artek

VERIFIED by SCS Global Services
ENVIRONMENTAL PRODUCT DECLARATION
BASED ON LCA

Declaration Owner

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Product

Chair K65

(UNSPSC Class Code 56101504)

Functional Unit

The functional unit is one chair serving the function of seating in the home or the office for a 15-year period. The reference unit used in the study is one complete chair.

EPD Number and Period of Validity

SCS-EPD-10265
EPD Valid September 30, 2024, through September 29, 2029
Version Date: April 14, 2025

Product Category Rule

Product Category Rule for Furniture. Product Category Classification: NPCR 026. EPD Norge®. Version 2.0. September 2022

Program Operator

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SCSglobal SERVICES

Declaration Owner:	Artek oy ab
Address:	Mannerheimintie 12B, 00100 Helsinki, Finland
Declaration Number:	SCS-EPD-10265
Declaration Validity Period:	September 30, 2024 through September 29, 2029
Version:	April 14, 2025
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Gerard Mansell, Ph.D., SCS Global Services
LCA Software and LCI database:	OpenLCA v2.1 software and the Ecoinvent v3.10 database
Product RSL:	15 years
Markets of Applicability:	Global
EPD Type:	Product-Specific
EPD Scope:	Cradle-to-Grave
LCIA Method and Version:	EN 15804:2012+A2:2019 (EF3.1)
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☒ external
LCA Reviewer:	Lindita Bushi, Ph.D., Athena Sustainable Materials Institute
Product Category Rule:	Product Category Rule for Furniture. Product Category Classification: NPCR 026. EPD Norge®. Version 2.0. September 2022.
PCR approved by:	Christofer Skaar, Leader of the Technical Committee, Norwegian EPD Foundation
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Lindita Bushi, Ph.D., Athena Sustainable Materials Institute
Declaration Contents:	

Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and EN 15804+A2.*

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

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

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

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

1. Artek

Artek was founded in Helsinki in 1935 by four young idealists: Alvar and Aino Aalto, Maire Gullichsen, and Nils-Gustav Hahl. Their goal was "to sell furniture and to promote a modern culture of living by exhibitions and other educational means." In keeping with the radical spirit of its founders, Artek today remains an innovative player in the world of modern design, developing new products at the intersection of design, architecture, and art. The Artek collection consists of furniture, lighting, and accessories designed by Finnish masters and leading international designers. It stands for clarity, functionality, and poetic simplicity.

2. Product

2.1 PRODUCT DESCRIPTION

Chair K65

Alvar Aalto's long-legged High Chair K65 is the optimum height for high-top tables and bar counters. Its low seat back offers just the right amount of back support, and its curved rail serves as the perfect foot rest. Part of the L-leg collection and created from the original system of standardised components, High Chair K65 has been serving up style and substance since the 1930s.

2.2 PRODUCT FLOW DIAGRAM

A flow diagram illustrating the production processes and life cycle phases included in the scope of the EPD is presented in Figure 1.

