CARBON FOOTPRINT OF AN OFFICE CHAIR

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Jan Hurab, CEO, jan.hurab@ldseating.com

Summary:

This study was developed for the purpose of calculating carbon footprint for the cradle-to-grave & cradle-to-gate assessment of three office chairs according to EN 15804+A2 and ISO 14067 methodology. The study was developed in accordance with the requirements of ISO 14040, 14044.

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INTRODUCTION

1 GENERAL CHARACTERISTICS OF THE LCA STUDY

1.1 INFORMATION ABOUT THE COMPANY

LD Seating s.r.o. is a family-owned Czech company based in Boskovice, with over 30 years of experience in producing high-quality seating furniture for offices, public spaces, and private interiors. The company is known for its focus on precise craftsmanship, ergonomics, and timeless design, often created in collaboration with both Czech and international designers. Production takes place primarily in Boskovice, where modern technology is combined with the traditional skills of experienced seamstresses and upholsterers.

LD Seating is also strongly committed to sustainability. The company holds EMAS certification and prioritizes the use of recycled and natural materials, including fabrics certified by EU Ecolabel and Cradle to Cradle. To reduce its environmental footprint, LD Seating has installed photovoltaic panels and actively works toward zero-waste production - for example, by repurposing leftover materials into gifts or foam scraps into Block cubes.

FIGURE 1 ARCUS CHAIR SET-UP

More information can be found on the website ldseating.com.

1.2 INFORMATION ABOUT THE ASSESSED PRODUCT

Description of the chairs

Arcus

Designed by German designer Martin Ballendat, the Arcus chair stands out with its elegant, feminine-inspired curves and exceptional comfort. A distinctive arc seamlessly integrates into the mesh backrest frame, serving both as a unique design element and a practical handle. The backrest features a classic S-shape profile, providing pronounced lumbar support and gentle shoulder reinforcement. Available in black and light grey, the Arcus offers options like an upholstered seat, mesh backrest, adjustable lumbar support, and headrest. Its innovative design earned the prestigious Red Dot Design Award in 2023 and German Design Award in 2024.

Leaf

The Leaf series is characterized by its elegant, leaf-shaped backrests and spacious, comfortable seats. Designed for modern offices, these chairs combine functionality, ergonomics, and style to meet diverse user needs. The series includes both task and conference chairs, offering versatility for various professional settings.

Lyra Air

The Lyra Air series offers swivel task chairs featuring a mesh backrest with an integrated lumbar rest. Users can choose from a wide range of accessories to customize the chair to their preferences. This series is designed to provide ergonomic support and comfort throughout the workday.

1.3 THE AIM OF THE STUDY

The aim of the study is to assess environmental impacts with prior focus at carbon footprint of three office chairs (Arcus, Leaf and Lyra Air) according to ISO 14067 and EN 15804 + A2 (based on EF 3.1 methodology).

2 GOAL AND SCOPE DEFINITION

2.1 LCA METHODOLOGY

The Life Cycle Assessment (LCA) method is an analytical tool based on the measurement of technological, operational and environmental parameters of individual organisations or industrial enterprises involved in the production, transport, operation or disposal of any material, equipment, fuel or energy carrier entering any stage of the life cycle of a product.

The LCA method is performed according to ISO 14040 (ISO 14040:2006) and EN ISO 14044 (ISO 14044:2006). It is a robust and transparent tool for quantifying the potential environmental impacts associated with individual input and output materials and energies. LCA is an internationally used method recommended by United Nations Environment Program (UNEP) and is currently being discussed in the context of the transition to a circular economy.

The essence of the LCA method is to determine the material and energy flows into and out of the system under consideration. Their quantity, composition, nature and environmental significance are monitored. The causes and consequences of these flows then determine the resulting changes in the environment. The basic data shall be compiled by means of an inventory analysis. A predefined part of the life cycle of the system under assessment is divided into unit processes and the flows between them are mapped. This is followed by an environmental impact assessment and a final interpretation.

In this study, EN 15804 + A2 (based on EF 3.1 methodology), recommended by European Comission and ISO 14067 are used.

Values of Greenhouse Gases (GHG) are expressed as Global Warming Potential (GWP) in kilograms of carbon dioxide equivalents (kg CO2 eq).

2.2 FUNCTIONAL UNIT

The functional unit used in this study is 1 piece of the respective office chair.

2.3 PRODUCT SYSTEM AND BOUNDARIES OF THE SYSTEM

The product carbon footprint provided in this study is calculated under a cradle-to-gate and cradle-to-grave system except of use phase. The cradle-to grave boundary covers the processing of input materials, all relevant transport down to the process unit, manufacture of the chair and handling of waste from production. Than follows transportation to the customer and EOL of the product. Use phase is not covered in this assessment as the material impacts are not expected. The cradle-to-gate assessment covers processing of input materials, all relevant transport down to the process unit, manufacture of the chair and handling of waste from production.

The boundaries to nature cover the flow of materials and energy resources from nature to the system. All relevant elemental flows (emissions) to air, water and land across the system boundary are counted if are emitted or leave the product system.

In the following figure is available flowsheet (LCA for Experts, Sphera) of the product life cycle’s model (according to EN 15804). In the following table are mentioned respective modules, their description and colour designation according to EN 15804.

TABLE 1 USED MODULES AND THEIR DESCRIPTION FOR EN15804

Module	Description	Colour
A1	Raw material supply	Red
A2	Transport	Yellow
A3	Manufacturing	Green
A4	Transport	Blue
A5	Construction installation	Brown
C2	Transport EoL	Turquoise
C3	Waste processing	Pink
C4	Disposal	Dark green
D	Reuse, recovery, recycling potential	Purple

