Kiwa Ecobility Experts

Environmental Product Declaration

as per ISO 14025 and EN 15804

Owner of the declaration:	Zehnder Group Deutschland GmbH
Publisher:	Kiwa-Ecobility Experts
Programme operator:	Kiwa-Ecobility Experts
Registration number:	EPD-Kiwa-EE-000394-EN
Issue date:	04.07.2024
Valid to:	04.07.2029

Zehnder Charleston Multicolumn Radiator

The Zehnder Charleston is a multicolumn hydronic radiator to heat a room or building. It generally comes with a custom finish, delivered in a single piece with connections to order. The made-to-measure range from Zehnder allows to specify the precise dimensions of your radiator, providing a solution for unique spaces. To ensure optimal heat output and an ideal fit the height, width, and depth is adjustable.

1. General information

Zehnder Group Deutschland GmbH

Charleston Multicolumn Radiator

Programme operator:
Kiwa-Ecobility Experts
Kiwa GmbH, Ecobility Experts
Wattstraße 11-13
13355 Berlin
Germany

Registration number:
EPD-Kiwa-EE-000394-EN

This declaration is based on the Product Category Rules:
Part B: Requirements on the EPD for Radiators, Institut Bauen und Umwelt e.V., Berlin, v8, 19.10.2023.

Issue date:
04.07.2024

Valid to:
04.07.2029

Owner of the declaration:
Zehnder Group Deutschland GmbH
Europastraße 10
77933 Lahr/Schwarzwald
Germany

Declared product / declared unit:
1 kg of a multicolumn hydronic radiator

Scope:
This EPD applies to the Zehnder Charleston portfolio, which is a multicolumn hydronic radiator to heat a room or building. It generally comes with a custom finish, delivered in a single piece with connections to order. Hight, width and length are made to order. The radiator is produced in Lahr, Germany. EPD-Type 1C: average product of 1 plant.
The document relates to all life stages from the raw materials, manufacture, transport, installation, operation to disposal of the radiator. The disposal is assumed to be in Germany.
Kiwa-Ecobility Experts assumes no liability for manufacturer's information, LCA data and evidence.

Verification:
The European standard EN 15804+A2:2019 serves as the core PCR.

Independent verification of the declaration and data, according to EN ISO 14025:2010.

☐internal ☒external

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(Third party verifier)

2. Product

2.1 Product description

The Zehnder Charleston is a multicolumn hydronic radiator to heat a room or building. It generally comes with a custom finish, delivered in a single piece with connections to order. Hight, width and length are made to order. The finish in the analysis is white. In this document an average on the bases of two reference models is made. Both models (3060-16 and 2180-8) are among the most sold sizes and are a very good representation of the whole portfolio. The two products below have undergone detailed analysis, and an average assessment based on the two models weighted equally has been conducted for an average kilogram (kg) of radiator. The radiators are produced in Lahr, Germany. EPD-type 1C: average product of 1 plant.

The picture shows a 3060 radiator with 17 elements.

The document relates to all life stages from the raw materials, manufacture, transport, installation, operation to disposal of the radiator.
Further information can be found in the manufacturer's documentation. Regulation (EU) No 305/2011(CPR) applies to the placing on the market of the product in the EU/EFTA (excluding Switzer-land). The required declarations of performance and CE marking have been prepared in accordance with the requirements of the harmonised standards EN 442-1:2014 'Radiators and convectors - Part 1: Technical specifications and requirements' and EN 442-2:2014 'Radiators and convectors - Part 2: Test methods and performance specification'.

2.2 Application (Intended Use of the product)

The Zehnder Charleston is a multicolumn hydronic radiator to heat a room or building. The made-to-measure range from Zehnder allows to specify the precise dimensions of your radiator, providing a solution for unique spaces. To ensure optimal heat output and an ideal fit the height, width, and depth is adjustable.

2.3 Reference Service Life (RSL)

Steel radiators are durable products. When used properly, their average service life exceeds the reference service of 30 years life by more than several decades. As a rule, steel radiators generally achieve a reference service life of at least 35 years (VDI 2067), although a significantly longer service life is possible. We choose to state a reference service life of 30 years, as this service life is used in our sustainability report for the scope 3 emissions.

