min	Max
GWP-total	kg CO_2 eq	-6%	25%
ODP	kg CFC 11 eq	0%	0%
AP	kg SO_2 eq	-6%	18%
EP-fresh	kg P eq	1%	-1%
EP-marine	kg N eq	-1%	5%
POFP	kg O_3 eq	-2%	6%

The results of this analysis indicate the results are sensitive to the region of sourcing for some impact categories. In the 100% North American HDG scenario, impacts increase by a maximum of 6% (GWP-total, AP). This scenario shows a small difference relative to the baseline scenario because of the current dominance of North American steel in the industry-average supply; larger differences for this scenario would be expected if the baseline scenario supply mix included a larger portion of international steel. In the 100% Asian HDG scenario, impacts increase by a maximum of 25% (GWP-total). Results are also sensitive for AP. Other impact categories are not significantly affected by this sensitivity.

5.3 DATA QUALITY ASSESSMENT

Data quality is detailed throughout this section in line with the part A PCR. Overall, secondary data were assessed and deemed to be sufficiently representative on a temporal, geographical and technological basis.

Primary data in the form of energy consumption and water consumption were normalized based on total mass of production during the same time frame. The resulting energy and water per unit were used for product manufactured at the facilities under study. Overall, primary energy and water data quality are considered good.

Primary data also includes the bills of materials used to formulate the products that are included in the study. Overall, this data is considered very good. Upstream data quality can be increased through the use of supplier-specific secondary datasets.

5.3.1 Geographic Coverage

The geographical scope of the manufacturing portion of the life cycle is North America. Participating company facilities represent a mix of geographies across the United States and Mexico. All primary data were collected from participants. The geographic coverage of primary data is considered very good.

The geographical scope of the raw material acquisition is North America, Europe, Asia, Oceania, and South America. Industry-average datasets for hot-dip galvanized steel coil from AISI and worldsteel were used to represent raw materials impacts. These datasets represent industry-average production in the relevant regions. Geographical coverage of these data is considered good.

In selecting secondary data (i.e., ecoinvent datasets), priority was given to the accuracy and representativeness of the data. When available and deemed of significant quality, country-specific data were used. However, priority was given to technological relevance and accuracy in selecting secondary data. This often led to the substitution of regional and/or global data for country-specific data. The geographical coverage of secondary datasets can be referenced in the dataset references table in Appendix A. Overall geographic data quality is considered good.

5.3.2 Time Coverage

Primary data were provided by participants and represent all information for January 2024–December 2025. Using this data meets the part B PCR requirements that primary foreground data are less than 2 years old. Time coverage of this primary data is considered very good.

Data necessary to model cradle-to-gate unit processes were sourced from ecoinvent, AISI, and worldsteel datasets. Time coverage of the datasets varies based on latest updates in the ecoinvent database. All datasets rely on at least one 1-year average data. Overall time coverage of the datasets is considered good and meets PCR requirements. The specific time coverage of secondary datasets can be found in Appendix A.

5.3.3 Technological Coverage

Primary data provided by participants are representative of the technology the industry uses in manufacturing cold-formed steel framing and includes a mix of applicable technologies significantly dominating the North American market, including old, average, and modern technologies. Participating companies represent a mix of small, medium, and large CFS manufacturers.

Primary data is site-specific and considered of very good quality. It is worth noting that the energy and water used in manufacturing the product includes overhead energy such as lighting, heating, and sanitary use of water. Sub-metering was not available to extract process-only energy and water use from the total energy use. Sub-metering would improve the data quality of technological coverage.

Data necessary to model cradle-to-gate unit processes were sourced from ecoinvent datasets. Technological coverage of the datasets is considered good relative to the actual supply chain of the manufacturer. Facility specific data were not used for steel coil supply, which contribute more than 75% of the disclosed GWP-100 in the aggregated A1–A3 information modules. The choice to use industry-average secondary data for impacts of the steel coil supply is considered appropriate for an industry-average LCA because the sub-set of facilities assessed do not represent 100% of the CFS industry.

5.3.4 Data Quality Assessment

Appendix A shows an assessment for the data quality of all secondary processes included in the model. The following sections provide details on the data quality of the model itself.