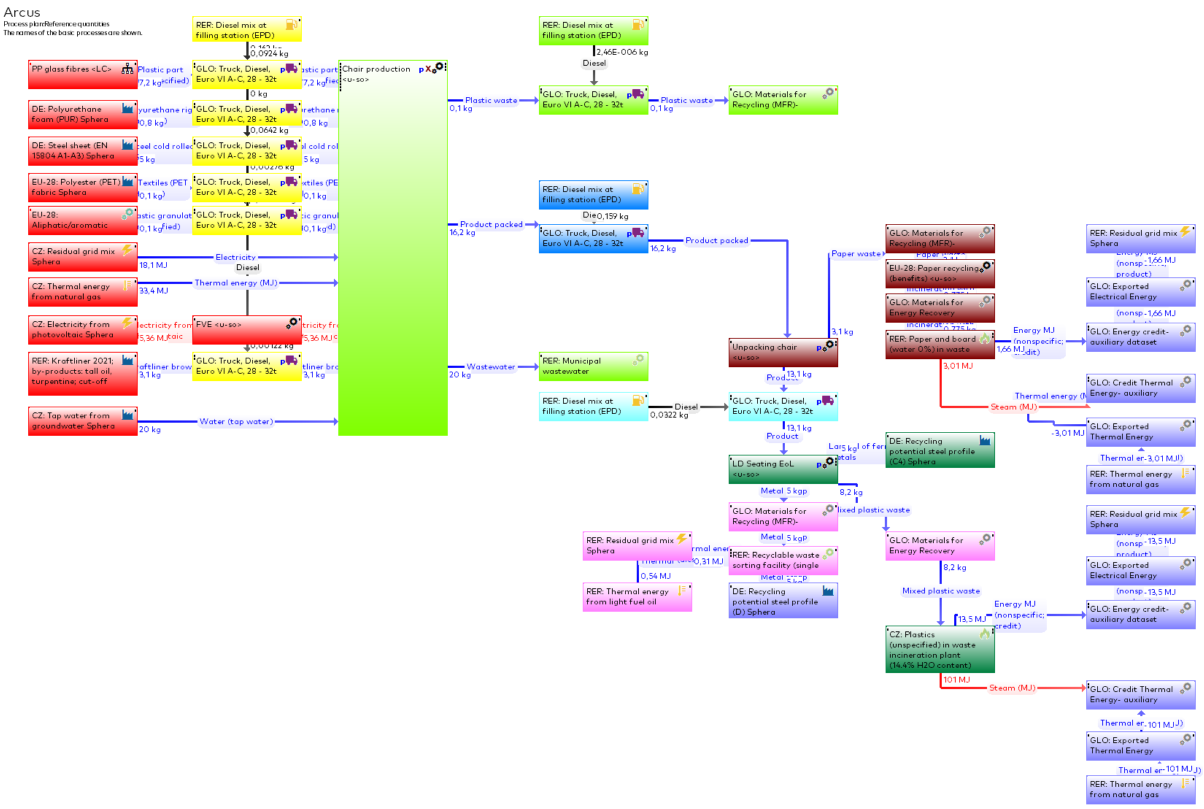

FIGURE 2 FLOWSHEET OF THE PRODUCT LIFE CYCLE'S MODEL FOR EN 15804

In the following figure is shown another flowsheet of the product life cycle's model. In this flowsheet, the division to upstream, core and downstream module according to ISO 14067 is illustrated. In the following table are mentioned respective modules, their description and colour designation according to ISO 14067.

TABLE 2 USED MODULES AND THEIR DESCRIPTION FOR ISO14067

Module	Description	Colour
Upstream	Raw material supply, pre-processing, transport	Red
Core	Manufacturing processes at factory	Yellow
Downstream	Distribution, use, end-of-life	Green

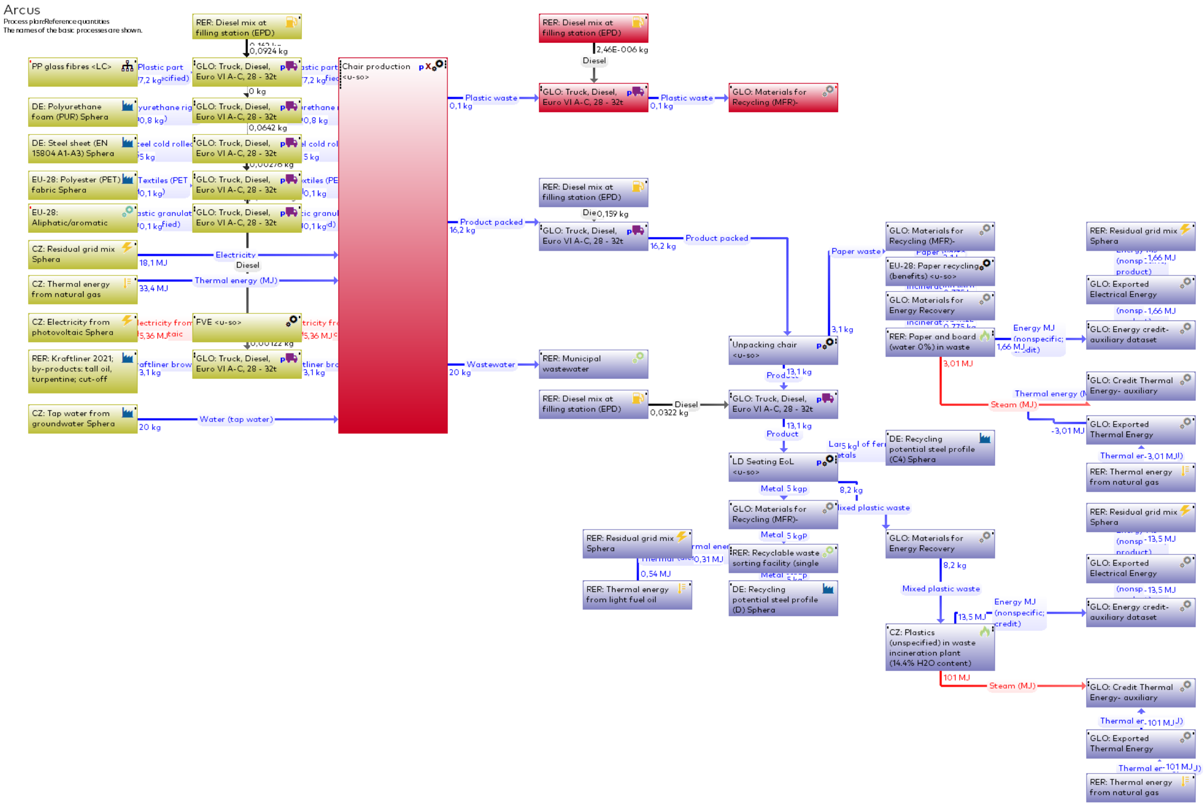

FIGURE 3 FLOWSHEET OF THE PRODUCT LIFE CYCLE'S MODEL FOR ISO 14067

In the following table are described specific system boundaries for each methodology.

