



Environmental Product Declaration

Program Operator: Smart EPD®

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IN ACCORDANCE WITH ISO 14025:2006 AND EN
15804:2012+A2:2019/AC:2021



Humanscale

SmartEPD-2026-107-1065-01

Liberty APAC

Date of Issue

Sep 21, 2026

Expiration Date

Sep 21, 2031

Last Updated

Sep 21, 2026



Refer to the EPD Library at www.smartepd.com for the latest EPD listing information

General Information

Humanscale

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Product Name:	Liberty APAC
Functional Unit:	1 unit of seating
Declaration Number:	SmartEPD-2026-107-1065-01
Date of Issue:	September 21, 2026
Expiration:	September 21, 2031
Last updated:	September 21, 2026
EPD Scope:	Cradle to gate with other options A1 - A3, A4, A5, C1 - C4, D
Market(s) of Applicability:	Australia

General Organization Information

Humanscale was founded in 1983 by CEO Bob King with a focus on high-performance tools that support a healthy, more active way of working. Humanscale is now a global ergonomics and furniture leader with a reputation for designing intuitive products which improve the comfort and health of office workers. Humanscale's global headquarters is located in New York, NY and the company has offices and manufacturing throughout North America, Latin America & The Caribbean, Europe, Asia Pacific, Oceania, The Middle East and Africa.

Company: Humanscale

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Limitations, Liability and Ownership

In conducting a comprehensive Life Cycle Assessment (LCA) for the assessed product/system, it is imperative to recognize and acknowledge certain inherent assumptions and limitations that shape the scope, boundaries, and precision of this environmental evaluation. As such, the following assumptions and limitations are fundamental to the modeling and interpretation of results, providing necessary context for stakeholders and decision-makers:

- The results and conclusions presented in this report are valid only within the defined scope of the study. The study was conducted in September 2026, using data representative of the annual period of 2025.
- LCA is a method used to assess potential rather than actual impacts. Consistent with our goal and scope, we obtained primary data for the final manufacturing step, and used secondary data for the background processes including the supply chain processes.
- 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.
- As stated in ISO 14044, it should be noted that LCA shall not be the sole basis for making comparative assertions. Other social, economic and environmental aspects should also be considered.

- Comparability of EPDs is limited to those applying a functional unit.

Reference Standards

Standard(s):	ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021
Core PCR:	EPD Norge Part A: Construction Products and Services v.2 Date of issue: March 24, 2021
Sub-category PCR:	EPD Norge Product Category Rules NPCR 026 Part B for Furniture and Components of Furniture v.3.0 Date of issue: October 09, 2024 Valid until: October 09, 2027
Sub-category PCR review panel:	 Contact Smart EPD for more information.
General Program Instructions:	 Smart EPD General Program Instructions v.2.0, March 2025

Verification Information

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Verification:	Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071:  Jack Geibig  Ecoform, LLC  jgeibig@ecoform.com Independent external verification of EPD, according to ISO 14025 and reference PCR(s):  Jack Geibig  Ecoform, LLC  jgeibig@ecoform.com

External

External

Product Information

Functional Unit:	1 unit of seating
Mass:	13.47 kg
Reference Service Life:	15 Years
Product Specificity:	 Product Average  Product Specific

Product Description

With a minimal aesthetic that complements any space, the Liberty chair is the ideal seating solution for the modern work environment. With advanced features, including automatic, weight-sensitive recline, arm rests that are attached to the back of the chair for constant support and an innovative tri-panel

mesh backrest, Liberty combines performance, simplicity and beauty. With fewer parts than traditional task chairs, Liberty is a timeless and environmentally friendly design.

Product Specifications

Product SKU(s): L113BM10FT10XFSHNSC
 Product Classification Codes: UNCPC - 3811
 EC3 - Furnishings -> Chairs
 Options: ✓ Indoor seating

Table 1. Material Composition

Material/Component Category	Origin	% Mass of product	Post-consumer %	Post-consumer weight (kg)	Pre-consumer %	Pre-consumer weight (kg)	Mass (kg)
STEEL - (LOW-ALLOYED)	Various	22.24	5.4	0.16	38.6	1.16	2.996
BRASS	Various	0.14	0.0	0.00	0.0	0.00	0.019
NYLON 6, GLASS-FILLED	Various	10.78	0.0	0.00	0.0	0.00	1.452
POLYETHYLENE (PE)	Various	0.22	0.0	0.00	0.0	0.00	0.030
NYLON 6	Various	11.99	5.1	0.08	0.0	0.00	1.616
POLYPROPYLENE	Various	8.54	0.0	0.00	0.0	0.00	1.150
POLYURETHANE FLEXIBLE FOAM	Various	0.48	0.0	0.00	0.0	0.00	0.064
POLYURETHANE	Various	1.52	0.0	0.00	0.0	0.00	0.204
ALUMINUM	Various	30.66	0.0	0.00	100.0	4.13	4.129
THERMOPLASTIC VULCANIZATES (TPV)	Various	0.06	0.0	0.00	0.0	0.00	0.008
POWDER COATING (ZINC PLATING)	Various	0.85	0.0	0.00	0.0	0.00	0.115
LUBRICATING OIL	Various	0.03	0.0	0.00	0.0	0.00	0.004
NITRILE BUTADIENE RUBBER (NBR)	Various	0.06	0.0	0.00	0.0	0.00	0.008