5.3.4.1 Precision

The precision of the data is considered very good. Purchasing teams provided detailed supply data, and facility operations managers provided utility information for the manufacturing facilities. The raw material transportation distances were calculated based on the supplier addresses when provided in purchasing data. Proxy datasets were utilized in the LCA model when secondary data were not available, as shown in Appendix A. Precision for individual facility data can be increased via sub-metering individual manufacturing processes to better account for manufacturing processes rather than including overhead utility information.

5.3.4.2 Completeness

The data included is considered complete. The LCA model included all known material and energy flows, with the exception of what is listed in Section 2.13. As pointed out in that section, no known flows above 1% were excluded and the sum of all excluded flows totals less than 5%, whether evaluated by mass, energy, or potential environmental impact.

5.3.4.3 Consistency

The consistency of the model is considered very good. The supply data provided by the purchasing teams were developed for multiple internal departments use and are maintained regularly. The LCA practitioner also cross-referenced the installation documents and other relevant information to ensure consistency. Furthermore, modeling assumptions were consistent across the model, with preference given towards ecoinvent data, where available.

5.3.4.4 Reproducibility

This study is considered reproducible. Descriptions of the data and assumptions through this report would allow a practitioner to utilize the LCA tool to generate results for the products.

5.3.4.5 Uncertainty

Uncertainty for the secondary datasets is discussed in the documentation published by ecoinvent for the LCI database. Uncertainty of the primary data comes from the utility data allocated to each product. The yearly total energy use changes over time due to more efficient operations, warmer or cooler seasons and other factors. Because energy data comes directly from utility bills, the uncertainty is mainly based on the accuracy of the utility meters.

5.3.4.6 Datasets with Significant Contribution

Data for any unit process that contributes 10% or more to GWP-total in any module shall be documented. These are detailed in Table 20.

Table 20: Details on Datasets with Significant Contribution

Category	Module	Material/Process Name	Dataset Name	Dataset Geography	Dataset Reference Year
Material	A1	HDG Steel, Domestic	Steel hot dip galvanised AISI	RNA	2017
Material	A1	HDG Steel, Global	Steel hot dip galvanised worldsteel	GLO	2017-2022
Transportation	A2	Transport of Raw Materials, Truck	market group for transport, freight, lorry, diesel, unspecified ecoinvent	GLO	2025
Transportation	A2	Transport of Raw Materials, Train	market for transport, freight, train, fleet average ecoinvent	US	2025
Transportation	A2	Transport of Raw Materials, Ship	market for transport, freight, sea, container ship, heavy fuel oil ecoinvent	GLO	2025

Category	Module	Material/Process Name	Dataset Name	Dataset Geography	Dataset Reference Year
Packaging	A3	Plastic Packaging Materials	polyethylene production, low density, granulate ecoinvent	US	2025
Packaging	A3	Plastic Packaging Production Process	market for injection moulding ecoinvent	GLO	2025
Energy	A3	Electricity, RFC	market for electricity, low voltage ecoinvent	US-RFC	2025
Energy	A3	Electricity, SERC	market for electricity, low voltage ecoinvent	US-SERC	2025
Energy	A3	Electricity, WECC	market for electricity, low voltage ecoinvent	US-WECC	2025
Energy	A3	Propane	market for propane, burned in building machine ecoinvent	GLO	2025

5.3.4.7 Supply Chain Specificity

Supply chain specificity as calculated per the 2022 ACLCA PCR Open Standard – Process and Methods Toolkit Guidance for Determining EPD Types and Calculating and Communicating Data Specificity Through the Supply Chain (ACLCA, 2025) is 0 due to the use of industry-average datasets to represent raw materials impacts in A1.

5.4 TRANSPARENCY DECISIONS THAT MAY HAVE AFFECTED THE LCA

Throughout this report, value choices and judgements that may have affected the LCA have been described. Assumptions related to raw materials, transport, and production data are detailed throughout section 3.1.1.