2.4 Technical data

Characteristic	Unit	Value
Heat output to EN 442 at ΔT50K (75 / 65 / 20 °C)*	W	85 - 18’658
Weight*	kg	2 - 458
Dimensions (L x W x D)*	mm	210x260x62 to 1774x3000x210
Content of water*	l	1 - 285
Steel tube (⌀)	mm	25
Length of the individual section	mm	46
Type of finish: Dip primer plus powder coating to DIN 55900	-	-
Maximum operating pressure	bar	10
Maximum operating temperature	°C	110

*the ranges are based on 99% of the portfolio, customised products may differ from the ranges.

The performance values of the product according to the declaration of performance with regard to its essential characteristics in accordance with EN 442:2014 'Radiators and convectors‘.

2.5 Substances of very high concern

A comparison between the 232 substances in the updated list of 17 January 2023 and our products has shown that Zehnder radiator portfolio and their accessories do not contain any substances of the ECHA-list (European Chemical Agency) for substances of very high concern (SVHC) of more than 0.1%.

2.6 Base materials / Ancillary materials

Raw material	Unit	Value
Steel	97.7	%
Dip primer	0.2	%
Powder coating	2.1	%

Packaging material: LDPE film (30% recycled content), Corrugated board.
Ancillary materials: Brass valves, EPDM baffle, PE caps, Nylon plugs, Grinding paper, Copper electrodes, EPDM O-rings, Sulphuric acid, Caustic Soda 33%, pH correction agent, Solid construction timber.

Biogenic Carbon

The only part of the model that contains biogenic carbon is the packaging and fuel with 5% biogenic carbon.

2.7 Manufacturing

The processing steps are described below and are illustrated as video here: https://youtu.be/uUhLzT4TmcQ.

Step 1: Preparation of raw materials: During the first phase of production of a multicolumn radiator, sheet metal is wound into a coil measuring 1.2 m to 1.5 m in diameter and weighing over 2 t. Steel tubes measuring 5.6 m are cut to the desired length to create the radiator columns.

Step 2: Production of the header: The coils of sheet metal are punched by a press to create the two halves of the header. The two pieces are then welded together to form a header. These headers are then sanded and pressure tested with 13 bar before moving onto the next stage.

Step 3: Production of the section: The headers and the tubes are now welded together and then ground to make neat joins. At each stage the sections are quality controlled. The sections are hermetically sealed and then immersed in a bath of water. The batch of section is then subjected to a pressure of 15 bar to check for leaks.

Step 4: Assembly: The radiator sections are now connected to each other using spot lab welding. Plugs with gaskets are drilled into the radiator according to the specified connection. Further testing checks each radiator for leaks with 15 bar.

Step 5: The finishing: Radiators are initially cleaned to remove dust and grease before an electrophoretic dip primer is applied for corrosion protection and a flawless foundation. The radiator then undergoes baking in a furnace at roughly 180 °C to affix the primer to the steel.

Upon cooling, the radiator advances along the production line for powder coating. While standard white radiators receive automated painting, other colours and finishes are manually sprayed. The radiator then re-enters the oven, where the powder melts uniformly to provide a shock and heat-resistant finish of superior quality.

Step 6: Quality control and packing: Before packing, each radiator is thoroughly quality checked once again and then the radiators are packaged and wrapped using a fully automated system.

2.8 Other Information

For further information on this product please visit the webpage under the following link: Zehnder Charleston - Hydronic operation | Zehnder Group Sales International (zehnder-systems.com)