Material/Component Category	Origin	% Mass of product	Post-consumer %	Post-consumer weight (kg)	Pre-consumer %	Pre-consumer weight (kg)	Mass (kg)
NYLON 6-6	Various	0.04	0.0	0.00	0.0	0.00	0.006
PHENOLIC RESIN	Various	0.02	0.0	0.00	0.0	0.00	0.003
POLYOXYMETHYLENE (POM)	Various	0.76	0.0	0.00	0.0	0.00	0.103
POLYURETHANE, RIGID FOAM	Various	5.34	0.0	0.00	0.0	0.00	0.720
POLYMERIC MATERIAL, 82% POLYESTER 18% NYLON	Various	0.74	0.0	0.00	0.0	0.00	0.100
THERMOPLASTIC ELASTOMER (TPE)	Various	0.02	0.0	0.00	0.0	0.00	0.003
BRONZE	Various	0.01	0.0	0.00	0.0	0.00	0.002
POLYSTYRENE, GENERAL PURPOSE	Various	5.49	0.0	0.00	0.0	0.00	0.740
POLYETHYLENE, HIGH DENSITY	Various	0.00	0.0	0.00	0.0	0.00	0.000
ZINC	Various	0.00	0.0	0.00	0.0	0.00	0.000
POLYVINYL CHLORIDE (PVC)	Various	0.01	0.0	0.00	0.0	0.00	0.001
Total	None	100.00	None	None	None	None	13.474

Packaging Material	Origin	kg Mass
FOLDING BOXBOARD CARTON	China	5.397
PACKAGING FILM, LOW DENSITY POLYETHYLENE	China	0.0519
POLYETHYLENE, LOW DENSITY	Seoul, South Korea	0.0007

Biogenic Carbon Content	kg C per unit
Biogenic carbon content in product	0
Biogenic carbon content in accompanying packaging	2.375

Hazardous Materials

This product contains no substances required to be reported as hazardous to human health or the environment.

EPD Data Specificity

- Primary Data Year:2025
- Manufacturing Specificity:
 - ✗ Industry Average
 - ✗ Manufacturer Average
 - ✓ Facility Specific

Averaging:
Averaging was not conducted for this EPD. This EPD is product specific.

Table 2. System Boundary

Production	A1	Raw material supply	✓
	A2	Transport	✓
	A3	Manufacturing	✓
Construction	A4	Transport to site	✓
	A5	Assembly / Install	✓
Use	B1	Use	MND
	B2	Maintenance	MND
	B3	Repair	MND
	B4	Replacement	MND
	B5	Refurbishment	MND
	B6	Operational Energy Use	MND
	B7	Operational Water Use	MND
End of Life	C1	Deconstruction	✓
	C2	Transport	✓
	C3	Waste Processing	✓
	C4	Disposal	✓