Additional decisions are summarized below:

- Plastic packaging processing impacts were modeled based on default energy use and scrap rates from the background database used.
- The inclusion of overhead energy data was determined appropriate due to the inability to sub-meter and isolate manufacturing energy from overhead energy.
- The use and selection of secondary datasets from ecoinvent – The selection of which generic dataset to use to represent an aspect of a supply chain is a significant value choice. Collaboration between the LCA practitioner and the manufacturer was invaluable in determining best-case scenarios in the selection of data. However, no generic data can be a perfect fit. Improved supply chain specific data would improve the accuracy of results, however budgetary and time constraints also must be considered.

Some limitations to the study have been identified as follows:

- This study is cradle-to-gate in scope and does not consider impacts of distribution, installation, use, or end-of-life of the product.
- Industry-average results are calculated as a production-weighted average based on the production volume of the facilities included in the sample. The influence of this decision is assessed in a sensitivity analysis in section 5.2.1.
- The choice to use industry-average secondary data for impacts of the steel coil supply is considered appropriate for an industry-average LCA because the sub-set of facilities assessed do not represent 100% of the CFS industry.
- While secondary datasets for hot-dip galvanized coil from AISI and worldsteel use system expansion for co-product allocation, these datasets are the best data available for representing industry-average impacts for production of hot-dip galvanized coil in the relevant regions.
- Availability of geographically more accurate datasets would have improved the accuracy of the study.
- Since this LCA uses the cut-off approach to model recycled material in the product, no credit is given to the product system. Instead, the manufacturer realizes reduced environmental impacts through the absence of the burden of extracting virgin material.
- Only known and quantifiable environmental impacts are considered.
- Due to the assumptions and value choices listed above, these do not reflect real-life scenarios and hence they cannot assess actual and exact impacts, but only potential environmental impacts.

5.5 CONCLUSION

For industry-average cold-formed steel framing products, the A1 and A3 life cycle modules drive potential environmental impacts, depending on the indicator. The key drivers of these modules are raw materials of hot-dip galvanized steel coil, electricity consumed in production, and plastic packaging. Raw materials (A1) dominate impacts for most impact categories, while production (A3) electricity and plastic packaging dominate EP-fresh. Transport (A2) also contributes significantly to AP, EP-fresh, EP-marine, and POFP due to fuel combustion.

Based on a sensitivity analysis, alternative averaging methods may have significant effects on cradle-to-gate LCIA results for all impact categories other than GWP and EP-fresh. Sensitivity of ODP results is compounded by conservative assumptions used for packaging materials and secondary ecoinvent datasets, while sensitivity in other impact categories are mainly driven by raw material transport. In conclusion, averaging by production volume of facilities included in the sample is conservative relative to an arithmetic average for most cradle-to-gate impacts, is more representative of actual

CFS industry operations than an arithmetic average, meets PCR requirements, and satisfies the goals of the industry-average LCA.

A sensitivity on alternative steel supply scenarios indicates that a dramatic increase in international sourcing of steel could lead to significantly higher LCIA results for some impact categories (GWP-total, AP).

The quality of the LCA study would be improved by the inclusion of more participants and facilities to provide greater coverage of the industry. Using one facility per participant, however, maximizes representativeness of the industry-average LCA within project constraints while meeting the requirements of the PCR and study goal.

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APPENDIX A SECONDARY DATASETS