TABLE 3 DESCRIPTION OF SPECIFIC SYSTEM BOUNDARIES FOR THE USED METHODOLOGIES

System boundary	Modules	Methodology
Cradle-to-gate	A1-A3	EN 15804
Cradle-to-grave	A1-D	EN 15804
Cradle-to-gate	Upstream + core	ISO 14067
Cradle-to-grave	Upstream + core + downstream	ISO 14067

2.4 ASSUMPTIONS FOR THE STUDY

The product system does not include the manufacturing processes of the capital goods or spare parts and/or maintenance. The environmental impact of infrastructure for general management, office, and headquarters operations is not included. Product system does not include the consumption of natural gas for sanitary and heating system for the staff’s comfort.

The energy consumption was sourced from the Czech residual energy mix and photovoltaics installed at the place of production. The use phase is not taken into consideration.

2.5 ALLOCATION AND CUT OFF CRITERIA

All material and energy flows were assigned to one production line and one marketable product: the chair. Mass allocation was applied in case of electricity consumption, thermal energy consumption and waste production.

For secondary material, the allocation of impacts is based on the polluter pays principle. No secondary fuels are used in the production.

More than 99 % of flows were included.

2.6 GEOGRAPHIC BOUNDARIES

All emission factors used for the calculation are specified for Czech conditions, if available. Otherwise, European or Global datasets are used.

3 LIFE CYCLE INVENTORY (LCI)

3.1 DATA SOURCES AND COLLECTION

Based on the operational data provided by LD Seating s.r.o., product system models were created. All relevant data were used. Generic data from Sphera databases were used. Sphera database is used internationally and contains process datasets validated at the European level.

Site specific data from producer are based on a general manufacture procedure in 2024. The integrity of generic data records is ensured by Sphera (LCA software provider).

All data used for this LCA study were collected in LD Seating s.r.o.

Data were collected and provided by: Jan Hurab, CEO, jan.hurab@ldseating.com

The following assumptions were accepted in this LCA study:

1. Czech residual electricity grid mix is assumed.
2. The electricity from photovoltaics covers approx. 22 % from the whole electric consumption.

Specific data were used for modelling of processes, which are operated by the producer (manufacturing of products) and modelling of some input materials. Also, specific parameters for some generic processes were considered (site-specific distance in transportation processes). Generic data were used for modelling of other processes (production of raw materials, components, generation of electricity and heat, general transport processes).

Accuracy of data is according to the operating documentation of the manufacturer and no variability is available. Completeness is reached due to considered flows, which is accounted for according to cut-off rules.

The following rules for time scope of data were applied:

< 10 years for background data,
< 2 years for manufacturer's data.

3.2 DATA INVENTORY

Generic and specific process data were used for the study. Specific data were obtained directly from the company and were used in relevant production processes. If there were no specific data available, then generic data from the Sphera database were used in calculations as is summarized below.

Production of electricity consumed within LD Seating s.r.o. production was based on the Czech residual electricity grid mix and modelled based on a process from Sphera database.

The following generic and specific process data were used in calculations:

TABLE 4 SPECIFIC AND GENERIC PROCESSES.

Generic process	Produced material/component
CZ: Residual grid mix Sphera	Electricity consumption in Czech Rep.
GLO: Truck, Diesel, Euro VI A-C, 28 – 32 t gross weight Sphera	Transportation by truck
RER: Diesel mix at filling station (EPD)	Diesel consumption
DE: Polyurethane foam (PUR) Sphera	Polyurethane production

DE: Steel sheet (EN 15804 A1-A3) Sphera	Steel sheet production
EU-28: Polyester (PET) fabric Sphera	Polyester production
EU-28: Aliphatic/aromatic copolyester granulate secondary Sphera	Secondary polyester production
RER: Kraftliner 2021; by-products: tall oil, turpentine; cut-off	Kraftliner production
Chair production <u-so>	Respective chair production
Unpacking chair <u-so>	Unpacking of a chair
GLO: Materials for Recycling (MFR) Sphera-EPD <u-so>	Material recycling
GLO: Materials for Energy Recovery (MER) Sphera-EPD <u-so>	Materials for energy recovery
GLO: Credit Thermal Energy auxiliary dataset Sphera <u-so>	Credit thermal energy
GLO: Energy credit auxiliary dataset Sphera <u-so>	Energy credit Sphera
GLO: Exported Electrical Energy (EEE) auxiliary dataset Sphera-EPD <u-so>	Exported electrical energy
GLO: Exported Thermal Energy (EET) auxiliary dataset Sphera-EPD <u-so>	Exported thermal energy
PP glass fibres <LC>	PP glass fibres production
CZ: Electricity from photovoltaic Sphera	Electricity from photovoltaics
CZ: Plastics (unspecified) in waste incineration plant (14.4% H2O content) Sphera <p-agg>	Plastics in waste incineration plant
CZ: Tap water from groundwater Sphera	Tap water
CZ: Thermal energy from natural gas Sphera	Thermal energy from natural gas
DE: Recycling potential steel profile (C4) Sphera	Recycling potential for steel
DE: Recycling potential steel profile (D) Sphera	Recycling potential for steel
EU-28: Paper recycling (benefits) <u-so>	Benefits of paper recycling
FVE <u-so>	Auxiliary process for electricity from photovoltaics
RER: Municipal wastewater treatment (mix) Sphera	Municipal wastewater treatment
RER: Paper and board (water 0%) in waste incineration plant Sphera <p-agg>	Paper and board in waste incineration plant
RER: Recyclable waste sorting facility (single flow) Sphera <u-so>	Recyclable waste sorting facility
RER: Residual grid mix Sphera	Electricity consumption in Europe
RER: Thermal energy from light fuel oil (LFO) Sphera	Thermal energy from light fuel oil
RER: Thermal energy from natural gas Sphera	Thermal energy from natural gas
LD Seating EoL <u-so>	EoL of the chair

The following table illustrates the data relating to transport, inputs and outputs.