Benefits & Loads Beyond System Boundary	D	Recycling, Reuse Recovery Potential	✓
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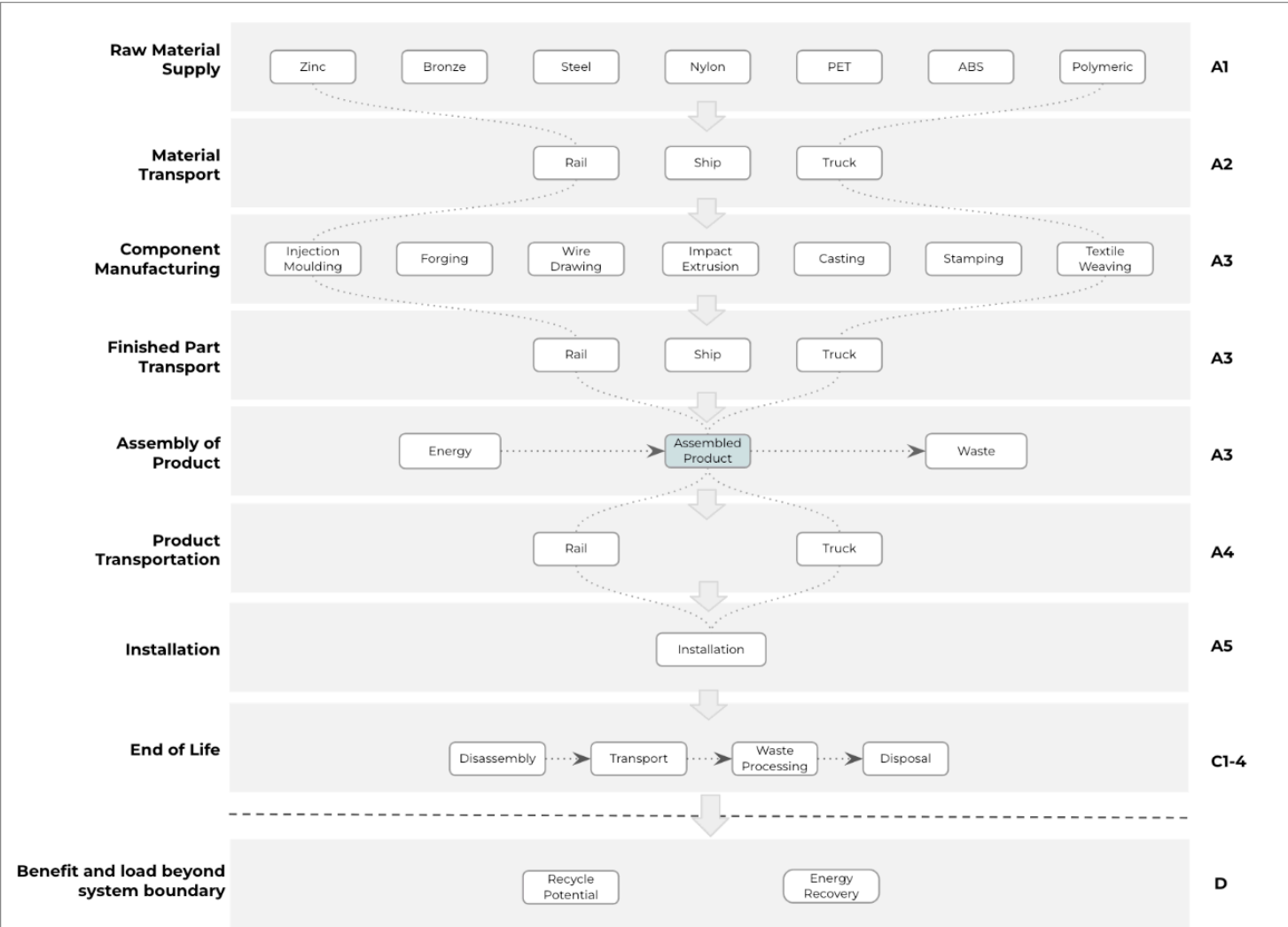
Note:

MND = Module not declared

Plants

 Humanscale Zhejiang Zhejiang, China

Product Flow Diagram



The following is a description of the typical scenario. For additional detail on the processes taking place during each reported information module, please see Module Descriptions:

- The Liberty APAC is produced from a combination of materials specified in the materials declaration (Section 4.2). Both virgin and recycled materials are used.
- These raw and semi-finished materials are transported by land and sea to supplier manufacturing sites. At the supplier manufacturer's facilities, components are shaped, molded, welded, cut, and assembled into subassemblies.
- These components are then shipped to the final manufacturer assembly facility in Jiaxing Shi, Zhejiang, China, where they are assembled into the final product and prepared for shipping. Final assembly includes finishing, quality inspection, and packaging with cardboard and protective wrap.
- From this location, the product is distributed to customers primarily in Australia by ship and truck and installed with minimal effort, generating primarily packaging waste which is disposed of by the consumer using conventional disposal practices.
- During its 15 year service life, the Office Chairs requires no energy inputs, as it contains no electrical components, and is designed for long-term use consistent with commercial office furniture.
- At end-of-life, Office Chairs is typically disassembled and disposed of in landfill, recycled or incinerated.

Software And Database

LCA Software:

Carbon Bright v. 1.2.2

LCI Foreground Database(s):

Ecoinvent v. 3.11 | Allocation, cut-off, EN15804

LCI Background Database(s):

Ecoinvent v. 3.11 | Allocation, cut-off, EN15804

A foreground LCI database is the database used to model the primary, site-specific data collected for this EPD. A background LCI database is the database used to model generic or non-specific data.

Data Quality

The data used to create the inventory model is intended to be as precise, complete, consistent, and representative as possible with regards to the goal and scope of the study under given time and budget constraints.

Geographical Coverage

From a geographical perspective, an individual model has been developed to accurately represent the environmental impacts associated with material sourcing, supply chain logistics and final assembly. The study considers regional energy grids, transportation modes/distances, and primary data relevant to assembly location energy use. Overall, the geographical representativeness is considered to be of good quality.

Time Coverage

The study reflects the current conditions, using primary data from 2025, the reporting year supplied for this EPD data package. All secondary data are derived from sources developed within the last 10 years, as required by the PCR. Overall the time coverage of the data for this EPD is considered good.

Technical Coverage

From a technical perspective, primary data is being used from the Manufacturer's BOM to reflect material sourcing characteristics, including production processes relevant to various components. Primary data is from the calendar year (2025), is site-specific and considered of good quality. For secondary data, we use the Ecoinvent database, v3.11. released on 20 November 2024. Proxy data was used only when secondary data was not available and was used for less than 1% of materials. Secondary data quality is considered good.

