ENVIRONMENTAL PRODUCT DECLARATION

synergy 100 | 200

Program	The International EPD® System EPD International AB www.environdec.com
EPD registration number	S-P-02767
Published	2022-04-11
Valid until	2027-04-10

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

ECO PLATFORM EPD VERIFIED

In accordance with
ISO 14025:2006 and
EN 15804:2012+A2:2019

MOVE BEYOND

Measuring the environmental performance of our products is the foundation for continuous improvement.

CONTENTS

Program-related information & mandatory statement

Program operator
The International EPD® System

more information is available on www.environdec.com, email: info@environdec.com

EPD International AB
Box 210 60
SE-100 31 Stockholm, Sweden

EPD owner
TK Elevator Manufacturing Spain S.L.U.
Federico Cantero Villamil, 4
28935 – Móstoles (Madrid) Spain
www.tkelevator.es

EPD® registration number
S-P-02767

Date of publication
2022-04-11

Valid until
2027-04-10

Geographical scope of application
Europe

Reference year for underlying data
2021

Reference years of datasets
2016-2021

Product category rules (PCR)
EN15804:2012 + A2:2019 as core PCR
PCR 2019:14 Construction Products, version 1.1 C-PCR-008 (TO PCR 2019:14) LIFTS (ELEVATORS) version 2020-10-30

Product classification
UN CPC 4354 – Lifts, skip hoists, escalators and moving walkways

PCR review was conducted by
The Technical Committee of the International EPD® System
Chair: Hüdai Kara

The Technical Committee can be contacted via the Secretariat
www.environdec.com/contact-us

Verification

CEN standard EN 15804 serves as core PCR
Independent verification of the declaration and data, according to EN ISO 14025:2010 ☐ Internal ☒ External
Third party verifier: Rubén Carnerero Acosta (individual verifier) Approved by the International EPD® System Contact: r.carnerero@ik.ingeniera.com

About this EPD

At TK Elevator, we have a strong sense of responsibility towards our customers, employees, society and the environment. Our aim is always to develop solutions that go far beyond the industry standards in all these areas. Within the context of sustainability, we want to understand the environmental performance of our products. That is why we develop Life Cycle Assessments (LCAs) to identify relevant fields of action and enhance the design process.

Our goal is to minimize the environmental impact of our products. To communicate the results of LCAs to the public and ensure transparency regarding the environmental impact of our products, we publish EPDs.

The benefit for our customers is solutions that fulfil the highest demands in terms of efficiency and product responsibility. In addition, they can use EPDs in the context of their green building certifications and introduce elevators into the life cycle assessment of their buildings.

What is an EPD®?
An EPD® provides information about the environmental performance of a product. In the case of this publication, the results refer to TKE synergy 100/200 elevators.

Development of this EPD
Both the EPD® and the underlying LCA study have been developed and third-party-verified in accordance with the product category rules (PCRs) for elevators within the framework of the International EPD® system and its general program instructions for type III environmental declarations according to ISO 14025.

Furthermore, development and verification also follow ISO 14040/44 and the calculation of the energy demand is carried out in accordance with ISO 25745-2. The characterization methodologies used to calculate impact categories on midpoint level are those recommended by EC-JRC, as requested by the PCRs.

Data collection
The data used in the present study is a combination of measured, calculated and estimated data.
The main data sources are the internal data of TK Elevator, generic databases such as GaBi and data from Tier 1 suppliers.

Description of functional unit (FU)
According to the PCRs for elevators, the functional unit is defined as “transportation of a load over a distance, expressed in ton [t] over a kilometer [km] travelled, i.e. ton-kilometer [tkm].”

Comparability of results
Comparability between EPDs based on this c-PCR-008 (to PCR 2019:14) and EPDs based on PCR 2015:05 is not conceivable and shall be avoided. Any comparability of this kind shall be considered as false and misleading the EPD user. EPD®s within the same product category but from different program operators may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804+A2:2019.

Reference standards
ISO 14040 (2006). Environmental management. Life cycle assessment. Principles and framework.
ISO 14044 (2006). Environmental management. Life cycle assessment. Requirements and guidelines.
ISO 14025 (2006). Environmental labels and declarations. Type III environmental declarations. Principles and procedures.
ISO 25745-2 (2015). Energy performance of lifts, escalators and moving walks. Part 2: Energy calculation and classification for lifts (elevators).
EN15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
PCR 2019-14 Construction products.