TABLE 5 INVENTORY OF THE MODEL

Inputs	**Arcus**	**Leaf**	**Lyra Air**
Polypropylene glass fibres	7,2 kg	9,85 kg	7,83 kg
Polyurethane	0,8 kg	0,8 kg	0,8 kg
Steel sheet	5 kg	4,35 kg	4,35 kg
Polyester fabric	0,1 kg	0,1 kg	0,1 kg

Polyester secondary	0,1 kg	0,1 kg	0,1 kg
Residual grid mix	18,1 MJ	18,1 MJ	17,9 MJ
Electricity from photovoltaics	5,36 MJ	4,9 MJ	4,72 MJ
Thermal energy from natural gas	33,4 MJ	33,4 MJ	32 MJ
Kraftliner	3,1 kg	2,8 kg	2,8 kg
Tap water	20 l	20 l	20 l
Transportation by truck			
Polypropylene glass fibres	522 km	770 km	687 km
Polyurethane	0 km	0 km	0 km
Steel sheet	522 km	770 km	687 km
Polyester fabric	1124 km	991 km	1153 km
Polyester secondary	839 km	839 km	839 km
Kraftliner	16 km	16 km	16 km
Average distance to customer	400 km	400 km	400 km
Outputs			
Marketable product	13,1 kg	15,1 kg	13,1 kg
Production waste	0,1 kg	0,1 kg	0,1 kg

RESULTS

4 LIFE CYCLE IMPACT ASSESSMENT (LCIA)

For contribution analysis purpose, results in ISO 14067 and EN 15804 + A2 (based on EF 3.1 methodology) are assessed. The detailed results and discussion are available in the upcoming sections.

4.1 CARBON FOOTPRINT ASSESSMENT

In the conducted LCA study were evaluated two methodologies as there is no clear standard for environmental impact evaluation methodology in the sector.

In the following tables are shown results for cradle-to-gate and cradle-to-grave carbon footprint according to both studied methodologies.

TABLE 6 THE CARBON FOOTPRINT ACCORDING TO ISO 14067 GWP (BASED ON IPCC AR6) METHODOLOGY

Chair	Cradle-to-gate (kg CO2 eq.)	Cradle-to-grave (kg CO2 eq.)
Arcus	**40,9**	**54,0**
Leaf	**48,8**	**65,0**
Lyra Air	**42,0**	**55,7**

TABLE 7 THE CARBON FOOTPRINT ACCORDING TO EN 15804 + A2 METHODOLOGY

Chair	Cradle-to-gate (kg CO2 eq.)	Cradle-to-grave (kg CO2 eq.)
Arcus	**40,9**	**54,0**
Leaf	**48,8**	**65,0**
Lyra Air	**42,0**	**55,7**

4.1.1 ANALYSIS OF ISO 14067 IMPACT CATEGORIES (GWP)

Contribution analysis within the cradle-to-grave system boundaries is conducted on the LCA results using the impact categories defined in ISO 14067. As shown in the following table, the far highest contributions have fossil GHG emissions ranging up to 100% for all products. Biogenic GHG emissions have approx. 13%, 11%, 12%, contribution, for Arcus, Leaf and Lyra Air. The biogenic GHG removal range from 13%, 10% and 12%, respectively. The biogenic GHG removal represents the GHG sequestration, therefore resulting in an environmental benefit.

TABLE 8 CONTRIBUTION ANALYSIS RESULTS – LIFE CYCLE PHASES CONTRIBUTION TO THE TOTAL RESULT (ISO 14067).

Type	Arcus		Leaf		Lyra Air	
	Total [kg CO2 eq.]	Contribution	Total [kg CO2 eq.]	Contribution	Total [kg CO2 eq.]	Contribution
ISO14067 GWP100, Air craft emissions	5,46E-06	0,00%	5,51E-06	0,00%	5,25E-06	0,00%
ISO14067 GWP100, Biogenic GHG emissions	7,10E+00	13,16%	6,84E+00	10,54%	6,62E+00	11,90%
ISO14067 GWP100, Biogenic GHG removal	-7,08E+00	-13,11%	- 6,78E+00	-10,44%	-6,58E+00	-11,83%

ISO14067 GWP100, Emissions from land use change (dLUC)	3,44E-02	0,06%	4,01E-02	0,06%	3,52E-02	0,06%
ISO14067 GWP100, Fossil GHG emissions	5,40E+01	100,00%	6,49E+01	100,00%	5,56E+01	100,00%

4.1.2 ANALYSIS OF EN 15804 + A2 (BASED ON EF 3.1 METHODOLOGY) IMPACT CATEGORIES (GWP)

For EN 15804 + A2 (based on EF 3.1 methodology), the highest contribution to produced CO2 emissions within cradle-to-grave system boundaries have fossil GHG emissions as well. EN 15804 accounts for biogenic GHG in a similar conceptual way to ISO 14067 - as both emissions and removals - but typically reports only the net value (e.g., as 'Climate Change, biogenic'), unlike ISO 14067 which reports both separately.

TABLE 9 CONTRIBUTION ANALYSIS RESULTS – LIFE CYCLE PHASES CONTRIBUTION TO THE TOTAL RESULT (EN 15804).

Type	**Arcus**		**Leaf**		**Lyra Air**	
	Total [kg CO2 eq.]	**Contribution**	**Total [kg CO2 eq.]**	**Contribution**	**Total [kg CO2 eq.]**	**Contribution**
EN15804+A2 (EF 3.1) Climate Change, fossil [kg CO2 eq.]	5,40E+01	99,89%	6,49E+01	99,84%	5,56E+01	99,86%
EN15804+A2 (EF 3.1) Climate Change, biogenic [kg CO2 eq.]	2,59E-02	0,05%	6,27E-02	0,10%	4,09E-02	0,07%
EN15804+A2 (EF 3.1) Climate Change, land use and land use change [kg CO2 eq.]	3,44E-02	0,06%	4,01E-02	0,06%	3,52E-02	0,06%
01 EN15804+A2 (EF 3.1) Climate Change - total [kg CO2 eq.]	5,40E+01	100,00%	6,50E+01	100,00%	5,57E+01	100,00%

5 CONCLUSION

The purpose of the study was to calculate the carbon footprint of three office chairs Arcus, Leaf and Lyra Air with respect to ISO 14067 and EN 15804 + A2 (based on EF 3.1 methodology). System boundaries are set to cradle-to-grave, the functional unit is 1 piece of chair. Aditionally, results for carbon footprint for the cradle-to-gate boundary are shown as well.