Process	Dataset Name	Source	Year of Last Update	Geography	Time Coverage	Geographical Coverage	Technological Coverage	Relevant Module
HDG Steel, Domestic	Steel hot dip galvanised	AISI	2017	RNA	Fair	Very Good	Appropriate technology except where coatings include materials other than zinc	A1
HDG Steel, Europe	Steel hot dip galvanised	worldsteel	2017	RER	Fair	Very Good	Appropriate technology	A1
HDG Steel, Global	Steel hot dip galvanised	worldsteel	2017	GLO	Fair	Good	Appropriate technology	A1
HDG Steel, Asia	Steel hot dip galvanised	worldsteel	2017	RAS	Fair	Very Good	Appropriate technology	A1
Transport, Truck	market group for transport, freight, lorry, diesel, unspecified	ecoinvent	2025	GLO	Very Good	Good	Appropriate technology	A2, A3
Transport, Train	market for transport, freight, train, fleet average	ecoinvent	2025	US	Very Good	Very Good	Appropriate technology	A2
Transport, Ship	market for transport, freight, sea, container ship, heavy fuel oil	ecoinvent	2025	GLO	Very Good	Good	Appropriate technology	A2
Lubricant	market for lubricating oil	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3
Coolant	market for lubricating oil	ecoinvent	2025	RoW	Very Good	Good	Proxy technology	A3
Hydraulic Fluid	market for lubricating oil	ecoinvent	2025	RoW	Very Good	Good	Similar technology	A3
Solvent	market for solvent, organic	ecoinvent	2025	GLO	Very Good	Good	Appropriate technology	A3
Ink	market for printing ink, rotogravure, without solvent, in 55% toluene solution state	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3
Packaging, wood	EUR-flat pallet production	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3
Packaging, Cardboard	corrugated board box production	ecoinvent	2025	US	Very Good	Very Good	Appropriate technology	A3
Packaging, Steel banding	metal working, average for steel product manufacturing	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3
Packaging, Plastic strapping (PP)	polypropylene production, granulate	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3

Process	Dataset Name	Source	Year of Last Update	Geography	Time Coverage	Geographical Coverage	Technological Coverage	Relevant Module
Packaging, Plastic strapping (unknown polymer)	polyethylene terephthalate production, granulate, bottle grade	ecoinvent	2025	RoW	Very Good	Good	Proxy technology	A3
Packaging, Plastic film (unknown polymer)	polyethylene terephthalate production, granulate, bottle grade	ecoinvent	2025	RoW	Very Good	Good	Proxy technology	A3
Packaging, Plastic strapping (PET)	polyethylene terephthalate production, granulate, bottle grade	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3
Packaging, Plastic Film (LLDPE)	polyethylene production, linear low density, granulate	ecoinvent	2025	US	Very Good	Very Good	Appropriate technology	A3
Packaging, Paper	kraft paper production	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3
Packaging, Plastic buckets/lids (HDPE)	polyethylene production, high density, granulate	ecoinvent	2025	US	Very Good	Very Good	Appropriate technology	A3
Packaging, Plastic strapping (LDPE)	polyethylene production, low density, granulate	ecoinvent	2025	US	Very Good	Very Good	Appropriate technology	A3
Packaging, Plastic injection molding	market for injection moulding	ecoinvent	2025	GLO	Very Good	Good	Appropriate technology	A3
Packaging, Plastic film extrusion	market for extrusion, plastic film	ecoinvent	2025	GLO	Very Good	Good	Appropriate technology	A3
Electricity, US-RFC	market for electricity, low voltage	ecoinvent	2025	US-RFC	Very Good	Good	Appropriate technology	A3
Electricity, SERC	market for electricity, low voltage	ecoinvent	2025	US-SERC	Very Good	Good	Appropriate technology	A3
Electricity, MX	market for electricity, low voltage	ecoinvent	2025	MX	Very Good	Very Good	Appropriate technology	A3
Electricity, US-WECC	market for electricity, low voltage	ecoinvent	2025	US-WECC	Very Good	Good	Appropriate technology	A3
Electricity, US-MRO	market for electricity, low voltage	ecoinvent	2025	US-MRO	Very Good	Good	Appropriate technology	A3
Propane	market for propane, burned in building machine	ecoinvent	2025	GLO	Very Good	Good	Appropriate technology	A3
Gasoline	market for petrol, unleaded, burned in machinery	ecoinvent	2025	GLO	Very Good	Good	Appropriate technology	A3

Process	Dataset Name	Source	Year of Last Update	Geography	Time Coverage	Geographical Coverage	Technological Coverage	Relevant Module
Diesel	market for diesel, burned in building machine	ecoinvent	2025	GLO	Very Good	Good	Appropriate technology	A3
Water (Municipal Supply)	market for tap water	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3
Wastewater to Municipal Treatment	treatment of wastewater, average, wastewater treatment	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3
Oil and coolant waste to landfill	treatment of waste bitumen, sanitary landfill	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3
Trash to landfill	treatment of municipal solid waste, sanitary landfill	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3
Wood waste to landfill	treatment of waste wood, untreated, sanitary landfill	ecoinvent	2025	RoW	Very Good	Good	Appropriate technology	A3