Key terms

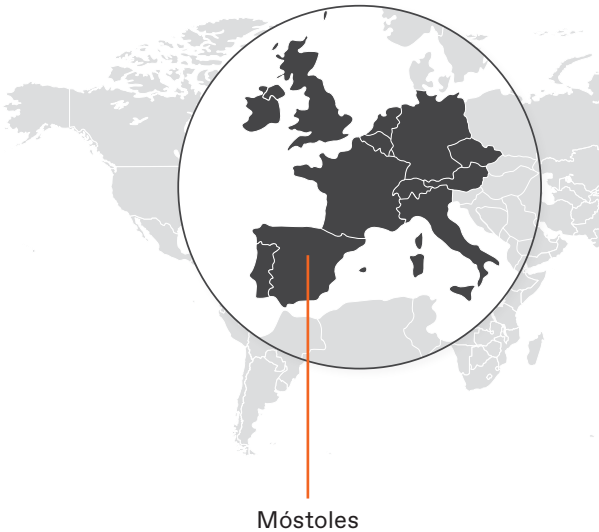
Environmental product declaration according to ISO 14025: Type III environmental declarations provide quantified environmental data using predetermined parameters.

Life cycle assessment (LCA) according to ISO 14040: "Compilation and evaluation of the inputs, outputs and the potential environmental impact of a product system throughout its life cycle."

Product category rules (PCR) according to ISO 14025: "A set of specific rules, requirements and guidelines for developing Type III environmental declarations.

Functional unit (FU) according to ISO 14040: "The quantified performance of a product system for use as a reference unit."

About us



TK Elevator serves customers in over 150 countries and employs more than 50,000 people across approximately 1,000 locations.

Our customers are around the world, and our manufacturing footprint reflects this reality, extending from North and South America to Europe and the Far East. At each of these locations, we concentrate our expertise and experience on engineering and manufacturing urban mobility solutions, developing innovations and continuously optimising existing products.

As a part of this network, our plant in Móstoles, Spain, produces synergy elevators to the highest quality standards customers expect from TK Elevator.

Commited to excellence

We are also committed to achieving the highest standards in all our processes and operations with regard to health, safety, environmental protection and the responsible use of energy and resources. For this reason, all our operations are certified in accordance with the following international standards:

- Lift Directive 214/33/EU, Annex VI, Module E: Quality Assurance for Safety Components
- Lift Directive 214/33/EU, Annex XI, Module H1: Full Quality Assurance for Lifts
- DIN EN ISO 9001: Quality Management System
- DIN EN ISO 14001: Environmental Management System
- DIN EN ISO 50001: Energy Management Systems
- ISO 45001: Occupational Health and Safety Management System

THE SYNERGY ELEVATOR SYSTEM

The synergy elevator system
The new synergy elevator system has been designed to meet the requirements of the future. Drawing on all our decades of experience and expertise across the group, we set out to develop a range of elevators that would combine maximum quality, compactness and technology with an attractive A, B and C design lines.

Boasting innovative features for long life, low maintenance and optimised energy performance, this revolutionary system for new installations and renovations reflects the expertise of TK Elevator on an international level.

Efficiency

Low energy consumption:
Thanks to the highly efficent gearless machine with no contaminant lubricants.

Standby model:
Cabin lighting comes with automatic switch-off as standart.

Sleep mode:
The electronic components are turned off when the elevator is in sleep mode and are instantly activated when the elevator is called.

45% savings by adding sleep mode option

LED lighting is standard for all lighting devices in shaft, cabin (ceilings, push-buttons, etc.) and landings. LED lighting can last 10 times longer and is up to 80% more energy efficient than halogen lighting.

Gearless machine: low energy consumption, no need for oil or other lubricants, maintenance free.

Reliability
- Robust design
- High-quality materials
- Future-proof control system
- Efficient maintenance

C design line: Long-lasting skinplate and stainless steel finishes


C20


C30

B design line: High-quality laminates, melamines and stainless steel finishes


B56


B66

A design line: Top-class glass finishes and patterned stainless steel


A52


A53

The synergy elevator series complies with all relevant international standards and regulations:

- **Lifts Directive 2014/33/EU:** Directive of the European Parliament
- **EN 81:** Safety rules for the construction and installation of lifts
  - Part 20: Passenger and goods/ passenger lifts
  - Part 50: Design rules, calculations, examinations and tests of lift components
- **Type-tested system:** certification by notified body
- **CE marking** in compliance with EU legal requirements to guarantee health, safety and environmental protection
- **ISO 25754 – 1/2**