3. LCA: Calculation rules

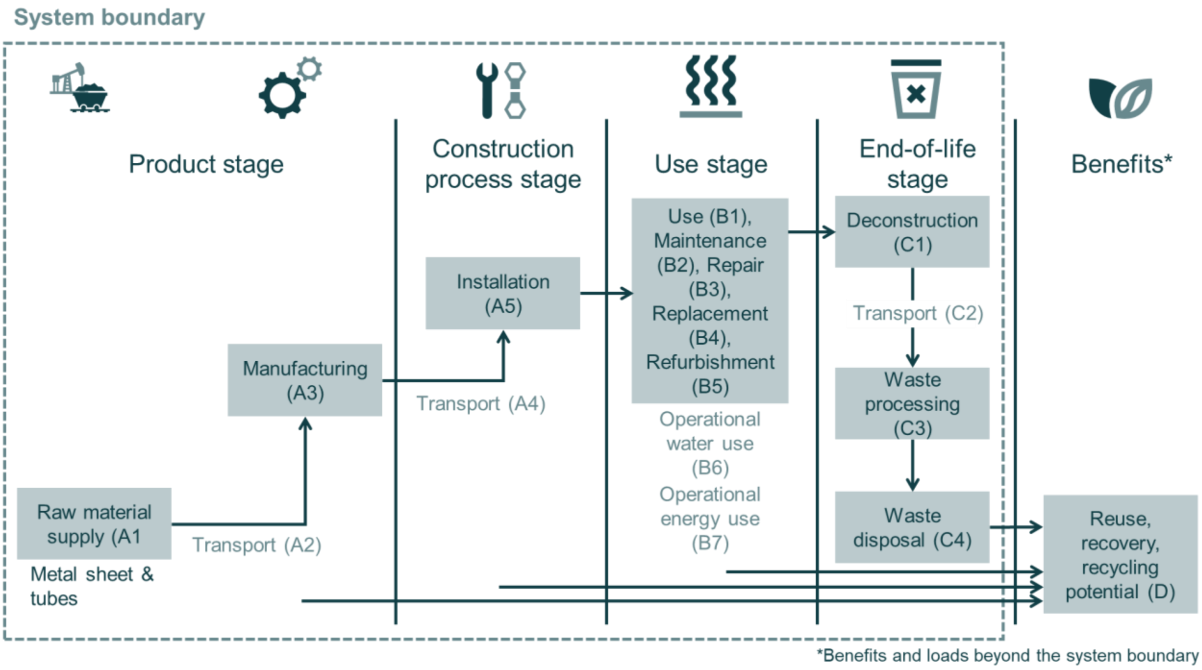
3.1 Declared unit

Product	Unit	Value
Declared Unit	1	kg

A sensitivity analysis confirms that the influence of the ratio between steel sheet and steel tube is minimal.

3.2 Scope of declaration and system boundaries

Type of EPD: Cradle to grave and module D for an average product made in one factory (type 1C).



Description of the system boundary																
Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manu-facturing	Transport from manu-	Construc-tion-installa-	Use	Main-tenance	Repair	Replacement	Refur-bishmen	Operational energy use	Operational water use	De-construction	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	NR	NR	NR	NR	NR	NR	NR	NR	X	NR	X	X
X=Module declared | ND=Module not declared | NR= Module not relevant;																

3.3 Geographical reference area

Production site is Lahr, Germany. The auxiliary material, energy demand and including related volatile organic compound (VOC) emissions as well as the waste treatment is included.

3.4 Cut-off Criteria

The cut-off rule excludes irrelevant flows of material or energy from system boundaries. Some auxiliary flows were cut-off; accounting for less than 0.15% in total. The production of capital equipment, facilities and infrastructure needed for production are not the subject of this assessment. Long-term emissions (> 100 years) are not taken into consideration in the impact estimate.

3.5 Allocation

The production process does not deliver any co-products. The applied software model allocates raw material, auxiliary materials, waste, and energy use during production per produced kg. The burdens and benefits from recycling or and disposal of all materials are allocated per kg. Information about allocation procedure of single datasets for background data is documented in https://sphera.com/product-sustainability-gabi-data-search/.

3.6 Data collection and reference time period

The primary data were collected using a survey template, which was filled out by Zehnder's experts. Upon reception, the questionnaire was checked for completeness and plausibility using mass balancing. If gaps, outliers, or other discrepancies appeared, the experts who provided the data were contacted to clarify any outstanding issues. These foreground data refer to annual data for 2022.

3.7 Estimates and assumptions

All relevant process steps are considered and modelled to represent the specific situations. The process chain is considered sufficiently complete regarding the goal and scope of this study.

The end fittings (0.5 kg per radiator) are averaged over the whole portfolio. Control equimnet is not included in this analyis.

The data quality of the inventory is assessed based on its precision (measured, calculated, literature values or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methods used) and representativeness (geographical, temporal, technological).

In order to do justice to these aspects and thus ensure reliable results, first-hand industrial data were used together with consistent background data from the Sphera LCA FE (GaBi) 2022 databases. The inventory data from the Sphera LCA FE (GaBi) databases are widely used in the Sphera LCA FE (GaBi) software. The data sets are used worldwide in LCA models both internally and in many critically reviewed and published studies for industrial and scientific purposes. As part of the data provision, the data sets are compared with those of other databases as well as data from industry and science.

3.8 Comparability

In principle, a comparison or assessment of the environmental impacts of different products is only possible if they have been prepared in accordance with EN 15804. For the evaluation of the comparability, the following aspects have to be considered in particular: PCR used , functional or declared unit, geographical reference, definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs and general program instructions of different EPDs programs may differ. A comparability needs to be evaluated. For further guidance see EN 15804+A2 (5.3 Comparability of EPD for construction products) and ISO 14025 (6.7.2 Requirements for comparability). All background data come from the Sphera LCA FE (GaBi) 2022 databases.