Overall, the data quality for this study is considered high, reliable, and fit for purpose. It is also deemed sufficient to meet the requirements of the applicable PCR and EN15804, ensuring representativeness and robustness for EPD verification.

Life Cycle Module Description

A1: Raw Material Extraction

This stage covers raw material extraction and initial processing, including processing of secondary materials such as recycled inputs. All source data analyzed in this section comes from primary data reported in the Manufacturer's Bill of Materials. Emission factors were inventoried and allocated to account for the production of these materials. Where specific emission factors were unavailable, suitable substitutes from recognized databases were applied, with all sources referenced.

A2: Transport to Manufacturer

This stage covers the transportation of all materials from their respective processing sites to the manufacturing facility. Transport modes (e.g., truck, rail, ship), distances, and fuel types are modeled using primary supplier source locations. The model accounts for both inbound delivery and empty return trips in order to capture the full environmental burden of logistics.

A3: Manufacturing, Assembly & Packaging

This stage covers all manufacturing and assembly processes, including shaping, forming, machining, joining, finishing, and packaging of the product. On-site energy consumption and emissions associated with production activities are included. Waste and scrap generated at the manufacturer's facilities is based on primary data, while waste treatment and destination parameters not available from primary sources are represented through secondary datasets. No co-products are modeled in this stage.

A4: Transport to Site

This stage accounts for the transportation of the finished product from the manufacturing facility to the point of installation or customer location.

A5: Installation

Module A5 includes only the treatment of transport packaging waste occurring at delivery/installation (e.g., collection and recycling/incineration/landfilling of cardboard, plastic film). For this product, installation is assumed to be manual, requiring negligible energy or water use.

The environmental burdens of packaging production are included in A1–A3; A5 covers only end-of-life treatment of this packaging at the point of installation.

B1 - B7: Use Phase

Modules B1–B7 (Use Stage) have been excluded from the system boundary. Use (B1) is excluded from the impact results as the product is certified with SCS Indoor Advantage Gold, confirming it meets strict low-emission requirements. The declared product is a non-electric, passive furniture product (Office Chairs) that does not require operational energy (B6) or water (B7) during its service life. Maintenance (B2), Repair (B3), Replacement (B4), and Refurbishment (B5) are not declared as they are considered optional for this EPD type the PCRs.

C1: Deconstruction

Module C1 covers the dismantling of the product. The product is assumed to be dismantled manually by the end-user using hand tools. As such, the environmental impact of this process is assumed to be zero.

C2: Transport to Waste Processing

This stage accounts for transportation of the product or its components from the site of deconstruction to a waste processing, recycling, recovery, or disposal facility. Transport distances are modeled based on typical distances for transport to waste processing facilities in Australia, as per Transport for NSW Carbon Estimate and Reporting Tool (CERT) Manual

C3: Waste Processing for Recovery/Recycling

This stage covers processing activities that prepare product components for reuse, recycling, or energy recovery. It includes shredding, sorting, cleaning, and other treatment processes. The amount of each material in the product that is assumed to be recycled, is determined by multiplying the typical disposal ratio within Australia, by the amount of each homogenous material type that is able to be disassembled. No energy recovery is accounted for in this module.

C4: Disposal

This stage accounts for final disposal of product components that are not reused, recycled, or recovered. The amount of each material in the product that is assumed to be disposed, is determined by multiplying the typical disposal ratio within Australia, by the amount of each homogenous material type that is able to be disassembled.

D: Benefit and Load Beyond System Boundary

In accordance with EN 15804+A2 Section 6.3.5.6, this module includes:

- Reuse, recovery and/or recycling potentials, expressed as net impacts and benefits.
- Potential benefits or avoided loads from secondary materials, secondary fuels, or recovered energy leaving the product system.
- In accordance with EN 15804:A2, these benefits and loads are calculated based on the net output flow of materials and energy crossing the system boundary. Net output flow is determined as total outputs minus total inputs of the same secondary material/fuel/recovered energy across the declared modules (i.e., including A1–A3 for production-stage inputs of recycled content, and A5 and C1–C4 for end-of-life outputs).

The calculation of these benefits relies on the following methodological assumptions and data sources:

Material Recycling (Avoided Material Production)

The benefit of recycling is modeled as the avoided production of virgin materials. To ensure the calculation reflects technical realities and market quality, the following parameters were applied:

- Quality Ratios: To account for downcycling or quality loss during reprocessing, quality correction factors of 100% for metals, 90% for plastics and 85% for paper were applied using default values from the European Commission – Joint Research Centre (2020), Annex C [13].

- **Recycling Yields:** The process efficiency and yield rates for recycling operations were derived from Cui and Sošić (2019) [15]. Data specifically representing California was utilized as a proxy for Australia due to comparable technological maturity in waste management infrastructure. Based on this the following efficiency rates are used : 98% for metals, 70% for plastics, 60% for paper, 85% for glass.