The synergy elevator system

Table 1: Specification of assessed elevator according to the PCRs

synergy®		
Index	**Representative values for the reference unit**	**Application range of the elevator model**
Type of installation	New installation	
Commercial name (type)	synergy 100 / 200	
Main purpose	Transport of passengers	
Type of elevator	Electric, without machine room (MRL)	Electric, MR / MRL
Type of drive system	Gearless traction drive	
Rated load [Q]	1,000 kg	320 up to 1600 kg
Rated speed	1 m/s	1 m/s up to 1.75 m/s
Number of stops	5	up to 20
Travelled height	12,25 m	Up to 75 m
Number of operating days per year	365	
Applied usage category (UC) according to ISO 25745-2	1 & 2	
Designed reference service life (RSL)	25 years	
Geographic region of installation	Europe	
Optional equipment	Sleep mode	

Table 2: Transportation performance for selected usage categories according to the PCRs

	UC1	UC2
FU (tkm)	196.07	490.18

Representative installation
The reference for the underlying life-cycle assessment (LCA) study was an elevator installed in a residential building in Spain. Its configuration corresponds to the typical application range of the synergy series. For energy consumption during operation, the European average grid mix was considered.

Value and relevance of functional unit (FU)
The FU is determined by the physical characteristics of the assessed elevator (e.g. rated load, rated speed, travelled height) and parameters that are chosen based on its assumed use (e.g. use category, trips per day, operating days per year). The usage categories included in the analysis reflect the use of this product in low rise residential buildings.

Content declaration
A detailed composition of the reference elevator and packaging in quantitative terms according to the PCRs is set out in Figure 1. This content declaration considers all life-cycle phases and cut-off rules according to the PCRs.

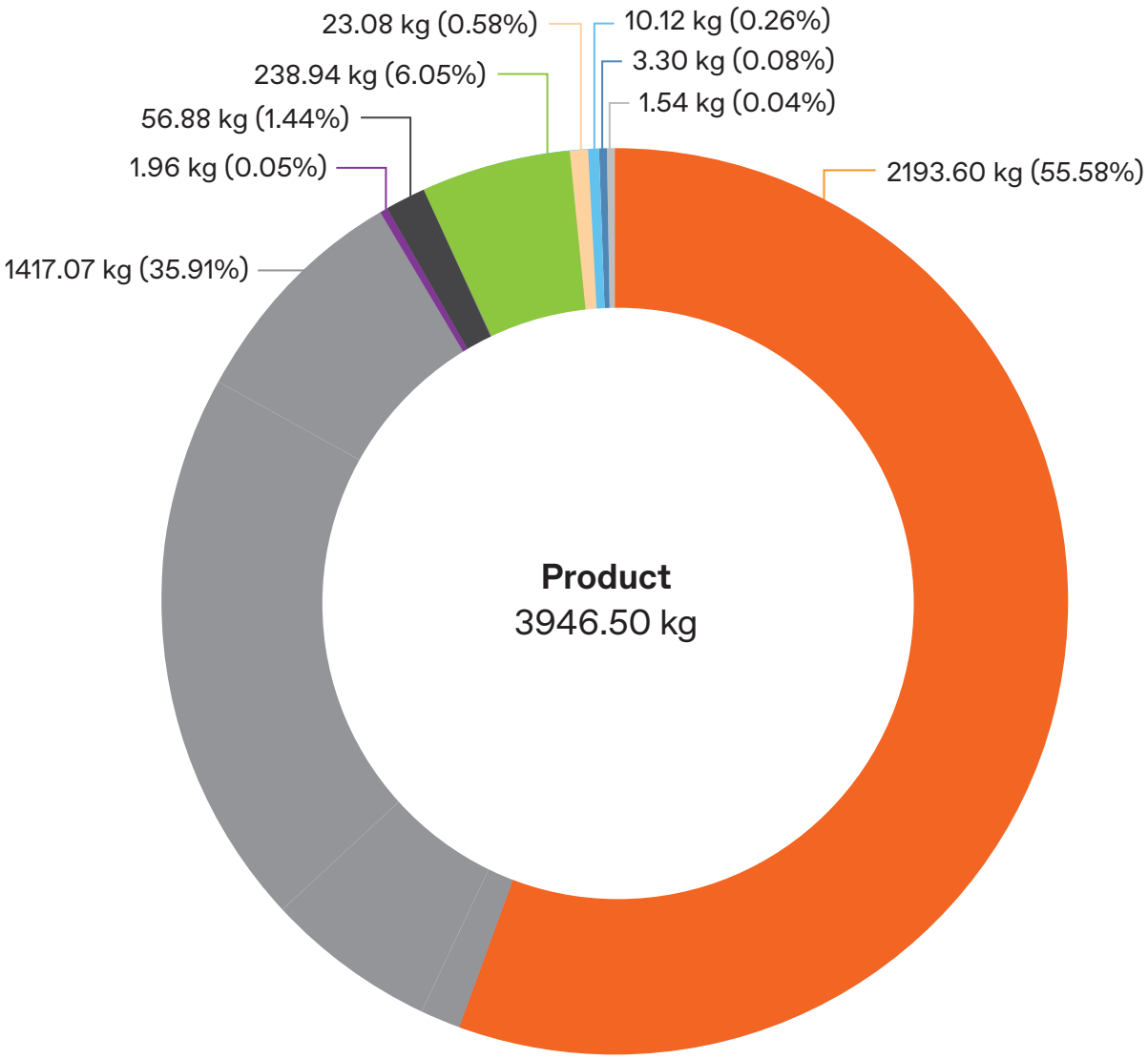
Almost 56% of the material the elevator is made of belongs to the material category of ferrous metals, followed by inorganic materials with more than 35%, organic materials (6,05%) and plastics and rubbers (1,44%) . The rest of the material categories account each for less than 1%.