4. LCA: Scenarios and additional technical information

Modules include impacts and aspects related to losses or/and waste in the module in which the losses or waste occur (i.e. production, transport and waste processing and disposal of the lost waste products and materials). Impacts and aspects related to waste are considered in the module in which the waste occurs.

Module A4 to A5:

The construction process stage includes transportation to the installation site by truck and installation, considering the energy demand and auxiliary material including related Volatile Organic Compound (VOC) emissions. Transport to building site (A4) considers the specific average distance (831 km) by truck transport to site (Truck, Euro 0 - 6 mix, 20 - 26t gross weight / 17,3t payload capacity, 55% utilization, 5% biogenic C in fuel).

Transport to the building site	Unit	Value
Distance	km	831

Packaging material	Unit	Value
LDPE film (30% recycled content)	kg	3.5E-02
Corrugated board	kg	4.7E-02

Treatment and disposal of packaging material in A5. Credits for potential avoided burdens due to energy substitution of electricity and thermal energy generation by the packaging waste are declared in module D and affects only the rate of primary material (no secondary materials). Installation into the building is done with simple tools and is therefore neglected.

Module B1 to B7:

The use stage of the products has no direct emissions (B1) and is designed so that no maintenance is required (B2) or parts need to be replaced (B4). Furthermore, no standard repairs (B3) or refurbishments (B5) are foreseen. The use of the product does not require any electricity consumption (B6) and water consumption (B7) as water use of the heating system is part of the heating system and not the radiator. These effects are therefore stated as zero.

Module C1 to C4:

The end-of-life stage includes the deconstruction, considering the energy demand and auxiliary materials, the transportation by truck to waste processing facilities, the waste processing, considering sorting, and the waste disposal, considering a scenario with recycling, incineration, and landfill. The removal of the radiator is made with simple tools and is therefore neglected and stated as zero. The transport of end-of-life (EOL) stage (C2) considers 300 km for the shipment of collected waste to approved treatment centres by truck (Truck, Euro 0 - 6 mix, 20 - 26t gross weight / 17,3t payload capacity, 55% utilization, 5% biogenic C in fuel). The steel of the radiator is 100% recycled without further treatment and stated as zero, all other waste is incinerated with heat recovery.

Transport to EOL	Unit	Value
Distance	km	300

End of life	Unit	Value
Recycling	%	100

Module D:

For the recycled steel, the avoidance of primary production is considered as a source of credits (substitution approach) and considered as a benefit outside the product system (Module D). The 100% recycling rate of the steel radiator is realistic as the removal of the radiator is done in one piece, with not much effort and the material is very valuable.

The thermal and electrical energy generated in A5 and C4 is linked to thermal treatment of packaging and the product. Avoided burdens have been calculated by the inversion of electricity grid mix and thermal energy from natural gas.

5. LCA: Results

The following tables show the results of the impact assessment indicators, resource use, waste and other output streams. The results presented here refer to the declared average product.

Disclaimer on ADP-e, ADP-f, WDP, ETP-fw, HTP-c, HTP-nc, SQP: The results of these environmental impact indicators must be used with caution, as the uncertainties in these results are high or as there is limited experience with the indicator.

Disclaimer on IR: This impact category mainly addresses the potential effect of low dose ionizing radiation on human health in the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents and occupational exposures, nor does it consider radioactive waste disposal in underground facilities. Potential ionizing radiation from soil, radon, and some building materials is also not measured by this indicator.

LCA results - Indicators describing environmental impacts based on the impact assessment (LCIA): 1 kg of a multicolumn hydronic radiator (EN 15804+A2)