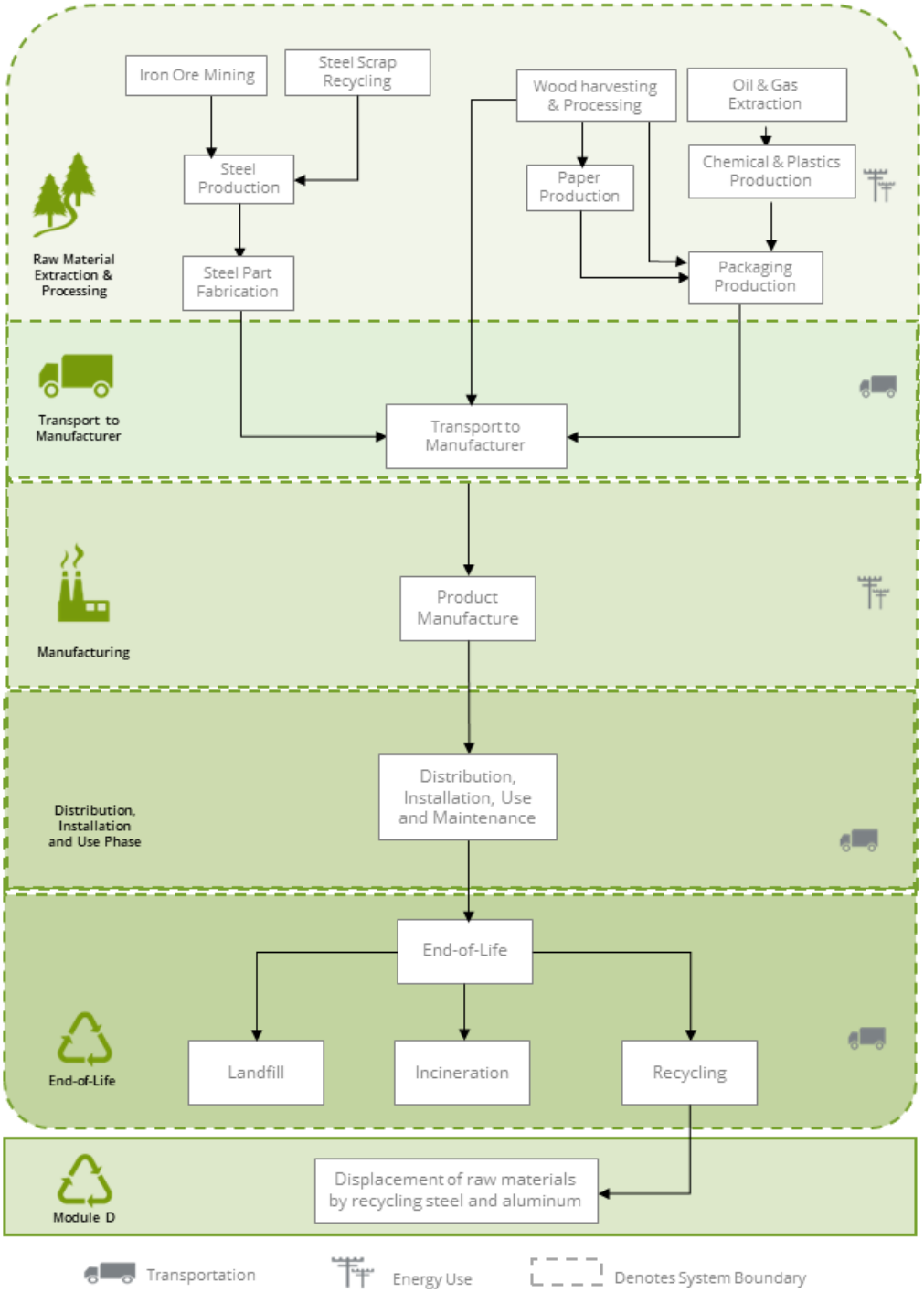

Figure 1. *Flow diagram for the life cycle of the Artek products.*

2.3 APPLICATION

The Artek products are used in public spaces, offices as well as in domestic environments.

2.4 DECLARATION OF METHODOLOGICAL FRAMEWORK

The scope of the EPD is cradle-to-grave, including raw material extraction and processing, transportation, product manufacture, product delivery, installation and use, and product disposal. The LCA is conducted using an attributional approach. The environmental loads and benefits resulting from recyclable materials leaving a product system (Module D) are negligible. The life cycle phases included in the product system boundary are shown below.

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

Table 1. *Life cycle phases included in the product system boundary.*

Product			Construction Process		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

X = included

2.5 TECHNICAL DATA

Technical specifications for the products can be found at the manufacturer's website https://www.artek.fi/en/products

2.6 MARKET PLACEMENT/APPLICATION RULES

The products are distributed to consumer markets globally. Detailed product performance results can be found on the manufacturer's website https://www.artek.fi/en/products.

2.7 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

The products are delivered assembled and wrapped in plastic and corrugate.

2.8 MATERIAL COMPOSITION

The products are manufactured primarily of wood and various hardware.