Energy Recovery (Avoided Energy Production)

For materials sent to incineration with energy recovery, the potential benefit is calculated based on the displacement of grid electricity and thermal energy production.

- **Incineration Efficiency:** The specific output ratios of heat and electricity generated per kilogram of waste were derived directly from the Ecoinvent v3.11 documentation for the specific incineration activity processes used in Module C3.
- **Substituted Energy:** The avoided environmental burden is calculated by substituting the following background datasets from Ecoinvent v3.11:
- **Electricity:** Displaces "market for electricity, medium voltage".
- **Thermal Energy:** Displaces "market for heat, district or industrial, other than natural gas".

The environmental burdens associated with the incineration processes themselves (combustion, flue gas treatment, ash management) are included in Modules C3–C4; Module D only reports the net avoided burdens from displaced grid electricity and district/industrial heat.

Materials that are landfilled without subsequent energy recovery do not generate benefits in Module D; their associated emissions are fully accounted for in Module C4.

LCA Discussion

Allocation Procedure

The product system as described contained several multi-product processes, which required an allocation of resources and emissions.

- For primary data, economic allocation was used to model waste and energy inputs.
- The annual energy and waste totals were divided by the total economic value of all products produced in the Jiaxing Shi, China facility during the most recent calendar year to proportionately allocate waste and energy. For background processes the Ecoinvent database, v3.11 was used, which implements an attributional modeling approach.
- In accordance with EN 15804 Section 6.3.5.2, production residues leaving the product system (A1-A3) that have reached the end-of-waste state (e.g., metal scrap) are classified as co-products. Allocation of burdens to these co-products was based on economic value. Due to the low economic value of the scrap relative to the primary product (contributing less than 1% to the overall revenue), zero environmental burden has been allocated to these co-product flows. Consequently, and in compliance with EN 15804 Section 6.3.5.6, no benefits or loads associated with these allocated co-products are declared in Module D.
- End-of-life processes (modules C1 – C4) and associated recycling and recovery flows are modelled according to EN 15804+A2, NPCR Part A, and NPCR 026. Consistent with the "polluter pays" principle, all waste treatment operations (including recycling, incineration with energy recovery, and landfill) bear their respective gross environmental burdens within modules C3 and C4 without netting out energy credits. Materials leaving the system for recycling are reported as secondary material outputs and do not carry environmental credits within modules A1 – C4. Benefits from exported energy (e.g., from landfill gas capture or incineration) are calculated as substituted energy and reported separately in Module D.

Cut-off Procedure

Cut-off Procedure

This LCA follows the cut-off rules specified in the NPCR 026 Part B for Furniture and components of Furniture PCR for Office Chairs. Flows may only be omitted if they collectively account for no more than 5% of the total mass, energy, or environmental impact of the system, and any single flow does not exceed 1% of total mass input or 1% of total renewable or non-renewable primary energy use. All material and energy flows known to have the potential to cause significant emissions into air and water or soil related to the environmental indicators of this standard have been included.

In this study, Humanscale has attempted to include all relevant inputs; where data gaps existed, they were due to data quality limitations, and their exclusion is within the allowable PCR thresholds. Capital goods (machinery and buildings), personnel activities (such as travel and commuting), and services from the technosphere (such as internet and general office administration) for the foreground manufacturing process (A3) have been excluded. These exclusions are justified as these inputs, when annualised and allocated to the declared unit, are estimated to contribute less than 1% of the total mass and primary energy

usage, and less than 5% of the total environmental impact of the product system. Furthermore, installation (A5) is manual and does not require significant personnel travel directly related to the provision of the declared unit.

Renewable Electricity

Energy Attribute Certificates (EACs) such as Renewable Energy Certificates (RECs) or Power Purchase Agreements (PPAs) are included in the baseline reported results: ✗ No

Scenarios

Transport to the building/construction site (A4)

A4 Module

Fuel Type:	Diesel
Liters of Fuel:	See Assumption Comment I/100km
Vehicle Type:	Fleet Average Lorry Class
Transport Distance:	2718 km by Truck, 11406 km by Container Ship km
Capacity Utilization:	Average Load Factor including empty return trips (modeled by Ecoinvent) %
Packaging Mass:	5.450 kg
Weight of products transported:	13.473 kg
Capacity utilization volume factor:	=1
Assumptions for scenario development:	The distribution of product from the manufacturing gate to the construction site is calculated using one or more modes of transportation based on land and sea transportation routes between the factory location and Australia's capital as a conservative estimate for transport within APAC region. Liters of Fuel, and Capacity utilization are not reported separately because this is modeled using the Ecoinvent transport service dataset "market for transport, freight, lorry, unspecified", in which fuel consumption, load factor, and empty returns are embedded in the background model.