APPENDIX B VERIFICATION DOCUMENTS

APPENDIX C ENHANCED PEDIGREE MATRIX

		Reliability				Data Collection Methods		Time period			Geography		Technology		Process Review	Process Completeness	
Input/Output	Dataset	Is the inventory data checked for mass/ energy balance, recalculation etc.?	What is the status quo for the ownership and continuous support of data?	Is the data regularly updated?	Is the data of deterministic nature or are there statistically established confidence intervals stated for the data?	How representative is the data of the market?	How compatible is the life-cycle inventory data with TRACI 2.1 impact assessment method from LCA Commons?	Does the data capture seasonal variations?	How well is the time period the data correlated with the data quality objective?	How old is the data at the time of data quality assessment?	How well is the geography of the data correlated with the data quality objective?	What is the regional granularity associated with the data?	How well is the technology of the data correlated with the data quality objective?	How well is the technology of the data described?	How well is the process reviewed?	How complete is the process?	**Weighted Total**
HDG Steel, Domestic	RNA: Steel hot dip galvanised (AISI)	2	1	2	3	1	1	1	3	3	1	3	2	1	4	1	**2.0**
HDG Steel, Europe	RER: Steel hot dip galvanised (worldsteel)	2	1	2	3	1	1	1	3	3	1	3	1	1	4	1	**1.9**
HDG Steel, Global	GLO: Steel hot dip galvanised (worldsteel)	2	1	2	3	1	1	1	3	3	3	4	1	1	4	1	**2.1**
HDG Steel, Asia	RAS: Steel hot dip galvanised (worldsteel)	2	1	2	3	1	1	1	3	3	1	3	1	1	4	1	**1.9**
Transport, Truck	GLO: market group for transport, freight, lorry, diesel, unspecified (ecoinvent)	2	3	2	3	1	1	1	1	1	3	4	1	1	2	5	**2.3**
Transport, Train	US: market for transport, freight, train, fleet average (ecoinvent)	2	3	2	3	1	1	1	1	1	1	2	1	1	2	5	**2.0**
Transport, Ship	GLO: market for transport, freight, sea,	2	3	2	3	1	1	1	1	1	3	4	1	1	5	5	**2.7**

		Reliability				Data Collection Methods		Time period			Geography		Technology		Process Review	Process Completeness	
Input/Output	**Dataset**	Is the inventory data checked for mass/ energy balance, recalculation etc.?	What is the status quo for the ownership and continuous support of data?	Is the data regularly updated?	Is the data of deterministic nature or are there statistically established confidence intervals stated for the data?	How representative is the data of the market?	How compatible is the life-cycle inventory data with TRACI 2.1 impact assessment method from LCA Commons?	Does the data capture seasonal variations?	How well is the time period the data correlated with the data quality objective?	How old is the data at the time of data quality assessment?	How well is the geography of the data correlated with the data quality objective?	What is the regional granularity associated with the data?	How well is the technology of the data correlated with the data quality objective?	How well is the technology of the data described?	How well is the process reviewed?	How complete is the process?	**Weighted Total**
	container ship, heavy fuel oil (ecoinvent)																
Lubricant	RoW: market for lubricating oil (ecoinvent)	4	3	2	3	5	1	1	1	1	5	5	1	1	5	5	**3.3**
Coolant	RoW: market for lubricating oil (ecoinvent)	4	3	2	3	5	1	1	1	1	5	5	5	1	5	5	**3.6**
Hydraulic Fluid	RoW: market for lubricating oil (ecoinvent)	4	3	2	3	5	1	1	1	1	5	5	3	1	5	5	**3.4**
Solvent	GLO: market for solvent, organic (ecoinvent)	2	3	2	3	5	1	1	1	1	3	4	3	1	2	5	**2.7**
Ink	RoW: market for printing ink, rotogravure, without solvent, in 55% toluene solution state (ecoinvent)	4	3	2	3	5	1	1	1	1	5	5	3	1	2	5	**3.0**
Packaging, wood	RoW: EUR-flat pallet production (ecoinvent)	3	3	2	3	5	1	1	1	1	5	5	1	1	1	5	**2.7**
Packaging, Cardboard	US: corrugated board box production (ecoinvent)	2	3	2	3	5	1	1	1	1	1	2	1	1	1	5	**2.1**