Table 2. *Material content for the products in kg per unit and percent of total mass.*

Material	Chair K65	
	kg	% mass
Wood	4.06	98%
Steel	7.20×10^{-2}	1.7%
Other	6.00×10^{-3}	0.15%
Total Product	**4.14**	**100%**

Based on a review of the product components provided by the manufacturer, no regulated chemicals, i.e., substances of Very High Concern (SVHC) or substances on the REACH Candidate List, were identified in the product or product components.

2.9 MANUFACTURING

The products are manufactured at Artek's production facility, the a-factory in Finland. The manufacturer provided primary data for their annual production, resource use and electricity consumption and waste generation at the facility.

Electricity consumption is modeled using Ecoinvent datasets for the regional electricity grid for Finland and is accounted for in the A3 stage of the life cycle.

2.10 PACKAGING

The products are packaged for shipment using plastic and corrugated cartons.

Table 3. *Material content for the product packaging in kg per unit.*

Material	Chair K65	
	kg	% mass
Corrugate/Paper	1.16	99%
Plastic	6.00×10^{-3}	0.51%
Total Packaging	**1.17**	**100%**

2.11 PRODUCT INSTALLATION

Installation of the product is accomplished using hand tools with negligible impacts. The impacts associated with packaging disposal are included with the installation phase as per PCR requirements.

2.12 USE CONDITIONS

No special conditions of use are noted.

2.13 REFERENCE SERVICE LIFE

The Reference Service Life (RSL) of the products is 15 years.

2.14 RE-USE PHASE

The products are not reused at end-of-life.

2.15 DISPOSAL

End-of-life assumptions are based on waste disposal statistics for the European Union.

2.16 FURTHER INFORMATION

Further information on the product can be found on the manufacturer's website https://www.artek.fi/en/products.

3. LCA: Calculation Rules

3.1 FUNCTIONAL UNIT

The Artek products serve the function of home or office seating. According to ISO 14044, the functional unit is "the quantified performance of a product system, for use as a reference unit." The functional unit used in the study, consistent with the PCR, is one complete product serving the specified function for a 15-year period. The reference flow for the product system is one complete product with mass as summarized in Table 4.

Table 4. *Reference flow and RSL for the table products.*

Product name	Reference flow (kg)	Reference Service Life – RSL (years)	Total # of Products Modeled
Chair K65	4.14	15	1

3.2 SYSTEM BOUNDARY

The scope of the EPD is cradle-to-grave, including raw material extraction and processing, transportation, product manufacture, product delivery, installation and use, and product disposal. The life cycle phases included in the EPD scope are described in Table 5.

Table 5. *The modules and unit processes included in the scope for the product system.*

Module	Module Description	Unit Processes Included in Scope
A1	Extraction and processing of raw materials; any reuse of products or materials from previous product systems; processing of secondary materials; generation of electricity from primary energy resources; energy, or other, recovery processes from secondary fuels	Extraction and processing of raw materials for the product components.
A2	Transport (to the manufacturer)	Transport of component materials to the manufacturing facilities
A3	Manufacturing, including ancillary material production	Manufacturing of flooring products and packaging (including upstream unit processes*)
A4	Transport (to the building site)	Transport of product (including packaging) to the building site
A5	Construction-installation process	Impacts from the installation of product are assumed negligible with no installation wastage. Only impacts from packaging disposal are included in this stage
B1	Product use	Use of the product in a commercial building setting. There are no associated emissions or impacts from the use of the product
B2	Product maintenance	Impacts associated with product maintenance are negligible.
B3	Product repair	The products are not expected to require repair over their lifetime
B4	Product replacement	The products are not expected to require replacement over their lifetime
B5	Product refurbishment	The product is not expected to require refurbishment over its lifetime
B6	Operational energy use by technical building systems	There is no operational energy use associated with the use of the product
B7	Operational water uses by technical building systems	There is no operational water use associated with the use of the product
C1	Deconstruction, demolition	Demolition of the product is accomplished using hand tools with no associated emissions and negligible impacts
C2	Transport (to waste processing)	Transport of the product to waste treatment at end-of-life
C3	Waste processing for reuse, recovery and/or recycling	The products are disposed of by recycling, landfilling or incineration which require no waste processing
C4	Disposal	Disposal of the product
D	Reuse-recovery-recycling potential	Supplementary information regarding the potential net benefits from material recycling and energy recovery beyond the system boundary.