Installation in to the building/construction site (A5)

A5 Module

Mass of Packaging Waste Specified by Type:	5.397 FOLDING BOXBOARD CARTON, 0.0519 PACKAGING FILM, LOW DENSITY POLYETHYLENE, 0.0007 POLYETHYLENE, LOW DENSITY kg
Biogenic Carbon Contained in Packaging (kg C):	2.37 kg
Assumptions for scenario development:	For this product, installation is assumed to be manual, requiring negligible energy, water or other material use. This module covers end-of-life treatment of this packaging at the point of installation.

End of Life (C1 - C4)

C1 - C4 Modules

Recovery

Recycling:	7.129 kg
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Landfill:	6.281 kg
Incineration with Energy Recovery:	0.063 kg

Assumptions for scenario development:

In module C2, Transport distances are modeled based on typical distances for transport to waste processing facilities in Australia , as per Transport for NSW Carbon Estimate and Reporting Tool (CERT) Manual The amount of each material in the product that is assumed to be recycled, incinerated with energy recovery or landfilled is determined by multiplying the typical ratio within Australia, by the amount of each homogenous material type that is able to be disassembled. This is based on National Waste and Resource Recovery Report 2024. Benefits of energy recovery are not accounted for in these modules.

Reuse, Recovery and / or Recycling Potentials & Relevant Scenario Information (D)

D Module

Recycling Rate of Product:	52.9 %
Recycled Content of Product:	41.04 %
Net Energy Benefit from Energy Recovery from Waste Treatment Declared as Export Energy in C3:	2.56 MJ
Process and Conversion Efficiencies:	Material Recycling: Quality Ratios: To account for downcycling or quality loss during reprocessing, quality correction factors were applied using default values from the European Commission – Joint Research Centre (2020), Annex C [13]. Recycling Yields: The process efficiency and yield rates for recycling operations were derived from Cui and Sošić (2019) [15]. Data specifically representing California was utilized as a proxy for Australia due to comparable technological maturity in waste management infrastructure. Based on this the following efficiency rates are used: 98% for metals, 70% for plastics, 60% for paper, 85% for glass. Energy Recovery: Incineration Efficiency: The specific output ratios of heat and electricity generated per kilogram of waste were derived directly from the Ecoinvent v3.11 documentation for the specific incineration activity processes used in Module C3. Substituted Energy: The avoided environmental burden is calculated by substituting the following background datasets from Ecoinvent v3.11: Electricity: Displaces "market for electricity, medium voltage". Thermal Energy: Displaces "market for heat, district or industrial, other than natural gas".

Results

Table 3. Environmental Impact Assessment Results

EN15804+A2 - Core impact categories and indicators

per 1 unit of product of seating.

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

Impact Category	Unit	Method	A1 - A3	A4	A5	C1	C2	C3	C4	D
climate change: total (EF v3.1 - IPCC 2021)	kg CO2-Eq	EN15804+A2 - Core impact categories and indicators	8.42e+1	1.05e+1	1.35e+1	0	2.82e-1	6.52e-1	5.61e-1	2.66e+0
climate change: fossil (EF v3.1 - IPCC 2021)	kg CO2-Eq	EN15804+A2 - Core impact categories and indicators	9.26e+1	1.05e+1	2.27e-1	0	2.82e-1	5.97e-1	5.61e-1	2.66e+0
climate change: biogenic (EF v3.1 - IPCC 2021)	kg CO2-Eq	EN15804+A2 - Core impact categories and indicators	-8.71e+0	0	8.71e+0	0	0	0	0	0
climate change: land use and land use change (EF v3.1 - IPCC 2021)	kg CO2-Eq	EN15804+A2 - Core impact categories and indicators	3.04e-1	5.02e-3	1.45e-4	0	1.31e-4	6.01e-4	4.81e-5	-1.55e-3
climate change: total excluding biogenic (EF v3.1 - IPCC 2021)	kg CO2 eq	EN15804+A2 - Core impact categories and indicators	9.29e+1	1.05e+1	4.76e+0	0	2.82e-1	6.52e-1	5.61e-1	2.66e+0
ozone depletion	kg CFC-11-Eq	EN15804+A2 - Core impact categories and indicators	2.31e-6	1.41e-7	2.67e-9	0	3.74e-9	4.12e-9	1.73e-9	-5.95e-7
acidification	mol H+-Eq	EN15804+A2 - Core impact categories and indicators	5.58e-1	1.03e-1	1.40e-3	0	1.29e-3	2.16e-3	5.01e-4	4.49e-2
eutrophication: freshwater	kg P-Eq	EN15804+A2 - Core impact categories and indicators	2.93e-2	9.96e-4	3.95e-5	0	3.12e-5	1.28e-4	8.26e-6	2.26e-3
eutrophication: freshwater	kg PO4 eq	EN15804+A2 - Core impact categories and indicators	8.97e-2	3.05e-3	1.21e-4	0	9.58e-5	3.91e-4	2.53e-5	6.92e-3
eutrophication: marine	kg N-Eq	EN15804+A2 - Core impact categories and indicators	1.11e-1	3.01e-2	2.00e-3	0	4.76e-4	2.54e-3	2.35e-2	4.86e-3