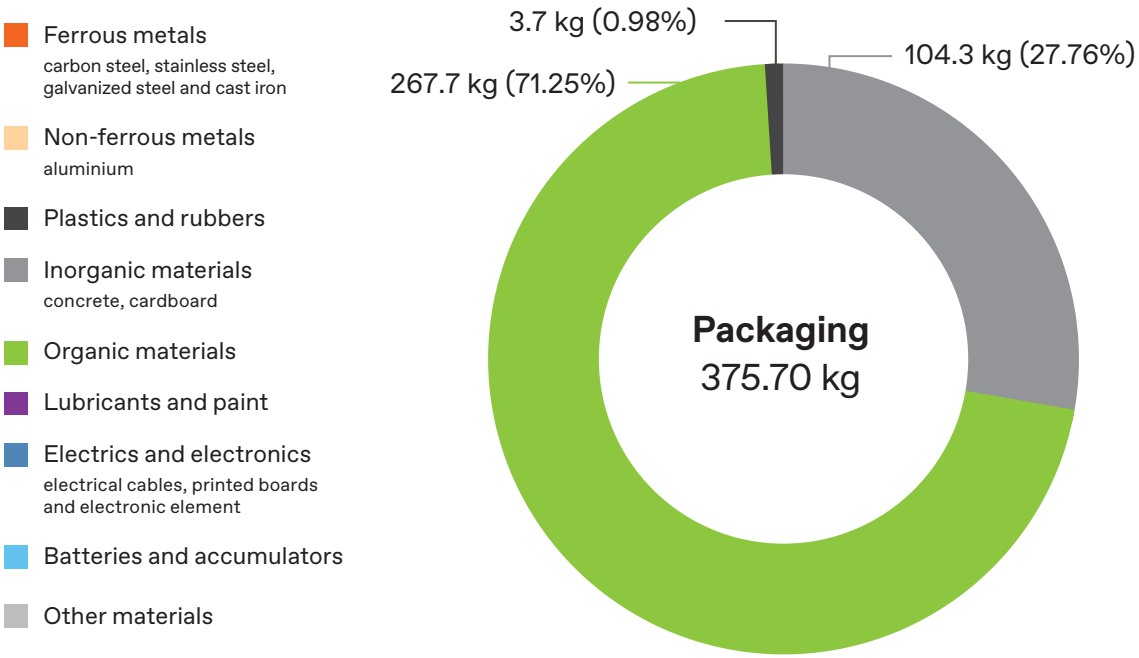
The subsystems in which these materials are included are mostly Counterweight, Car, Guiderails, Doors, Traction machine, Doors, Controller and Inverter.

Substances in the SVHC list according to REACH directive are avoided as far as possible. Nevertheless, lead (CAS number 7439-92-1) may be present above 0.1 % in weight in some articles used in the product.

The main materials used for the packaging of the elevator are wood and cardboard, that represents 99% of the overall packaging weight, and contain 169.4 kg C of biogenic carbon

Figure 1: Material balance of assessed elevator (excl. spare parts)





Life cycle assessment

According to the applicable PCRs, this EPD has a cradle to grave scope plus module D. Therefore, it covers four main stages. The product stage (A1-A3) aggregates all processes related to the obtention of raw materials and their further transformation and processing to produce, assemble and pack all components for the assessed unit. Manufacturing activities take place at TKE site in Spain and suppliers facilities located in Spain, Germany, and China. The construction process stage (A4-A5) considers the road and sea transport from TKE to the installation site (in Europe), the final assembly of the elevator, and the disposal of packaging. For product and construction stages, the percentage of specific data used is higher than 90%. The use stage (B1-B7) consists of all processes related to operation and preventive maintenance, mainly transport of workers to maintenance site, production of spare parts, energy and auxiliary materials used for maintenance and operational energy use. The end-of-life stage (C1-C4) considers all processes that take place at the end of the elevator service life, this is, the final disassembly, waste processing, and disposal of the elevator components and materials. Finally, module D includes the benefits derived from the recycling of metallic materials and energy recovery from the incineration of packaging materials. The geographical scope for all downstream processes is Europe.The resulting system boundaries are presented in the figure below:

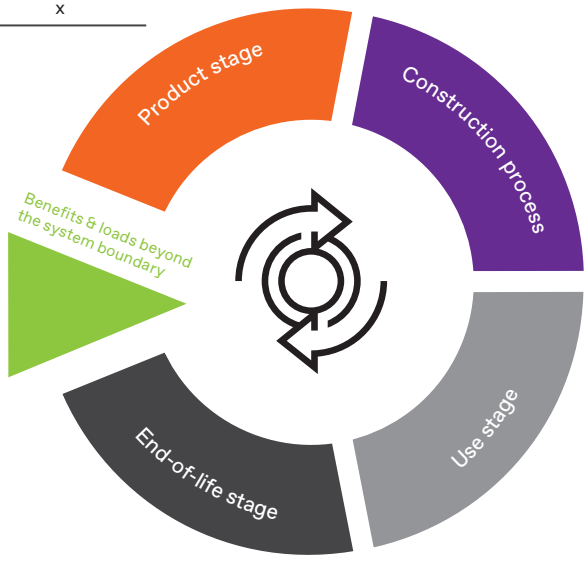
Figure 1: Life-cycle stages and respective information modules according to the PCRs

A1-A3 Product stage

Information module		Module declared
A1	Raw material supply	x
A2	Transport	x
A3	Manufacturing	x

A4-A5 Construction process

Information module		Module declared
A4	Transport	x
A5	Installation	x



D Benefits & loads beyond system boundary

Information module		Module declared
D	Reuse, recovery and recycling potential	x

C1-C4 End-of-life stage

Information module		Module declared
C1	Deconstruction	x
C2	Transport	x
C3	Waste processing	x
C4	Waste disposal	x

B1-B7 Use stage

Information module		Module declared
B1	Use	n.d.
B2	Maintenance	x
B3	Repair	n.d.
B4	Replacement	n.d.
B5	Refurbishment	n.d.
B6	Operational energy use	x
B7	Operational water use	n.d.

Results of the study

The following section contains the results of the underlying LCA study according to the PCRs. The disclosure of results is structured in three subsections: Potential environmental impacts, use of resources, waste categories and output flows. The tables show results per FU for the two analyzed UCs.