3.3 PRODUCT SPECIFIC CALCULATION FOR USE PHASE

There are no impacts associated with the use of the products. It is assumed any impacts associated with routine cleaning and maintenance are negligible over the product life cycle. Impacts related to indoor air quality during the product use phase are also negligible.

3.4 UNITS

All data and results are presented using SI units.

3.5 ESTIMATES AND ASSUMPTIONS

- Electricity and resource use Artek's production facility, part of the Vitra group, which is located in Finland and is called: a-factory, were allocated to the product based on the product mass as a fraction of the total facility production volume.
- The Artek products are manufactured at a facility in Finland. Ecoinvent country-specific electricity datasets were used to model electricity and resource use at the production facility in Finland,
- Data for the manufacturing processes to produce many of the steel, aluminum and plastic components of the products were not specifically known. Therefore, average metal working and plastic injection moulding datasets for steel, aluminum and plastic component manufacturing are used.
- Modeling of recycled material follows the recycled content method (also known as 100-0 method or cut-off method) whereby only the burdens of reprocessing the waste material are allocated to the system from the use of the recycled material.
- Impacts from the use phase of the product life cycle are assumed negligible.
- An analysis of impacts to indoor air quality during use of the product was considered outside the scope and was not included.
- For the product end-of-life, including product packaging, recycling rates (Section 2.15) are modeled based on regional data for Europe. These data supply recycling rates for durable goods, as well as for packaging and containers.
- For final disposal of the packaging material and product at end-of-life, all materials are assumed to be transported 161 km by diesel truck to either a landfill, incineration facility, or material reclamation facility (for recycling). Datasets representing disposal in a landfill and waste incineration are from Ecoinvent.

The PCR requires the results for several inventory flows related to construction products to be reported including energy and resource use and waste and outflows. These are aggregated inventory flows, and do not characterize any potential impact; results should be interpreted taking into account this limitation.

3.6 CUT-OFF RULES

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact are included in the inventory. No data gaps were allowed which were expected to significantly affect the outcome of the indicator results. No known flows are deliberately excluded from this EPD.

3.7 DATA SOURCES

Primary data were provided for the manufacturing facility. The sources of secondary LCI data are the Ecoinvent database.

Table 6. *Data sources for the Artek products.*

Component	Dataset	Data Source	Publication Date
PRODUCT			
Steel			
Steel	steel production, converter, low-alloyed | steel, low-alloyed | Cutoff, S/RoW	EI v3.10	2023
Wood			
Hardwood	sawnwood production, hardwood, dried (u=10%), planed | sawnwood, hardwood, dried (u=10%), planed | Cutoff, S/RoW	EI v3.10	2023
Plywood	plywood production | plywood | Cutoff, S/RoW	EI v3.10	2023
Other			
	kraft paper production | kraft paper | Cutoff, S/RoW	EI v3.10	2023
MATERIAL PROCESSING			
\Metal working - Steel	metal working, average for steel product manufacturing | metal working, average for steel product manufacturing | Cutoff, S/RoW	EI v3.10	2023
PACKAGING			
Cardboard/Paper	corrugated board box production | corrugated board box | Cutoff, S/RoW	EI v3.10	2023
	kraft paper production | kraft paper | Cutoff, S/RoW	EI v3.10	2023
Plastic	polyethylene production, low density, granulate | polyethylene, low density, granulate | Cutoff, S/RoW	EI v3.10	2023
TRANSPORT			
Road transport	transport, freight, lorry 16-32 metric ton, EURO4 | transport, freight, lorry 16-32 metric ton, EURO4 | Cutoff, S/RoW	EI v3.10	2023
Rail transport	transport, freight train, diesel | transport, freight train | Cutoff, S/RoW	EI v3.10	2023
Ship transport	transport, freight, sea, container ship | transport, freight, sea, container ship | Cutoff, S/GLO	EI v3.10	2023
RESOURCES			
Grid electricity – Finland[1]	market for electricity, medium voltage | electricity, medium voltage | Cutoff, S/FI	EI v3.10	2023
Heat - biomass	heat production, wood chips from industry, at furnace 50kW | heat, central or small-scale, other than natural gas | Cutoff, S/RoW	EI v3.10	2023
WASTE DISPOSAL			
Landfill	treatment of municipal solid waste, sanitary landfill | municipal solid waste | Cutoff, S/RoW	EI v3.10	2023
Incineration	treatment of municipal solid waste, incineration | municipal solid waste | Cutoff, S/RoW	EI v3.10	2023
Wastewater	treatment of wastewater, average, wastewater treatment | wastewater, average | Cutoff, S/RoW	EI v3.10	2023