Impact Category	Unit	Method	A1 - A3	A4	A5	C1	C2	C3	C4	D
eutrophication: terrestrial	mol H+-Eq	EN15804+A2 - Core impact categories and indicators	1.05e+0	3.32e-1	4.33e-3	0	5.19e-3	9.68e-3	2.06e-3	4.78e-2
material resources: metals/minerals	kg Sb-Eq	EN15804+A2 - Core impact categories and indicators	2.08e-3	2.95e-5	1.11e-6	0	9.27e-7	1.46e-6	1.35e-7	-6.94e-5
water use	m3 world Eq deprived	EN15804+A2 - Core impact categories and indicators	3.27e+1	7.30e-1	7.29e-2	0	2.22e-2	1.30e-1	6.76e-2	-6.68e-1

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particulate Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

Disclaimer: The results of the following environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator:

- ADP-Fossil: Abiotic depletion potential for fossil resources
- ADP-Minerals&Metals: Abiotic depletion potential for non-fossil resources
- WDP: Water deprivation potential

The following indicators are Not Declared:

- Land Use
- PM = Particulate Matter Emissions
- IRP = Ionizing radiation, human health
- ETP-fw = Eco-toxicity (freshwater)
- HTP-c = Human toxicity (cancer)
- HTP-nc = Human toxicity (non-cancer)

Table 4. Resource Use Indicator

per 1 unit of product of seating.

Indicator	Unit	A1 - A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	1.26e+1	1.88e+0	0	0	5.69e-2	4.83e-1	2.36e-2	-1.24e-1
PERM	MJ	8.38e+1	0	9.08e+1	0	0	0	0	-6.52e-1
PERT	MJ	9.63e+1	1.88e+0	9.91e-2	0	5.69e-2	4.83e-1	2.36e-2	-7.77e-1
PENRE	MJ	1.03e+3	1.44e+2	7.80e-1	0	3.97e+0	-2.54e+1	-1.98e+2	1.21e+1
PENRM	MJ	2.24e+2	0	2.08e+0	0	0	2.96e+1	2.00e+2	5.15e-1
PENRT	MJ	1.25e+3	1.44e+2	2.86e+0	0	3.97e+0	4.16e+0	1.54e+0	1.26e+1
SM	kg	1.04e+1	0	0	0	0	0	0	0
RSF	MJ	7.21e-1	6.86e-4	2.12e-5	0	2.24e-5	5.90e-5	1.03e-5	-2.26e-3
NRSF	MJ	0	0	0	0	0	0	0	0
FW	m3	7.52e-1	1.82e-2	-8.28e-3	0	5.60e-4	2.81e-3	-2.17e-2	-7.00e-2

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPRRT or PENRT = Total non-renewable primary resources with energy content, SM = Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

Table 5. Waste and Output Flow Indicators

per 1 unit of product of seating.

Indicator	Unit	A1 - A3	A4	A5	C1	C2	C3	C4	D
EEE	MJ	0	0	1.72e-5	0	0	1.02e-4	0	0
EET	MJ	0	0	2.77e-5	0	0	4.20e-5	0	0
MER	kg	0	0	2.97e-1	0	0	6.35e-2	0	0
MFR	kg	7.54e-1	0	2.72e+0	0	0	7.13e+0	0	0
MNER	kg	0	0	0	0	0	0	0	0
HWD	kg	0	0	0	0	0	0	0	0
HLRW	kg	1.90e-4	7.92e-6	3.86e-7	0	2.41e-7	2.74e-6	1.04e-7	2.26e-5
ILLRW	kg	4.68e-4	1.91e-5	9.05e-7	0	5.81e-7	9.28e-6	2.60e-7	6.13e-5
NHWD	kg	0	0	2.43e+0	0	0	0	6.28e+0	0
RWD	kg	6.58e-4	2.70e-5	1.29e-6	0	8.22e-7	1.20e-5	3.64e-7	8.39e-5
CRU	kg	0	0	0	0	0	0	0	0

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

Table 6. Carbon Emissions and Removals

per 1 unit of product of seating.

Indicator	Unit	A1 - A3	A4	A5	C1	C2	C3	C4	D
Biogenic CO2, packaging	kg CO2	-8.71e+0	0	8.71e+0	0	0	0	0	0
Biogenic CO2, products	kg CO2	0	0	0	0	0	0	0	0

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

BCRP = Biogenic Carbon Removal from Product, BCEP = Biogenic Carbon Emission from Product, BCRK = Biogenic Carbon Removal from Packaging, BCEK = Biogenic Carbon Emission from Packaging, BCEW = Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes, CCE = Calcination Carbon Emissions, CCR = Carbonation Carbon Removals, CWNR = Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes, GWP-luc = Carbon Emissions from Land-use Change.