Input/Output	Dataset	Reliability: Is the inventory data checked for mass/ energy balance, recalculation etc.?	Reliability: What is the status quo for the ownership and continuous support of data?	Reliability: Is the data regularly updated?	Reliability: Is the data of deterministic nature or are there statistically established confidence intervals stated for the data?	Data Collection Methods: How representative is the data of the market?	Data Collection Methods: How compatible is the life-cycle inventory data with TRACI 2.1 impact assessment method from LCA Commons?	Time period: Does the data capture seasonal variations?	Time period: How well is the time period the data correlated with the data quality objective?	Time period: How old is the data at the time of data quality assessment?	Geography: How well is the geography of the data correlated with the data quality objective?	Geography: What is the regional granularity associated with the data?	Technology: How well is the technology of the data correlated with the data quality objective?	Technology: How well is the technology of the data described?	Process Review: How well is the process reviewed?	Process Completeness: How complete is the process?	**Weighted Total**
Packaging, Steel banding	RoW: metal working, average for steel product manufacturing (ecoinvent)	4	3	2	3	5	1	1	1	1	5	5	5	1	5	5	**3.6**
Packaging, Plastic strapping (PP)	RoW: polypropylene production, granulate (ecoinvent)	3	3	2	3	5	1	1	1	1	5	5	1	1	1	5	**2.7**
Packaging, Plastic strapping (unknown polymer)	RoW: polyethylene terephthalate production, granulate, bottle grade (ecoinvent)	3	3	2	3	5	1	1	1	1	5	5	5	1	1	5	**3.0**
Packaging, Plastic film (unknown polymer)	RoW: polyethylene terephthalate production, granulate, bottle grade (ecoinvent)	3	3	2	3	5	1	1	1	1	5	5	5	1	1	5	**3.0**
Packaging, Plastic strapping (PET)	RoW: polyethylene terephthalate production, granulate, bottle grade (ecoinvent)	3	3	2	3	5	1	1	1	1	5	5	1	1	1	5	**2.7**
Packaging, Plastic Film (LLDPE)	US: polyethylene production, linear low	2	3	2	3	5	1	1	1	1	1	2	1	1	1	5	**2.1**

		Reliability				Data Collection Methods		Time period			Geography		Technology		Process Review	Process Completeness	
Input/Output	**Dataset**	Is the inventory data checked for mass/ energy balance, recalculation etc.?	What is the status quo for the ownership and continuous support of data?	Is the data regularly updated?	Is the data of deterministic nature or are there statistically established confidence intervals stated for the data?	How representative is the data of the market?	How compatible is the life-cycle inventory data with TRACI 2.1 impact assessment method from LCA Commons?	Does the data capture seasonal variations?	How well is the time period the data correlated with the data quality objective?	How old is the data at the time of data quality assessment?	How well is the geography of the data correlated with the data quality objective?	What is the regional granularity associated with the data?	How well is the technology of the data correlated with the data quality objective?	How well is the technology of the data described?	How well is the process reviewed?	How complete is the process?	**Weighted Total**
	density, granulate (ecoinvent)																
Packaging, Paper	RoW: kraft paper production (ecoinvent)	2	3	2	3	2	1	1	1	1	5	5	1	1	2	5	**2.6**
Packaging, Plastic buckets/lids (HDPE)	US: polyethylene production, high density, granulate (ecoinvent)	3	3	2	3	5	1	1	1	1	1	2	1	1	1	5	**2.2**
Packaging, Plastic strapping (LDPE)	US: polyethylene production, low density, granulate (ecoinvent)	4	3	2	3	5	1	1	1	1	1	2	1	1	1	5	**2.2**
Packaging, Plastic injection molding	GLO: market for injection moulding (ecoinvent)	4	3	2	3	5	1	1	1	1	3	4	2	1	5	5	**3.1**
Packaging, Plastic film extrusion	GLO: market for extrusion, plastic film (ecoinvent)	4	3	2	3	5	1	1	1	1	3	4	2	1	5	5	**3.1**
Electricity, US-RFC	US-RFC: market for electricity, low voltage (ecoinvent)	2	3	2	3	1	1	1	1	1	2	2	1	1	1	5	**1.9**