[1] The GWP impact of electricity from the Finnish national grid is ~0.1509 kg CO_2e/kWh.

3.8 DATA QUALITY

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

Table 7. *Data quality assessment for the product system.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 5 years old. All of the data used represented an average of at least one year's worth of data collection, and up to three years in some cases. Manufacturer-supplied data (primary data) are based on annual production for 2023.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Electricity use for product manufacture at the facilities in Germany is modeled using representative data for hydroelectricity. Electricity use for product manufacture in Finland and Hungary is modeled using country-specific electricity datasets from Ecoinvent. Surrogate data used in the assessment are representative of global or European operations. Data representative of European operations is considered sufficiently similar to actual processes. Data representing product disposal are based on regional statistics.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative fabrication datasets, specific to the type of material, are used to represent the actual processes, as appropriate.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the furniture products. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used; with a bias towards Ecoinvent v3.10 data where available. Different portions of the product life cycle are equally considered.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at the manufacturing facilities represents an annual average and are considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. For secondary LCI data, Ecoinvent v3.10 LCI data are used.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the products and packaging is low. Actual supplier data for upstream operations were not available and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

3.9 PERIOD UNDER REVIEW

The period of review is calendar year 2023.

3.10 ALLOCATION

Manufacturing resource use was allocated to the products based on mass. Impacts from transportation were attributed to the products based on the mass of material and distance transported.

3.11 COMPARABILITY

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

4. LCA: Scenarios and Additional Technical Information

Delivery and Installation stage (A4 - A5)

Distribution of the products to the point of installation is included in the assessment based on information provided by the manufacturer. Transportation parameters for modeling transport to consumer markets are summarized in Table 8.

Table 8. *Product distribution parameters by transport mode and consumer market.*

Parameter	Unit	Value
Ground transport		
Fuel type	-	Diesel
Liters of fuel	L/100km	18.7
Vehicle type	-	Diesel truck
Transport distance	km	488
Capacity utilization	%	76
Weight of products transported	kg	5.30
Ocean transport		
Fuel type	-	Fuel oil
Liters of fuel	L/tkm	2.23
Vehicle type	-	Ocean freighter
Transport distance	km	4,901
Capacity utilization	%	70
Weight of products transported	kg	5.30

Installation of the product is accomplished using hand tools with no associated emissions and negligible impacts. The impacts associated with packaging disposal are included with the installation phase as per PCR requirements.

Table 9. *Installation parameters for the products.*

Parameter		Value
Ancillary materials		0.00
Net freshwater consumption (m3)		0.00
Electricity consumption (kWh)		0.00
Product loss per functional unit (kg)		0.00
Waste materials generated by product installation (kg)		1.17
Output materials resulting from on-site waste processing (kg)		n/a
Mass of packaging waste (kg)	Corrugate	1.16
	Plastic	6.00×10^{-3}
Biogenic carbon contained in packaging (kg CO2)		2.13
Direct emissions (kg)		0.00

Use stage (B1)

No impacts are associated with the use of the product over the Reference Service Lifetime.

Maintenance stage (B2)

No specific maintenance of the product is identified by the manufacturer. It is assumed any impacts associated with routine cleaning and maintenance are negligible in the LCA model for the product life cycle.

Repair/Refurbishment stage (B3; B5)

Product repair and refurbishment are not relevant during the lifetime of the product.

Replacement stage (B4)

No product replacements are required on the 15 year lifetime of the product.

Building operation stage (B6 – B7)

There is no operational energy or water use associated with the use of the product.