Potential environmental impact

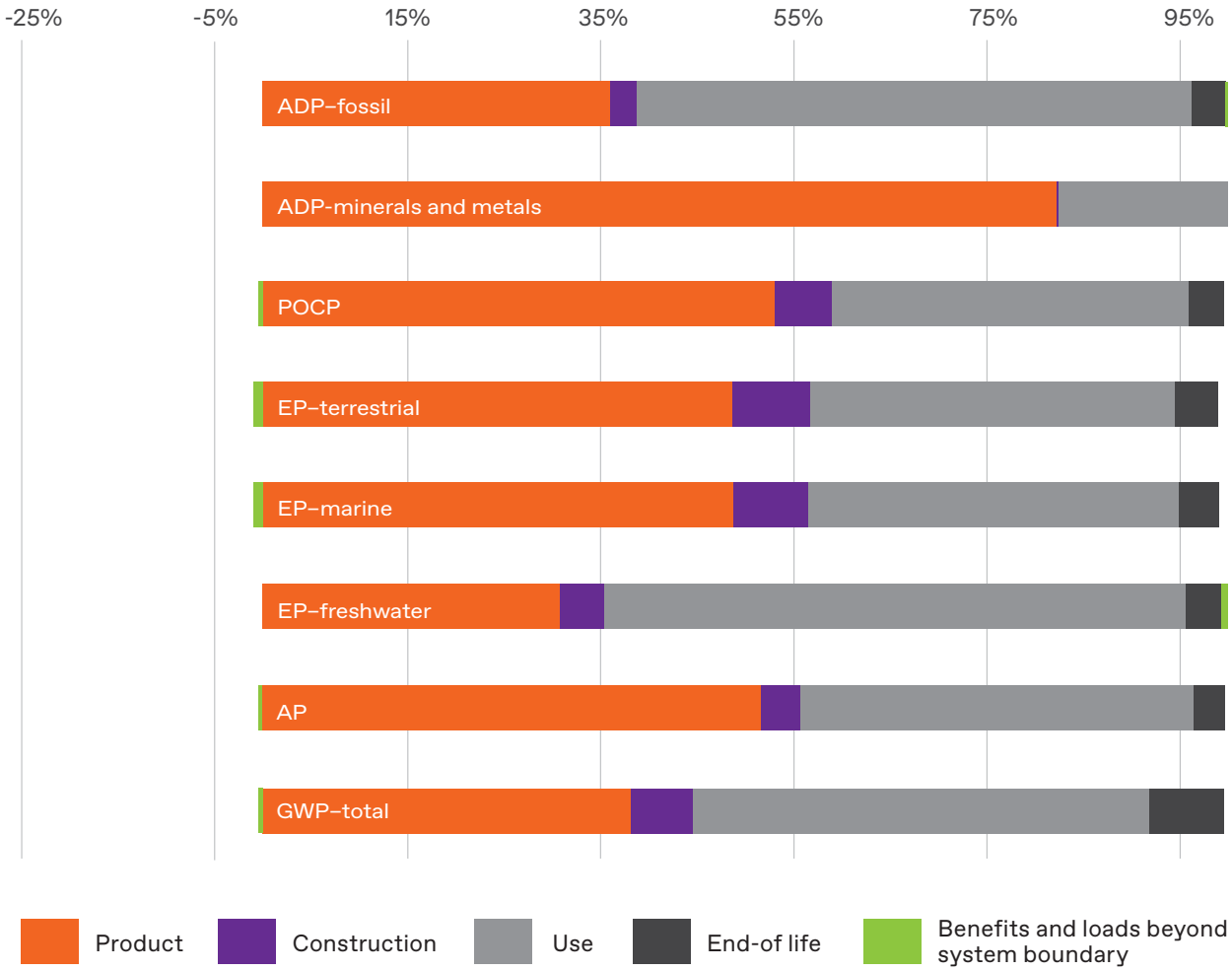
Table 3: Impact category results by information module