The carbon footprint obtained in ISO 14067 GWP (based on IPCC AR6) methodology is:

TABLE 10 THE CARBON FOOTPRINT ACCORDING TO ISO 14067 GWP (BASED ON IPCC AR6) METHODOLOGY

Chair	Cradle-to-gate (kg CO2 eq.)	Cradle-to-grave (kg CO2 eq.)
Arcus	**40,9**	**54,0**
Leaf	**48,8**	**65,0**
Lyra Air	**42,0**	**55,7**

In EN 15804 + A2 (based on EF 3.1 methodology), Carbon footprint – total value for the declared system is:

TABLE 11 THE CARBON FOOTPRINT ACCORDING TO EN 15804 + A2 METHODOLOGY

Chair	Cradle-to-gate (kg CO2 eq.)	Cradle-to-grave (kg CO2 eq.)
Arcus	**40,9**	**54,0**
Leaf	**48,8**	**65,0**
Lyra Air	**42,0**	**55,7**

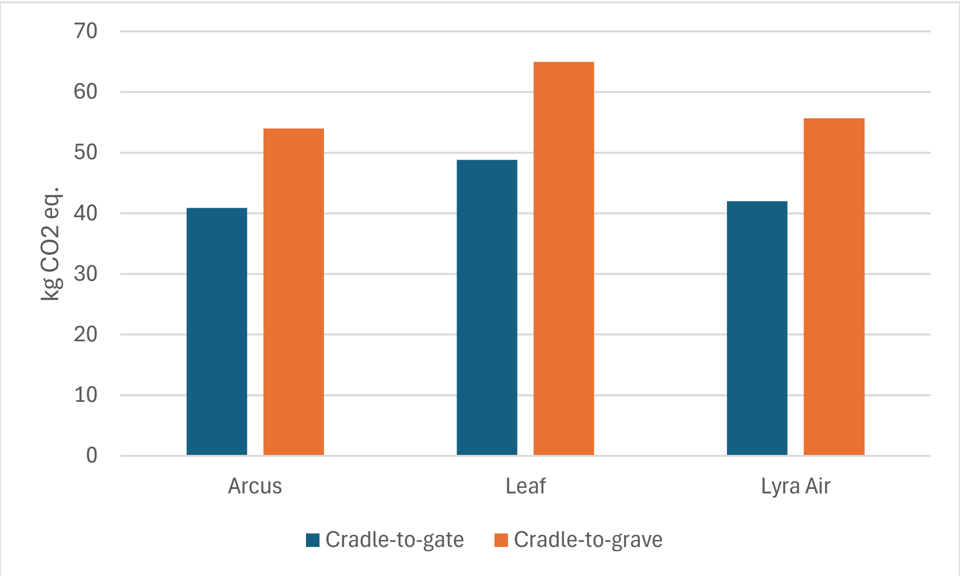

FIGURE 4 OVERVIEW OF THE CARBON FOOTPRINT – TOTAL FOR THE THREE STUDIED CHAIRS IN THE GIVEN SYSTEM BOUNDARIES

The contributions of core, upstream and downstream module to the fossil GHG emissions are shown in the following table:

TABLE 12 THE CONTRIBUTIONS OF CORE AND UPSTREAM MODULE TO THE FOSSIL GHG EMISSIONS

Chair	Contribution of core module (%)	Contribution of upstream module (%)	Contribution of downstream module (%)
Arcus	**0**	**85**	**15**
Leaf	**0**	**82**	**18**
Lyra Air	**0**	**83**	**17**

Further considering the GHG emissions with respect to the individual processes for Arcus, Leaf and Lyra Air, the polypropylene glass fibre is the most contributional with nearly 46%, 51% and 48% contribution, respectively. Next follows incineration of plastic waste (38%, 41% and 39%) and the used steel sheet (22%, 15% and 18%).

6 LITERATURE

- ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework
- ISO 14044:2006 Environmental management — Life cycle assessment — Requirements and guidelines
- ISO 14067:2019 Greenhouse gases - Carbon footprint of products - Requirements and guidelines for quantification
- Sphera: LCA for Experts, 2023, Sphera solutions.
- World Resources Institute (2019). The Greenhouse Gas Protocol - A Corporate Accounting and Reporting Standard. USA, World Resources Institute.
- GHG protocol guidance Scope 1, Scope 2, Scope 3, https://ghgprotocol.org
- https://www.ldseating.com/
- https://ec.europa.eu/eurostat/databrowser/
- IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation (2011): Chapter 7 - Energy Systems Integration for GHG Mitigation.

7 APPENDIX

Table 13 The overall results for ARCUS according to EN15804

ARCUS	TOTAL	A1-A3	A4	A5	C2	C3	C4	D
01 EN15804+A2 (EF 3.1) Climate Change - total [kg CO2 eq.]	5,40E+01	4,09E+01	6,07E-01	4,78E+00	1,23E-01	9,34E-02	1,89E+01	-1,14E+01
02 EN15804+A2 (EF 3.1) Climate Change, fossil [kg CO2 eq.]	5,40E+01	4,56E+01	6,01E-01	2,62E-02	1,22E-01	9,33E-02	1,89E+01	-1,14E+01
03 EN15804+A2 (EF 3.1) Climate Change, biogenic [kg CO2 eq.]	2,59E-02	-4,72E+00	5,32E-05	4,75E+00	1,07E-05	8,36E-05	6,21E-04	-1,24E-02
04 EN15804+A2 (EF 3.1) Climate Change, land use and land use change [kg CO2 eq.]	3,44E-02	2,87E-02	6,17E-03	3,63E-05	1,25E-03	2,44E-05	4,77E-04	-2,30E-03
05 EN15804+A2 (EF 3.1) Ozone depletion [kg CFC-11 eq.]	1,92E-09	1,95E-09	9,95E-14	1,52E-13	2,01E-14	5,39E-13	1,85E-12	-2,74E-11
06 EN15804+A2 (EF 3.1) Acidification [Mole of H+ eq.]	9,13E-02	9,51E-02	1,00E-03	3,08E-04	2,02E-04	1,79E-04	5,70E-03	-1,12E-02
07 EN15804+A2 (EF 3.1) Eutrophication, freshwater [kg P eq.]	1,12E-04	1,12E-04	1,62E-06	2,91E-08	3,27E-07	2,09E-08	4,52E-07	-1,69E-06
08 EN15804+A2 (EF 3.1) Eutrophication, marine [kg N eq.]	2,25E-02	2,36E-02	4,16E-04	1,13E-04	8,40E-05	6,29E-05	1,74E-03	-3,51E-03
09 EN15804+A2 (EF 3.1) Eutrophication, terrestrial [Mole of N eq.]	2,46E-01	2,50E-01	4,43E-03	1,41E-03	8,96E-04	6,89E-04	2,68E-02	-3,84E-02
10 EN15804+A2 (EF 3.1) Photochemical ozone formation, human health [kg NMVOC eq.]	7,80E-02	8,28E-02	9,05E-04	2,99E-04	1,83E-04	1,84E-04	4,56E-03	-1,09E-02
11 EN15804+A2 (EF 3.1) Resource use, mineral and metals [kg Sb eq.]	4,49E-06	4,75E-06	3,99E-08	1,78E-09	8,06E-09	4,55E-09	2,32E-08	-3,39E-07
12 EN15804+A2 (EF 3.1) Resource use, fossils [MJ]	6,91E+02	8,43E+02	7,68E+00	3,44E-01	1,55E+00	1,43E+00	5,60E+00	-1,68E+02
13 EN15804+A2 (EF 3.1) Water use [m³ world equiv.]	2,64E+00	7,10E-01	2,74E-03	1,36E-01	5,54E-04	2,51E-03	1,93E+00	-1,40E-01
2. Resource use indicators								
01 EN15804+A2 Use of renewable primary energy (PERE) [MJ]	1,75E+02	1,77E+02	5,79E-01	8,83E-02	1,17E-01	1,33E-01	9,04E-01	-4,14E+00
03 EN15804+A2 Total use of renewable primary energy resources (PERT) [MJ]	1,75E+02	1,77E+02	5,79E-01	8,83E-02	1,17E-01	1,33E-01	9,04E-01	-4,14E+00