Disposal stage (C1 - C4)

No specific data are available regarding the recycling rate of materials of the Artek products at end-of-life. Assumptions for end-of-life are based on statistics regarding municipal solid waste generation and disposal in the European Union[1,2]. The relevant recycling rates applied to the assessment are summarized in Table 10 while the disposal modeling parameters are presented in Table 11.

Table 10. *Recycling rates for packaging materials at end-of-life.*

Material	Product Recycling Rate (%)	Packaging Recycling Rate (%)
Recycling Rates		
Steel	50%	n/a
Plastics	50%	40%
Paper & Pulp	50%	84%
Wood	50%	n/a
Disposal of Non-recyclables		
Landfill	74%	55%
Incineration	26%	45%

[1] European Commission. EU Construction & Demolition Waste Management Protocol. 2016. Available online: http://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en

[2] Eurostat, Recovery and recycling rates for packaging. 2015. http://ec.europa.eu/eurostat/web/environment/waste/main-tables

Table 11. *End-of-life disposal scenario parameters for the Artek products.*

Parameter	Value
Assumptions for scenario development	EU Waste Statistics
Collection processes	
Collected with mixed construction waste (kg)	4.14
Recovery	n/a
Recycled (kg)	2.07
Landfill disposal (kg)	1.53
Incineration (kg)	0.538
Removals of biogenic carbon (kg CO_2 eq)[1]	3.7

[1] Excluding packaging materials.

Transportation of the products at end of life assumes a 161 km average distance to disposal, consistent with PCR guidance.

5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. These indicator results are based on characterization methods that still need development and the use of the indicator result is therefore limited.

All LCA results are stated to three significant figures for this product and therefore the sum of the total values may not exactly equal 100%.

Modules B1, B2, B3, B4, B5, B6, B7, C1 and C3 are assumed null. In the interest of space and table readability, these modules are not included in the results presented below. There are no significant impacts associated with Module D.

Table 12. *Core Life Cycle Impact Assessment results for the furniture products over a 15-yr product lifetime. Results reported in MJ are calculated using lower heating values.*