Interpretation

The Life Cycle Impact Assessment of Liberty APAC offers a rigorous evaluation of its environmental footprint across key indicators—greenhouse gas emissions, energy use, and water depletion. The analysis reflects decisions already made during the design and development process to prioritize materials and manufacturing methods that align with sustainability objectives—balancing product performance with environmental responsibility.

Key Contributors to the environmental impact include the following:

- Carbon Footprint: The top 3 activities contributing to carbon footprint (IPCC AR6 GWP100 total) are nylon 6 production (13.7%), nylon 6 production, glass-filled (10.0%), market for transport, freight, lorry, unspecified (9.2%).
- Energy Use: The top 3 activities contributing to non-renewable primary energy use are market for transport, freight, lorry, unspecified (14.8%), nylon 6 production (14.3%), nylon 6 production, glass-filled (10.7%).
- Water Use: The top 3 activities contributing to fresh water use are nylon 6 production, glass-filled (22.5%), nylon 6 production (15.0%), treatment of aluminium scrap, new, at remelter (12.1%).



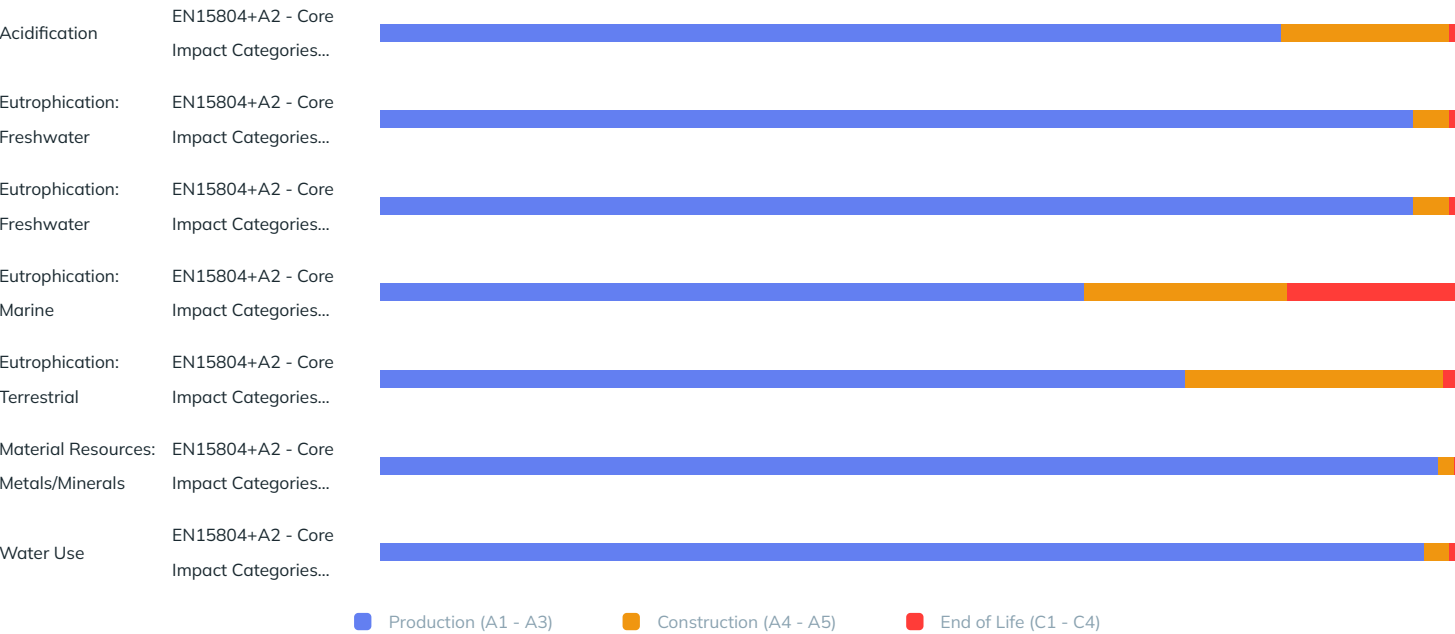


Table 7. Environmental Activities and Certifications

Certification
Humanscale BEAM (decommissioning) Program
Living Product Challenge (LPC)
SCS Indoor Advantage Gold
Declare LBC Red List Free
ANSI/BIFMA X5.1 Compliant
AFRDI Green Tick certification

Further Information

Key Environmental Indicators

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWPTotal	kg CO2-Eq	8.42e+01	1.05e+01	1.35e+01	0.00e+00	2.82e-01	6.52e-01	5.61e-01	2.66e+00
Total energy	MJ	1.04e+03	1.45e+02	7.80e-01	0.00e+00	4.02e+00	-2.49e+01	-1.98e+02	1.20e+01
Amount of recycled materials	%	41	ND	ND	ND	ND	ND	ND	ND



Greenhouse gas emissions from the use of electricity in the manufacturing phase

Electricity Mix	Data Source	Amount	Unit
Electricity, China (kWh)	Ecoinvent 3.11	0.847	kg CO2e/kWh

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