04 EN15804+A2 Use of non-renewable primary energy (PENRE) [MJ]	6,91E+02	8,43E+02	7,68E+00	3,44E-01	1,55E+00	1,43E+00	5,60E+00	-1,68E+02
06 EN15804+A2 Total use of non-renewable primary energy resources (PENRT) [MJ]	6,91E+02	8,43E+02	7,68E+00	3,44E-01	1,55E+00	1,43E+00	5,60E+00	-1,68E+02
10 EN15804+A2 Use of net fresh water (FW) [m3]	1,52E-01	1,11E-01	2,86E-04	3,20E-03	5,79E-05	1,58E-04	4,55E-02	-9,04E-03
3. Output flows and waste categories								
01 EN15804+A2 Hazardous waste disposed (HWD) [kg]	6,68E-07	6,70E-07	3,08E-10	1,76E-10	6,23E-11	1,78E-10	1,50E-09	-4,14E-09
02 EN15804+A2 Non-hazardous waste disposed (NHWD) [kg]	1,46E+00	8,41E-01	1,07E-03	3,45E-02	2,17E-04	3,23E-04	6,52E-01	-6,90E-02
03 EN15804+A2 Radioactive waste disposed (RWD) [kg]	1,25E-02	1,67E-02	1,45E-05	1,73E-05	2,93E-06	9,95E-05	2,60E-04	-4,62E-03
05 EN15804+A2 Materials for Recycling (MFR) [kg]	8,20E+00	1,00E-01	0,00E+00	3,10E+00	0,00E+00	5,00E+00	0,00E+00	0,00E+00
06 EN15804+A2 Material for Energy Recovery (MER) [kg]	8,98E+00	0,00E+00	0,00E+00	7,75E-01	0,00E+00	8,20E+00	0,00E+00	0,00E+00
07 EN15804+A2 Exported electrical energy (EEE) [MJ]	-1,52E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-1,52E+01
08 EN15804+A2 Exported thermal energy (EET) [MJ]	-1,04E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-1,04E+02
5. Optional indicators								
5a. Optional indicators detailed								
01 EN15804+A2 (EF 3.1) Particulate matter [Disease incidences]	9,10E-07	9,88E-07	9,89E-09	1,70E-09	2,00E-09	1,27E-09	3,23E-08	-1,25E-07
02 EN15804+A2 (EF 3.1) Ionising radiation, human health [kBq U235 eq.]	7,43E-01	1,47E+00	2,08E-03	2,71E-03	4,21E-04	1,63E-02	1,90E-02	-7,72E-01
03 EN15804+A2 (EF 3.1) Ecotoxicity, freshwater [CTUe]	3,92E+02	3,85E+02	9,99E+00	1,40E-01	2,02E+00	5,55E-01	2,28E+00	-8,02E+00
04 EN15804+A2 (EF 3.1) Human toxicity, cancer [CTUh]	2,00E-08	2,36E-08	1,35E-10	8,31E-12	2,72E-11	1,50E-11	1,89E-10	-3,98E-09
05 EN15804+A2 (EF 3.1) Human toxicity, non-cancer [CTUh]	4,42E-07	4,29E-07	7,53E-09	1,31E-10	1,52E-09	2,24E-10	8,74E-09	-4,68E-09
06 EN15804+A2 (EF 3.1) Land Use [Pt]	5,79E+02	5,76E+02	3,40E+00	9,90E-02	6,87E-01	6,96E-02	1,48E+00	-2,25E+00