Impact Category	A1	A2	A3	A4	A5	C2	C4	D
Core Indicators								
Climate change – total (kg CO_2 eq)	-5.27	0.315	2.38	0.787	0.451	0.224	0.942	0.00
	3000%	-180%	-1400%	-450%	-260%	-130%	-540%	
Climate change – fossil (kg CO_2 eq)	2.12	0.315	3.22	0.786	$7.41x10^{-2}$	0.224	$2.65x10^{-2}$	0.00
	31%	4.7%	48%	12%	1.1%	3.3%	0.39%	
Climate change - biogenic (kg CO_2 eq)	-7.40	$2.88x10^{-5}$	-0.887	$-2.58x10^{-5}$	0.377	$2.86x10^{-5}$	0.916	0.00
	110%	-0.00041%	13%	0.00037%	-5.4%	-0.00041%	-13%	
Climate change - land use and land use change (kg CO_2 eq)	$8.09x10^{-3}$	$1.24x10^{-4}$	$4.65x10^{-2}$	$3.41x10^{-4}$	$1.42x10^{-5}$	$2.15x10^{-5}$	$1.20x10^{-5}$	0.00
	15%	0.22%	84%	0.62%	0.026%	0.039%	0.022%	
Ozone Depletion (kg CFC11 eq)	$8.64x10^{-8}$	$4.57x10^{-9}$	$5.27x10^{-8}$	$1.13x10^{-8}$	$1.18x10^{-9}$	$3.35x10^{-9}$	$5.83x10^{-10}$	0.00
	54%	2.9%	33%	7.1%	0.74%	2.1%	0.36%	
Acidification (mol H+ eq)	$1.41x10^{-2}$	$1.29x10^{-3}$	$1.63x10^{-2}$	$9.92x10^{-3}$	$3.89x10^{-4}$	$1.15x10^{-3}$	$2.07x10^{-4}$	0.00
	33%	3%	38%	23%	0.9%	2.7%	0.48%	
Eutrophication aquatic freshwater (kg PO_4 eq)	$2.40x10^{-3}$	$7.40x10^{-5}$	$4.06x10^{-3}$	$1.47x10^{-4}$	$9.03x10^{-6}$	$1.25x10^{-5}$	$5.14x10^{-5}$	0.00
	36%	1.1%	60%	2.2%	0.13%	0.19%	0.76%	
Eutrophication aquatic marine (kg N eq)	$4.42x10^{-3}$	$4.71x10^{-4}$	$5.37x10^{-3}$	$2.71x10^{-3}$	$3.05x10^{-4}$	$5.00x10^{-4}$	$6.01x10^{-4}$	0.00
	31%	3.3%	37%	19%	2.1%	3.5%	4.2%	
Eutrophication terrestrial (mol N eq)	$4.81x10^{-2}$	$5.13x10^{-3}$	$5.05x10^{-2}$	$3.00x10^{-2}$	$1.73x10^{-3}$	$5.47x10^{-3}$	$9.37x10^{-4}$	0.00
	34%	3.6%	36%	21%	1.2%	3.9%	0.66%	
Photochemical ozone formation (kg NMVOC eq)	$1.52x10^{-2}$	$1.78x10^{-3}$	$1.47x10^{-2}$	$8.76x10^{-3}$	$7.04x10^{-4}$	$2.18x10^{-3}$	$3.15x10^{-4}$	0.00
	35%	4.1%	34%	20%	1.6%	5%	0.72%	
Depletion of abiotic resources - minerals and metals (kg Sb eq)[1]	$2.87x10^{-6}$	$4.36x10^{-7}$	$5.42x10^{-6}$	$8.16x10^{-7}$	$4.38x10^{-8}$	$6.68x10^{-8}$	$2.98x10^{-8}$	0.00
	30%	4.5%	56%	8.4%	0.45%	0.69%	0.31%	
Depletion of abiotic resources - fossil fuels (MJ)[1]	26.0	4.31	106	10.3	0.936	2.81	0.446	0.00
	17%	2.9%	70%	6.8%	0.62%	1.9%	0.3%	
Water use (m^3 depriv.)[1]	1.42	$2.42x10^{-2}$	3.07	$4.93x10^{-2}$	$-1.05x10^{-2}$	$6.26x10^{-3}$	-0.244	0.00
	33%	0.56%	71%	1.1%	-0.24%	0.15%	-5.6%	

1) The results of this environmental impact indicator shall be used with case as uncertainties on these results are high or as there is limited experience with the indicator.

Table 13. *Additional Life Cycle Impact Assessment results for the furniture products over a 15-yr product lifetime. Results reported in MJ are calculated using lower heating values.*

Impact Category	A1	A2	A3	A4	A5	C2	C4	D
Additional Indicators								
Particulate Matter emissions (disease inc.)	$3.76x10^{-7}$	$2.06x10^{-8}$	$5.08x10^{-7}$	$4.12x10^{-8}$	$7.95x10^{-9}$	$2.72x10^{-8}$	$3.57x10^{-9}$	0.00
	38%	2.1%	52%	4.2%	0.81%	2.8%	0.36%	
Ionizing radiation, human health (kBq U-235 eq)[2]	0.158	$3.56x10^{-3}$	5.40	$7.30x10^{-3}$	$5.52x10^{-4}$	$8.79x10^{-4}$	$4.61x10^{-4}$	0.00
	2.8%	0.064%	97%	0.13%	0.0099%	0.016%	0.0083%	
Eco-toxicity (freshwater) (CTUe)	107	4.45	132	9.50	7.32	1.43	0.827	0.00
	41%	1.7%	50%	3.6%	2.8%	0.55%	0.32%	
Human toxicity, cancer (CTUh)[1]	$1.47x10^{-7}$	$1.61x10^{-9}$	$1.37x10^{-8}$	$3.78x10^{-9}$	$1.73x10^{-10}$	$3.28x10^{-10}$	$1.22x10^{-10}$	0.00
	88%	0.96%	8.2%	2.3%	0.1%	0.2%	0.073%	
Human toxicity, non-cancer effects (CTUh)[1]	$4.60x10^{-8}$	$3.35x10^{-9}$	$8.34x10^{-8}$	$6.75x10^{-9}$	$3.87x10^{-8}$	$1.03x10^{-9}$	$3.34x10^{-9}$	0.00
	25%	1.8%	46%	3.7%	21%	0.57%	1.8%	
Land use related impacts/ Soil quality (dimensionless)[1]	627	2.38	217	4.16	0.263	0.313	0.931	0.00
	74%	0.28%	25%	0.49%	0.031%	0.037%	0.11%	

1) The results of this environmental impact indicator shall be used with case as uncertainties on these results are high or as there is limited experience with the indicator.