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Core environmental impact indicators (EN 15804+A2)																		
GWP-total	kg CO2 eqv.	2.69E+00	5.12E-02	9.59E-02	8.62E-02	3.24E-02	0	0	0	0	0	0	0	0	2.95E-02	0	3.79E-01	-2.72E+00
GWP-f	kg CO2 eqv.	2.69E+00	5.10E-02	2.39E-01	8.58E-02	1.61E-03	0	0	0	0	0	0	0	0	2.94E-02	0	3.74E-01	-2.71E+00
GWP-b	kg CO2 eqv.	6.51E-04	-6.00E-05	-1.44E-01	-1.01E-04	3.08E-02	0	0	0	0	0	0	0	0	-3.46E-05	0	4.44E-03	-6.20E-04
GWP-luluc	kg CO2 eqv.	8.38E-04	3.02E-04	2.30E-04	5.08E-04	1.29E-07	0	0	0	0	0	0	0	0	1.74E-04	0	5.97E-05	-8.59E-04
ODP	kg CFC 11 eqv.	2.76E-12	1.38E-14	4.85E-13	2.32E-14	5.68E-15	0	0	0	0	0	0	0	0	7.95E-15	0	6.98E-12	-1.55E-12
AP	mol H+ eqv.	5.84E-03	8.44E-05	3.86E-04	1.42E-04	7.66E-06	0	0	0	0	0	0	0	0	4.86E-05	0	9.59E-04	-6.17E-03
EP-fw	kg P eqv.	2.38E-06	1.20E-07	1.52E-06	2.01E-07	1.48E-09	0	0	0	0	0	0	0	0	6.89E-08	0	1.56E-06	-1.81E-06
EP-m	kg N eqv.	1.45E-03	3.54E-05	1.68E-04	5.95E-05	2.38E-06	0	0	0	0	0	0	0	0	2.04E-05	0	2.53E-04	-1.45E-03
EP-T	mol N eqv.	1.54E-02	3.98E-04	1.74E-03	6.68E-04	3.61E-05	0	0	0	0	0	0	0	0	2.29E-04	0	2.69E-03	-1.53E-02
POCP	kg NMVOC eqv.	4.90E-03	7.65E-05	4.74E-04	1.29E-04	6.20E-06	0	0	0	0	0	0	0	0	4.41E-05	0	9.63E-04	-5.05E-03
ADP-mm	kg Sb-eqv.	2.04E-06	3.69E-09	2.82E-08	6.20E-09	4.22E-11	0	0	0	0	0	0	0	0	2.12E-09	0	6.84E-08	-1.15E-06
ADP-f	MJ	2.52E+01	6.94E-01	3.87E+00	1.17E+00	8.68E-03	0	0	0	0	0	0	0	0	4.00E-01	0	4.81E+00	-2.30E+01
WDP	m3 world eqv.	1.02E-01	2.90E-04	1.37E-02	4.87E-04	3.58E-03	0	0	0	0	0	0	0	0	1.67E-04	0	2.68E-03	-1.09E-01
Additional environmental impact indicators (EN 15804+A2)																		
PM	disease incidence	8.41E-08	1.07E-09	1.25E-08	1.79E-09	4.16E-11	0	0	0	0	0	0	0	0	6.14E-10	0	1.36E-08	-8.92E-08
IR	kBq U235 eqv.	1.28E-02	1.04E-04	5.99E-03	1.75E-04	3.03E-05	0	0	0	0	0	0	0	0	5.99E-05	0	3.73E-02	-9.14E-04
ETP-fw	CTUe	5.33E+00	4.99E-01	7.72E-01	8.38E-01	3.41E-03	0	0	0	0	0	0	0	0	2.87E-01	0	1.63E+00	-4.34E+00
HTP-c	CTUh	3.09E-09	1.00E-11	1.16E-10	1.69E-11	2.40E-13	0	0	0	0	0	0	0	0	5.79E-12	0	1.55E-10	-3.26E-09
HTP-nc	CTUh	3.33E-08	5.29E-10	1.99E-09	8.89E-10	8.06E-12	0	0	0	0	0	0	0	0	3.05E-10	0	1.65E-08	-3.37E-08
SQP	Pt	1.88E+00	2.45E-01	2.81E+01	4.12E-01	2.96E-03	0	0	0	0	0	0	0	0	1.41E-01	0	2.48E+00	-1.16E+00

ADP-mm= Abiotic depletion potential for non-fossil resources | **ADP-f**=Abiotic depletion for fossil resources potential | **AP**= Acidification potential, Accumulated Exceedance | **EP-fw** = Eutrophication potential, fraction of nutrients reaching freshwater end compartment | **EP-m**= Eutrophication potential, fraction of nutrients reaching marine end compartment| **EP-T**= Eutrophication potential, Accumulated Exceedance | **GWP-b**=Global Warming Potential biogenic | **GWP-f**=Global Warming Potential fossil fuels | **GWP-luluc**=Global Warming Potential land use and land use change |**GWP-total**=Global Warming Potential total| **ODP**=Depletion potential of the stratospheric ozone layer |**POCP**=Formation potential of tropospheric ozone | **WDP**=Water (user) deprivation potential, deprivation- weighted water consumption | **ETP-fw**=Potential Comparative Toxic Unit for ecosystems | **HTP-c**=Potential Toxic Unit for Humans toxicity, cancer | **HTP-nc**= Potential Toxic Unit for humans, non-cancer | **IRP**=Potential Human exposure efficiency relative to U235, human health | **PM**=Potential incidence of disease due to Particulate Matter emissions | **SQP**=Potential soil quality index