Information module	Usage category	GWP–total	GWP–fossil	GWP–biogenic	ODP	AP	EP–freshwater	EP–freshwater	EP–marine	EP–terrestrial	POCP	ADP–minerals metals	ADP–fossil	WDP	GWP-100*
		kg CO_2 eq.	kg CO_2 eq.	kg CO_2 eq.	kg CFC-11 eq.	Mol of H+ eq.	kg P eq.	kg PO_4 eq.	kg N eq.	Mol N eq.	kg NMVOC eq.	kg Sb eq.	MJ, net cal. value	m^3 world eq.	kg CO_2 -eq
A1	UC1	3,41E+01	3,46E+01	-5,45E-01	9,99E-11	1,10E-01	3,57E-05	1,10E-04	2,13E-02	2,27E-01	7,25E-02	1,32E-03	3,83E+02	1,49E+01	3,42E+01
	UC2	1,36E+01	1,39E+01	-2,18E-01	3,99E-11	4,41E-02	1,43E-05	4,38E-05	8,52E-03	9,10E-02	2,90E-02	5,26E-04	1,53E+02	5,96E+00	1,37E+01
A2	UC1	8,93E-01	8,69E-01	2,04E-02	1,01E-16	1,87E-02	1,43E-06	4,39E-06	5,36E-03	5,88E-02	1,39E-02	4,70E-08	1,11E+01	4,56E-03	8,68E-01
	UC2	3,57E-01	3,47E-01	8,18E-03	4,04E-17	7,49E-03	5,72E-07	1,76E-06	2,14E-03	2,35E-02	5,57E-03	1,88E-08	4,45E+00	1,82E-03	3,47E-01
A3	UC1	1,86E+00	3,15E+00	-1,29E+00	5,59E-12	1,07E-02	2,55E-05	7,83E-05	3,36E-03	3,43E-02	1,02E-02	9,41E-07	9,59E+01	9,13E-01	4,63E+00
	UC2	7,46E-01	1,26E+00	-5,15E-01	2,24E-12	4,28E-03	1,02E-05	3,13E-05	1,34E-03	1,37E-02	4,08E-03	3,76E-07	3,84E+01	3,65E-01	1,85E+00
A1-A3	UC1	3,69E+01	3,87E+01	-1,81E+00	1,05E-10	1,40E-01	6,26E-05	1,92E-04	3,00E-02	3,21E-01	9,66E-02	1,32E-03	4,90E+02	1,58E+01	3,97E+01
	UC2	1,47E+01	1,55E+01	-7,25E-01	4,22E-11	5,59E-02	2,51E-05	7,69E-05	1,20E-02	1,28E-01	3,87E-02	5,27E-04	1,96E+02	6,33E+00	1,59E+01
A4	UC1	1,51E+00	1,43E+00	6,40E-02	1,85E-16	8,19E-03	4,30E-06	1,32E-05	4,00E-03	4,43E-02	7,71E-03	1,10E-07	1,93E+01	1,26E-02	1,43E+00
	UC2	6,03E-01	5,72E-01	2,56E-02	7,40E-17	3,27E-03	1,72E-06	5,28E-06	1,60E-03	1,77E-02	3,08E-03	4,41E-08	7,71E+00	5,03E-03	5,73E-01
A5	UC1	4,61E+00	1,37E+00	3,24E+00	2,32E-14	2,97E-03	5,10E-06	1,57E-05	8,57E-04	8,92E-03	3,11E-03	2,34E-06	1,90E+01	2,59E-01	3,66E+00
	UC2	1,84E+00	5,47E-01	1,30E+00	9,28E-15	1,19E-03	2,04E-06	6,26E-06	3,43E-04	3,57E-03	1,24E-03	9,37E-07	7,60E+00	1,03E-01	1,47E+00
B2	UC1	7,81E+00	7,57E+00	2,29E-01	6,44E-11	3,25E-02	2,04E-05	6,26E-05	5,05E-03	5,45E-02	1,68E-02	2,70E-04	1,20E+02	7,80E+00	7,72E+00
	UC2	3,12E+00	3,03E+00	9,17E-02	2,57E-11	1,30E-02	8,16E-06	2,51E-05	2,02E-03	2,18E-02	6,73E-03	1,08E-04	4,78E+01	3,12E+00	3,09E+00
B6	UC1	3,78E+01	3,74E+01	3,18E-01	8,96E-13	7,78E-02	1,02E-04	3,13E-04	1,85E-02	1,94E-01	5,02E-02	1,02E-05	6,65E+02	6,00E+00	3,76E+01
	UC2	2,10E+01	2,08E+01	1,77E-01	4,98E-13	4,32E-02	5,51E-05	1,69E-04	1,03E-02	1,08E-01	2,79E-02	6,12E-06	3,70E+02	3,33E+00	2,09E+01
C1	UC1	2,40E+00	2,38E+00	2,02E-02	5,68E-14	4,95E-03	5,10E-06	1,57E-05	1,18E-03	1,23E-02	3,19E-03	7,01E-07	4,23E+01	3,95E-01	2,39E+00
	UC2	9,61E-01	9,51E-01	8,07E-03	2,27E-14	1,98E-03	2,04E-06	6,26E-06	4,71E-04	4,94E-03	1,28E-03	2,80E-07	1,69E+01	1,58E-01	9,57E-01
C2	UC1	4,68E-02	4,45E-02	1,94E-03	8,75E-18	1,63E-04	1,32E-07	4,04E-07	7,65E-05	8,47E-04	1,48E-04	3,93E-09	5,90E-01	4,13E-04	4,44E-02
	UC2	1,87E-02	1,78E-02	7,77E-04	3,50E-18	6,53E-05	5,27E-08	1,62E-07	3,06E-05	3,39E-04	5,92E-05	1,57E-09	2,36E-01	1,65E-04	1,78E-02
C3	UC1	3,73E-02	3,70E-02	9,69E-05	1,65E-16	3,47E-04	8,42E-08	2,58E-07	1,68E-04	1,87E-03	4,95E-04	4,07E-08	6,97E-01	6,21E-03	3,69E-02
	UC2	1,49E-02	1,48E-02	3,88E-05	6,59E-17	1,39E-04	3,37E-08	1,03E-07	6,73E-05	7,49E-04	1,98E-04	1,63E-08	2,79E-01	2,48E-03	1,48E-02
C4	UC1	5,04E+00	2,32E+00	2,71E+00	5,03E-13	3,06E-03	2,23E-06	6,84E-06	1,14E-03	1,42E-02	3,01E-03	2,16E-08	3,85E+00	8,32E-01	2,32E+00
	UC2	2,02E+00	9,30E-01	1,09E+00	2,01E-13	1,22E-03	8,91E-07	2,73E-06	4,57E-04	5,67E-03	1,20E-03	8,65E-09	1,54E+00	3,33E-01	9,29E-01
D	UC1	-4,10E-01	-4,12E-01	-1,65E-03	1,79E-14	-1,03E-03	1,33E-06	4,07E-06	-5,81E-04	-6,68E-03	-7,91E-04	0,00E+00	3,97E+00	8,36E+00	-4,71E+00
	UC2	-1,64E-01	-1,65E-01	-6,59E-04	7,16E-15	-4,12E-04	5,30E-07	1,63E-06	-2,33E-04	-2,67E-03	-3,16E-04	0,00E+00	1,59E+00	3,34E+00	-1,89E+00