Table 14 The overall results for LEAF according to EN15804

LEAF	TOTAL	A1-A3	A4	A5	C2	C3	C4	D

01 EN15804+A2 (EF 3.1) Climate Change - total [kg CO2 eq.]	6,50E+01	4,88E+01	6,71E-01	4,32E+00	1,42E-01	8,12E-02	2,50E+01	-1,40E+01
02 EN15804+A2 (EF 3.1) Climate Change, fossil [kg CO2 eq.]	6,49E+01	5,30E+01	6,64E-01	2,37E-02	1,40E-01	8,11E-02	2,50E+01	-1,40E+01
03 EN15804+A2 (EF 3.1) Climate Change, biogenic [kg CO2 eq.]	6,27E-02	-4,21E+00	5,87E-05	4,29E+00	1,24E-05	7,28E-05	8,28E-04	-1,64E-02
04 EN15804+A2 (EF 3.1) Climate Change, land use and land use change [kg CO2 eq.]	4,01E-02	3,38E-02	6,82E-03	3,28E-05	1,44E-03	2,12E-05	6,25E-04	-2,54E-03
05 EN15804+A2 (EF 3.1) Ozone depletion [kg CFC-11 eq.]	1,92E-09	1,95E-09	1,10E-13	1,37E-13	2,32E-14	4,69E-13	2,44E-12	-3,46E-11
06 EN15804+A2 (EF 3.1) Acidification [Mole of H+ eq.]	1,07E-01	1,10E-01	1,11E-03	2,79E-04	2,33E-04	1,55E-04	7,53E-03	-1,25E-02
07 EN15804+A2 (EF 3.1) Eutrophication, freshwater [kg P eq.]	1,15E-04	1,14E-04	1,79E-06	2,62E-08	3,77E-07	1,82E-08	5,96E-07	-1,88E-06
08 EN15804+A2 (EF 3.1) Eutrophication, marine [kg N eq.]	2,55E-02	2,66E-02	4,59E-04	1,02E-04	9,69E-05	5,47E-05	2,30E-03	-4,08E-03
09 EN15804+A2 (EF 3.1) Eutrophication, terrestrial [Mole of N eq.]	2,82E-01	2,83E-01	4,90E-03	1,27E-03	1,03E-03	5,99E-04	3,54E-02	-4,47E-02
10 EN15804+A2 (EF 3.1) Photochemical ozone formation, human health [kg NMVOC eq.]	8,94E-02	9,43E-02	1,00E-03	2,70E-04	2,11E-04	1,60E-04	6,02E-03	-1,26E-02
11 EN15804+A2 (EF 3.1) Resource use, mineral and metals [kg Sb eq.]	4,87E-06	5,21E-06	4,41E-08	1,60E-09	9,29E-09	3,96E-09	3,06E-08	-4,31E-07
12 EN15804+A2 (EF 3.1) Resource use, fossils [MJ]	8,35E+02	1,03E+03	8,49E+00	3,11E-01	1,79E+00	1,24E+00	7,38E+00	-2,13E+02
13 EN15804+A2 (EF 3.1) Water use [m³ world equiv.]	3,53E+00	1,02E+00	3,03E-03	1,23E-01	6,39E-04	2,18E-03	2,55E+00	-1,73E-01
2. Resource use indicators								
01 EN15804+A2 Use of renewable primary energy (PERE) [MJ]	1,72E+02	1,76E+02	6,40E-01	7,98E-02	1,35E-01	1,16E-01	1,19E+00	-6,27E+00
03 EN15804+A2 Total use of renewable primary energy resources (PERT) [MJ]	1,72E+02	1,76E+02	6,40E-01	7,98E-02	1,35E-01	1,16E-01	1,19E+00	-6,27E+00
04 EN15804+A2 Use of non-renewable primary energy (PENRE) [MJ]	8,35E+02	1,03E+03	8,49E+00	3,11E-01	1,79E+00	1,24E+00	7,38E+00	-2,13E+02
06 EN15804+A2 Total use of non-renewable primary energy resources (PENRT) [MJ]	8,35E+02	1,03E+03	8,49E+00	3,11E-01	1,79E+00	1,24E+00	7,38E+00	-2,13E+02
10 EN15804+A2 Use of net fresh water (FW) [m3]	1,86E-01	1,33E-01	3,16E-04	2,89E-03	6,67E-05	1,38E-04	6,01E-02	-1,11E-02
3. Output flows and waste categories								

01 EN15804+A2 Hazardous waste disposed (HWD) [kg]	6,35E-07	6,40E-07	3,41E-10	1,59E-10	7,18E-11	1,55E-10	1,98E-09	-7,68E-09
02 EN15804+A2 Non-hazardous waste disposed (NHWD) [kg]	1,68E+00	9,73E-01	1,19E-03	3,12E-02	2,50E-04	2,81E-04	7,49E-01	-7,65E-02
03 EN15804+A2 Radioactive waste disposed (RWD) [kg]	1,27E-02	1,83E-02	1,60E-05	1,56E-05	3,38E-06	8,65E-05	3,44E-04	-6,00E-03
05 EN15804+A2 Materials for Recycling (MFR) [kg]	7,25E+00	1,00E-01	0,00E+00	2,80E+00	0,00E+00	4,35E+00	0,00E+00	0,00E+00
06 EN15804+A2 Material for Energy Recovery (MER) [kg]	1,16E+01	0,00E+00	0,00E+00	7,00E-01	0,00E+00	1,09E+01	0,00E+00	0,00E+00
07 EN15804+A2 Exported electrical energy (EEE) [MJ]	-1,94E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-1,94E+01
08 EN15804+A2 Exported thermal energy (EET) [MJ]	-1,36E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-1,36E+02
5. Optional indicators								
5a. Optional indicators detailed								
01 EN15804+A2 (EF 3.1) Particulate matter [Disease incidences]	1,01E-06	1,08E-06	1,09E-08	1,54E-09	2,30E-09	1,11E-09	4,26E-08	-1,33E-07
02 EN15804+A2 (EF 3.1) Ionising radiation, human health [kBq U235 eq.]	6,85E-01	1,64E+00	2,30E-03	2,45E-03	4,85E-04	1,42E-02	2,51E-02	-9,97E-01
03 EN15804+A2 (EF 3.1) Ecotoxicity, freshwater [CTUe]	5,05E+02	4,97E+02	1,10E+01	1,26E-01	2,33E+00	4,83E-01	2,99E+00	-9,33E+00
04 EN15804+A2 (EF 3.1) Human toxicity, cancer [CTUh]	2,05E-08	2,38E-08	1,49E-10	7,51E-12	3,14E-11	1,31E-11	2,50E-10	-3,80E-09
05 EN15804+A2 (EF 3.1) Human toxicity, non-cancer [CTUh]	4,81E-07	4,66E-07	8,32E-09	1,18E-10	1,76E-09	1,95E-10	1,16E-08	-7,03E-09
06 EN15804+A2 (EF 3.1) Land Use [Pt]	5,38E+02	5,34E+02	3,75E+00	8,94E-02	7,91E-01	6,06E-02	1,95E+00	-3,38E+00

Table 15 The overall results for LYRA AIR according to EN15804

LYRA AIR	TOTAL	A1-A3	A4	A5	C2	C3	C4	D
01 EN15804+A2 (EF 3.1) Climate Change - total [kg CO2 eq.]	5,57E+01	4,20E+01	5,96E-01	4,32E+00	1,23E-01	8,12E-02	2,04E+01	-1,18E+01
02 EN15804+A2 (EF 3.1) Climate Change, fossil [kg CO2 eq.]	5,56E+01	4,62E+01	5,90E-01	2,37E-02	1,22E-01	8,11E-02	2,04E+01	-1,18E+01
03 EN15804+A2 (EF 3.1) Climate Change, biogenic [kg CO2 eq.]	4,09E-02	-4,24E+00	5,22E-05	4,29E+00	1,07E-05	7,28E-05	6,73E-04	-1,34E-02