LCA results - Indicators describing resource use and environmental information derived from life cycle inventory (LCI): 1 kg of a multicolumn hydronic radiator (EN 15804+A2)

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	MJ	1.60E+00	4.67E-02	4.95E+00	7.85E-02	2.77E-03	0	0	0	0	0	0	0	0	2.69E-02	0	3.41E+00	-8.94E-01
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	1.60E+00	4.67E-02	4.95E+00	7.85E-02	2.77E-03	0	0	0	0	0	0	0	0	2.69E-02	0	3.41E+00	-8.94E-01
PENRE	MJ	2.54E+01	6.95E-01	3.88E+00	1.17E+00	8.68E-03	0	0	0	0	0	0	0	0	4.00E-01	0	4.81E+00	-2.31E+01
PENRM	MJ	7.79E-11	0	6.19E-14	0	0	0	0	0	0	0	0	0	0	0	0	-6.47E-14	-1.03E-10
PENRT	MJ	2.54E+01	6.95E-01	3.88E+00	1.17E+00	8.68E-03	0	0	0	0	0	0	0	0	4.00E-01	0	4.81E+00	-2.31E+01
SM	kg	1.78E-01	0	1.04E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FW	M3	3.13E-03	4.24E-05	2.82E-03	7.13E-05	8.42E-05	0	0	0	0	0	0	0	0	2.44E-05	0	1.64E-03	-4.66E-03
HWD	kg	3.69E-10	2.59E-12	1.37E-08	4.36E-12	1.02E-13	0	0	0	0	0	0	0	0	1.49E-12	0	-5.85E-10	5.07E-10
NHWD	kg	3.10E-02	1.06E-04	4.03E-03	1.77E-04	4.10E-04	0	0	0	0	0	0	0	0	6.08E-05	0	1.99E-04	3.06E-02
RWD	kg	1.89E-04	9.75E-07	4.24E-05	1.64E-06	2.87E-07	0	0	0	0	0	0	0	0	5.62E-07	0	3.56E-04	-1.13E-04
CRU	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	2.30E-01	0	0	0	0	0	0	0	0	0	0	0	9.77E-01	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EET	MJ	0	0	1.10E-02	0	9.50E-02	0	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	4.68E-03	0	4.06E-02	0	0	0	0	0	0	0	0	0	0	0	0

PERE=Use of renewable primary energy excluding renewable primary energy resources used as raw materials | **PERM**= Use of renewable primary energy resources used as raw materials | **PERT**=Total use of renewable primary energy resources | **PENRE**= Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | **PENRM**= Use of non-renewable primary energy resources used as raw materials | **PENRT**= Total use of non-renewable primary energy resources | **SM**=Use of secondary material | **RSF**=Use of renewable secondary fuels | **NRSF**=Use of non-renewable secondary fuels | **FW**=Use of fresh water | **HWD**=Hazardous waste disposed | **NHWD**=Non-hazardous waste disposed | **RWD**=Radioactive waste disposed | **CRU**=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EET**=Exported energy, thermical | **EE**=Exported energy, electrical

LCA results - information on biogenic carbon content at the factory gate: 1 kg of a multicolumn hydronic radiator (EN 15804+A2)

Parameter	Unit	Value
biogenic carbon content in product	kg C	0
biogenic carbon content in accompanying packaging	kg C	8.4E-03
NOTE 1 kg biogenic carbon is equivalent to 44/12 kg CO2		

6. LCA: Interpretation

6.1 Dominance analysis

The following figure shows the distribution of the impacts of the different phases of the LCA on the mandatory indicators using the example of one product. The distribution of the other products differs only minimally.