2) This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Table 14. *Resource use for the furniture products over a 15-yr product lifetime. Results reported in MJ are calculated using lower heating values.*

Parameter	A1	A2	A3	A4	A5	C2	C4	D
Resources								
Use of renewable primary energy (MJ)	146	$5.70x10^{-2}$	68.3	0.117	$8.07x10^{-3}$	$1.22x10^{-2}$	$7.37x10^{-3}$	0.00
	68%	0.027%	32%	0.055%	0.0038%	0.0057%	0.0034%	
Use of renewable primary energy resources used as raw materials (MJ)	61.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	100%	0%	0%	0%	0%	0%	0%	
Total renewable primary energy (MJ)	207	$5.70x10^{-2}$	68.3	0.117	$8.07x10^{-3}$	$1.22x10^{-2}$	$7.37x10^{-3}$	0.00
	75%	0.021%	25%	0.043%	0.0029%	0.0044%	0.0027%	
Use of nonrenewable primary energy (MJ)	26.0	4.31	105	10.3	0.936	2.81	0.446	0.00
	17%	2.9%	70%	6.9%	0.63%	1.9%	0.3%	
Use of nonrenewable primary energy resources used as raw materials (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	
Total nonrenewable primary energy (MJ)	26.0	4.31	105	10.3	0.936	2.81	0.446	0.00
	17%	2.9%	70%	6.9%	0.63%	1.9%	0.3%	
Use of secondary materials (MJ)	$3.84x10^{-2}$	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	100%	0%	0%	0%	0%	0%	0%	
Use of renewable secondary fuels (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Use of nonrenewable secondary fuels (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Use of net fresh water (m^3)	0.136	$3.46x10^{-3}$	0.645	$7.02x10^{-3}$	$7.21x10^{-4}$	$1.05x10^{-3}$	$7.12x10^{-4}$	0.00
	17%	0.44%	81%	0.88%	0.091%	0.13%	0.09%	

Table 15. *Waste and outflows for the furniture products over a 15-yr product lifetime. Results reported in MJ are calculated using lower heating values.*

Parameter	A1	A2	A3	A4	A5	C2	C4	D
Wastes								
Hazardous waste disposed (kg)	$8.89x10^{-5}$	$3.00x10^{-5}$	$1.50x10^{-4}$	$6.57x10^{-5}$	$6.46x10^{-6}$	$1.97x10^{-5}$	$2.98x10^{-6}$	0.00
	24%	8.2%	41%	18%	1.8%	5.4%	0.82%	
Non-hazardous waste disposed (kg)	0.158	0.204	0.868	0.339	0.125	$1.34x10^{-2}$	1.54	0.00
	4.9%	6.3%	27%	10%	3.9%	0.41%	47%	
Radioactive waste disposed (kg)	$3.94x10^{-5}$	$8.71x10^{-7}$	$1.16x10^{-3}$	$1.78x10^{-6}$	$1.35x10^{-7}$	$2.13x10^{-7}$	$1.13x10^{-7}$	0.00
	3.3%	0.072%	96%	0.15%	0.011%	0.018%	0.0094%	
Components for re-use (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for recycling (kg)	0.00	0.00	0.00	0.00	0.968	0.00	2.07	0.00
	0%	0%	0%	0%	32%	0%	68%	
Materials for energy recovery (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported energy, electrical (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported energy, thermal (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

6. LCA: Interpretation

Impact contributions are dominated by the manufacturing stage (A3) followed by raw material extraction and processing (A1), product distribution (A4) and product disposal. Impacts from the remaining stages are minimal.

7. References

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