04 EN15804+A2 (EF 3.1) Climate Change, land use and land use change [kg CO2 eq.]	3,52E-02	2,96E-02	6,06E-03	3,28E-05	1,25E-03	2,12E-05	5,12E-04	-2,25E-03
05 EN15804+A2 (EF 3.1) Ozone depletion [kg CFC-11 eq.]	1,94E-09	1,97E-09	9,76E-14	1,37E-13	2,01E-14	4,69E-13	2,00E-12	-2,89E-11
06 EN15804+A2 (EF 3.1) Acidification [Mole of H+ eq.]	9,26E-02	9,58E-02	9,83E-04	2,79E-04	2,02E-04	1,55E-04	6,15E-03	-1,10E-02
07 EN15804+A2 (EF 3.1) Eutrophication, freshwater [kg P eq.]	1,09E-04	1,08E-04	1,59E-06	2,62E-08	3,27E-07	1,82E-08	4,87E-07	-1,66E-06
08 EN15804+A2 (EF 3.1) Eutrophication, marine [kg N eq.]	2,25E-02	2,35E-02	4,08E-04	1,02E-04	8,40E-05	5,47E-05	1,88E-03	-3,53E-03
09 EN15804+A2 (EF 3.1) Eutrophication, terrestrial [Mole of N eq.]	2,47E-01	2,50E-01	4,35E-03	1,27E-03	8,96E-04	5,99E-04	2,89E-02	-3,87E-02
10 EN15804+A2 (EF 3.1) Photochemical ozone formation, human health [kg NMVOC eq.]	7,86E-02	8,31E-02	8,88E-04	2,70E-04	1,83E-04	1,60E-04	4,92E-03	-1,09E-02
11 EN15804+A2 (EF 3.1) Resource use, mineral and metals [kg Sb eq.]	4,38E-06	4,66E-06	3,91E-08	1,60E-09	8,06E-09	3,96E-09	2,50E-08	-3,58E-07
12 EN15804+A2 (EF 3.1) Resource use, fossils [MJ]	7,16E+02	8,77E+02	7,54E+00	3,11E-01	1,55E+00	1,24E+00	6,03E+00	- 1,77E+02
13 EN15804+A2 (EF 3.1) Water use [m³ world equiv.]	2,82E+00	7,52E-01	2,69E-03	1,23E-01	5,54E-04	2,18E-03	2,08E+00	-1,46E-01
2. Resource use indicators								
01 EN15804+A2 Use of renewable primary energy (PERE) [MJ]	1,64E+02	1,67E+02	5,68E-01	7,98E-02	1,17E-01	1,16E-01	9,74E-01	- 4,85E+00
03 EN15804+A2 Total use of renewable primary energy resources (PERT) [MJ]	1,64E+02	1,67E+02	5,68E-01	7,98E-02	1,17E-01	1,16E-01	9,74E-01	- 4,85E+00
04 EN15804+A2 Use of non-renewable primary energy (PENRE) [MJ]	7,16E+02	8,77E+02	7,54E+00	3,11E-01	1,55E+00	1,24E+00	6,03E+00	- 1,77E+02
06 EN15804+A2 Total use of non-renewable primary energy resources (PENRT) [MJ]	7,16E+02	8,77E+02	7,54E+00	3,11E-01	1,55E+00	1,24E+00	6,03E+00	- 1,77E+02
10 EN15804+A2 Use of net fresh water (FW) [m3]	1,59E-01	1,16E-01	2,81E-04	2,89E-03	5,79E-05	1,38E-04	4,91E-02	-9,36E-03
3. Output flows and waste categories								
01 EN15804+A2 Hazardous waste disposed (HWD) [kg]	6,16E-07	6,19E-07	3,02E-10	1,59E-10	6,23E-11	1,55E-10	1,61E-09	-5,50E-09
02 EN15804+A2 Non-hazardous waste disposed (NHWD) [kg]	1,47E+00	8,50E-01	1,05E-03	3,12E-02	2,17E-04	2,81E-04	6,51E-01	-6,76E-02
03 EN15804+A2 Radioactive waste disposed (RWD) [kg]	1,23E-02	1,69E-02	1,42E-05	1,56E-05	2,93E-06	8,65E-05	2,81E-04	-4,94E-03
05 EN15804+A2 Materials for Recycling (MFR) [kg]	7,25E+00	1,00E-01	0,00E+00	2,80E+00	0,00E+00	4,35E+00	0,00E+00	0,00E+00

06 EN15804+A2 Material for Energy Recovery (MER) [kg]	9,55E+00	0,00E+00	0,00E+00	7,00E-01	0,00E+00	8,85E+00	0,00E+00	0,00E+00
07 EN15804+A2 Exported electrical energy (EEE) [MJ]	-1,61E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-1,61E+01
08 EN15804+A2 Exported thermal energy (EET) [MJ]	-1,12E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-1,12E+02
5. Optional indicators								
5a. Optional indicators detailed								
01 EN15804+A2 (EF 3.1) Particulate matter [Disease incidences]	8,97E-07	9,68E-07	9,71E-09	1,54E-09	2,00E-09	1,11E-09	3,48E-08	-1,20E-07
02 EN15804+A2 (EF 3.1) Ionising radiation, human health [kBq U235 eq.]	7,09E-01	1,49E+00	2,04E-03	2,45E-03	4,21E-04	1,42E-02	2,05E-02	-8,24E-01
03 EN15804+A2 (EF 3.1) Ecotoxicity, freshwater [CTUe]	4,18E+02	4,11E+02	9,80E+00	1,26E-01	2,02E+00	4,83E-01	2,45E+00	-8,07E+00
04 EN15804+A2 (EF 3.1) Human toxicity, cancer [CTUh]	1,91E-08	2,23E-08	1,32E-10	7,51E-12	2,72E-11	1,31E-11	2,04E-10	-3,62E-09
05 EN15804+A2 (EF 3.1) Human toxicity, non-cancer [CTUh]	4,52E-07	4,39E-07	7,39E-09	1,18E-10	1,52E-09	1,95E-10	9,43E-09	-5,45E-09
06 EN15804+A2 (EF 3.1) Land Use [Pt]	5,30E+02	5,27E+02	3,33E+00	8,94E-02	6,87E-01	6,06E-02	1,59E+00	-2,62E+00