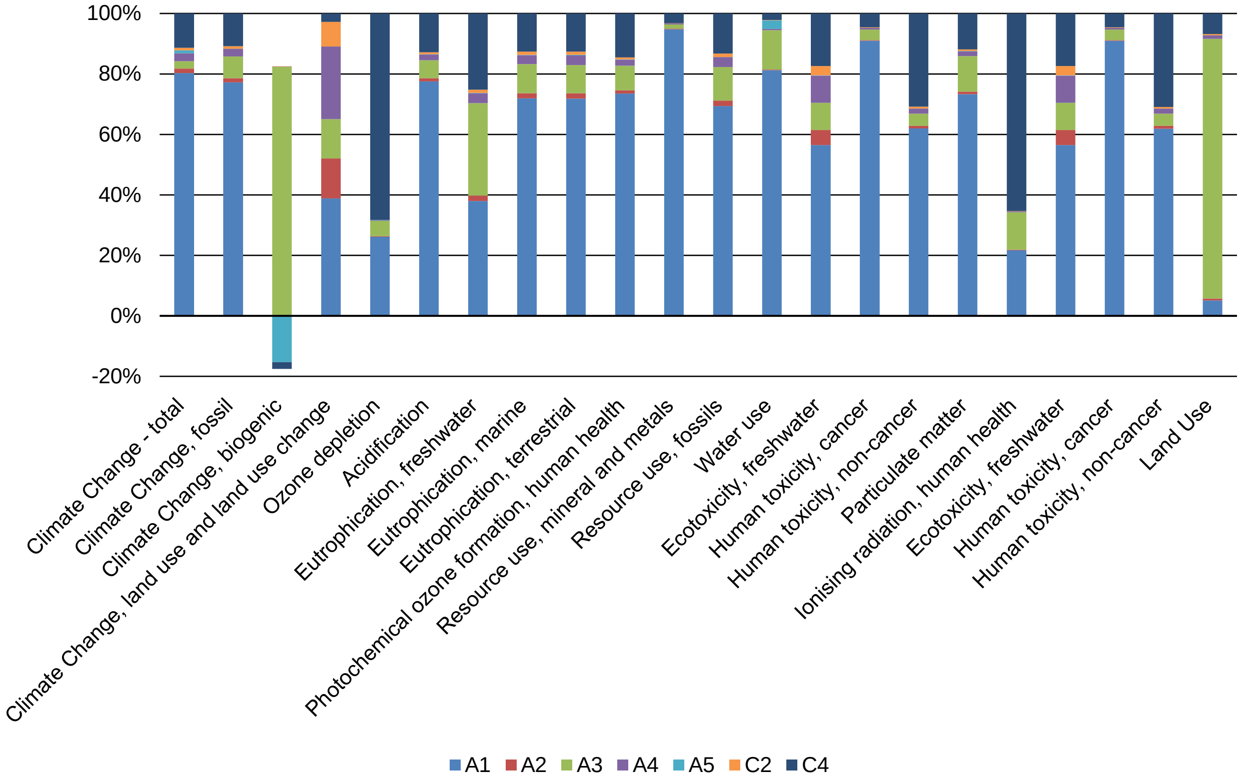


Figure 1: Distribution of the effects of the different phases without model D of the LCA on the impact categories of the Charleston 3060 (16 elements) according to EN15804+A2.

It is visible that the impact linked to the raw material and components (A1) are a hotspot of the results, followed by the impact from manufacturing (A3). In addition, the recycling of the product (C4) has relevant environmental impacts, followed by the disposal of the packaging (A5).

6.2 Sensitivity analysis

The two Charleston model show little differences in their individual impact: Biggest difference lies in model A3 with the packing material is (Figure 2). Even though the ratio of steel tube to steel sheet is high, it has no to very little impact.