		Reliability				Data Collection Methods		Time period			Geography		Technology		Process Review	Process Completeness	
Input/Output	**Dataset**	Is the inventory data checked for mass/ energy balance, recalculation etc.?	What is the status quo for the ownership and continuous support of data?	Is the data regularly updated?	Is the data of deterministic nature or are there statistically established confidence intervals stated for the data?	How representative is the data of the market?	How compatible is the life-cycle inventory data with TRACI 2.1 impact assessment method from LCA Commons?	Does the data capture seasonal variations?	How well is the time period the data correlated with the data quality objective?	How old is the data at the time of data quality assessment?	How well is the geography of the data correlated with the data quality objective?	What is the regional granularity associated with the data?	How well is the technology of the data correlated with the data quality objective?	How well is the technology of the data described?	How well is the process reviewed?	How complete is the process?	**Weighted Total**
Electricity, SERC	US-SERC: market for electricity, low voltage (ecoinvent)	2	3	2	3	1	1	1	1	1	2	2	1	1	1	5	**1.9**
Electricity, MX	MX: market for electricity, low voltage (ecoinvent)	2	3	2	3	1	1	1	1	1	1	2	1	1	1	5	**1.9**
Electricity, US-WECC	US-WECC: market for electricity, low voltage (ecoinvent)	2	3	2	3	1	1	1	1	1	2	2	1	1	1	5	**1.9**
Electricity, US-MRO	US-MRO: market for electricity, low voltage (ecoinvent)	2	3	2	3	1	1	1	1	1	2	2	1	1	1	5	**1.9**
Propane	GLO: market for propane, burned in building machine (ecoinvent)	2	3	2	3	5	1	1	1	1	3	4	1	1	5	5	**3.0**
Gasoline	GLO: market for petrol, unleaded, burned in machinery (ecoinvent)	2	3	2	3	5	1	1	1	1	3	4	1	1	5	5	**3.0**

		Reliability				Data Collection Methods		Time period			Geography		Technology		Process Review	Process Completeness	
Input/Output	**Dataset**	Is the inventory data checked for mass/ energy balance, recalculation etc.?	What is the status quo for the ownership and continuous support of data?	Is the data regularly updated?	Is the data of deterministic nature or are there statistically established confidence intervals stated for the data?	How representative is the data of the market?	How compatible is the life-cycle inventory data with TRACI 2.1 impact assessment method from LCA Commons?	Does the data capture seasonal variations?	How well is the time period the data correlated with the data quality objective?	How old is the data at the time of data quality assessment?	How well is the geography of the data correlated with the data quality objective?	What is the regional granularity associated with the data?	How well is the technology of the data correlated with the data quality objective?	How well is the technology of the data described?	How well is the process reviewed?	How complete is the process?	**Weighted Total**
Diesel	GLO: market for diesel, burned in building machine (ecoinvent)	2	3	2	3	5	1	1	1	1	3	4	1	1	5	5	**3.0**
Water (Municipal Supply)	RoW: market for tap water (ecoinvent)	3	3	2	3	5	1	1	1	1	5	5	1	1	1	5	**2.7**
Wastewater to Municipal Treatment	RoW: treatment of wastewater, average, wastewater treatment (ecoinvent)	4	3	2	3	5	1	1	1	1	5	5	1	1	5	5	**3.3**
Oil and coolant waste to landfill	RoW: treatment of waste bitumen, sanitary landfill (ecoinvent)	4	3	2	3	5	1	1	1	1	5	5	2	1	1	5	**2.8**
Trash to landfill	RoW: treatment of municipal solid waste, sanitary landfill (ecoinvent)	4	3	2	3	5	1	1	1	1	5	5	2	1	2	5	**2.9**
Wood waste to landfill	RoW: treatment of waste wood, untreated, sanitary landfill (ecoinvent)	4	3	2	3	5	1	1	1	1	5	5	2	1	5	5	**3.4**