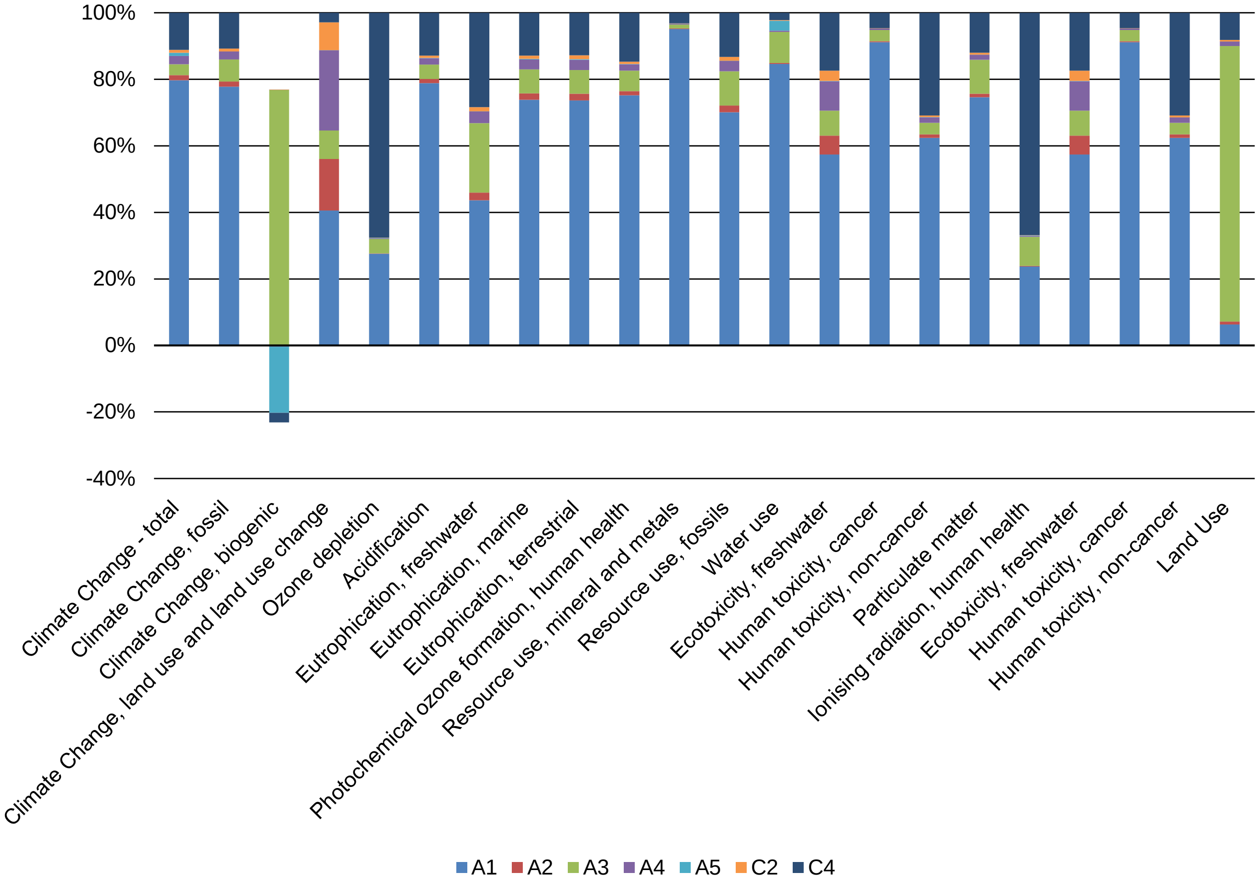


Figure 2: Distribution of the effects of the different phases without model D of the LCA on the impact categories of the Charleston 2180 (12 elements) according to EN15804+A2.

6.3 Data quality

Data quality is based on the principle that the data quality of the data of the processes that take place at the producer of the product must be higher than that of the other processes.

Technological: All primary and secondary data are modelled to be specific to the technologies or technology mixes under study. Therefore, the overall technological representation is very good.

Geographical: All primary and secondary data are collected specifically to the countries / regions under study. Where country / region specific data are unavailable, proxy data are used. Therefore, the overall geographical representation is good.

Temporal: All primary data are collected for the year 2022. All secondary data come from the Sphera LCA FE (GaBi) databases and are representative of the years 2019-2022, expect RER: Polyethylene film (PE-LD) for 2005, where no data more recent data was available in the database. As the study intended to compare the product systems for the reference year 2022 temporal representativeness is good.

7. References

Sphera LCA FE (GaBi)	Sphera LCA FE (GaBi) Version CUP2022.2 database
EN 15804	EN 15804:2012+A2:2019: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products
ISO 14025	ISO 14025:2010 Environmental labels and declarations — Type III environmental declarations — Principles and procedures
ISO 14040	ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework
ISO 14044	ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
EN 442-1	EN 442-1:20214: Radiators and convectors, Part 1: Technical specifications and requirements.
PCR A	Kiwa-Ecobility Experts, Berlin, 2022: PCR A – General Program Category Rules for Construction Products from the EPD programme of Kiwa-Ecobility Experts; Version 2.1
PCR B	Institut Bauen und Umwelt e.V., Berlin, 2024: Part B: Requirements on the EPD for Radiators, Version 8, 2023-10-19.

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