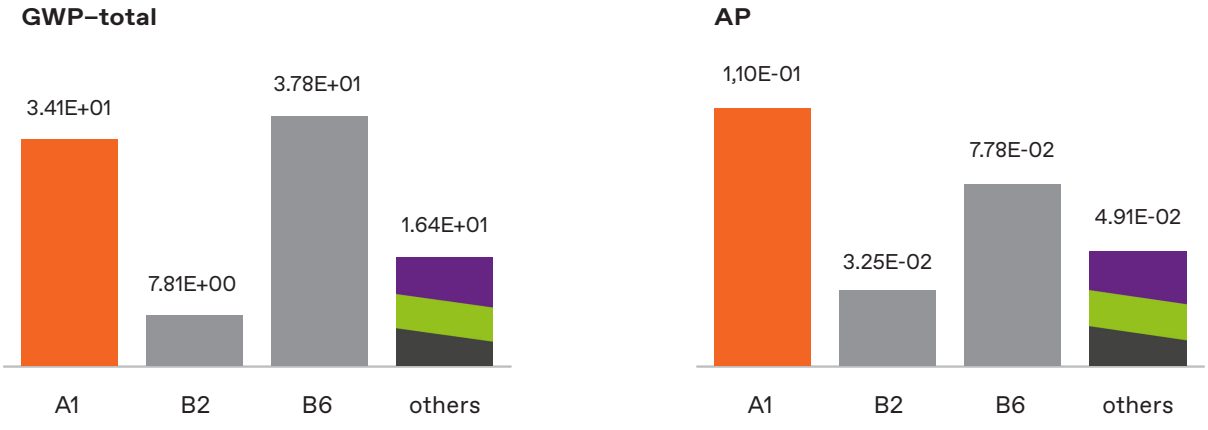
* GWP-100: IPCC AR5 GWP, excluded biogenic carbon.

Impact category results by life cycle stage per FU

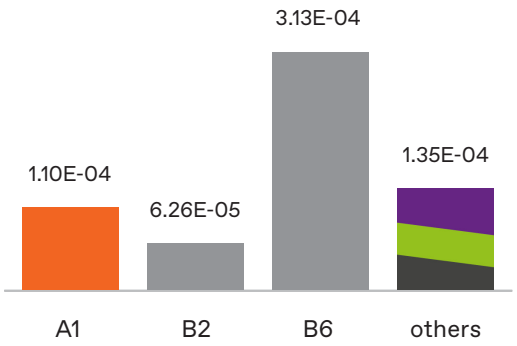
Figure 2: Impact category results by life-cycle stage (in %, UC1) The figure below shows the share of the different life-cycle stages for the most relevant impact categories in percentages, resulting in a sum of 100%. It is based in UC1.



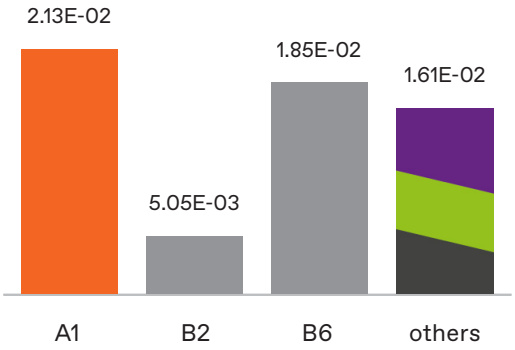
In **Figure 3: Comparison of impacts of main contributors**, below, the impact results of the three largest contributors (A1, B2 and B6) to the overall UC1 results are compared with each other and the sum of the rest of the information modules.



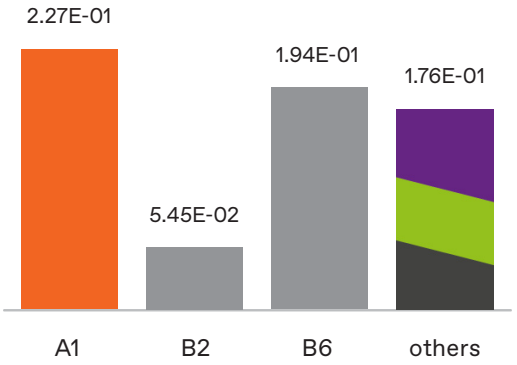
EP–freshwater



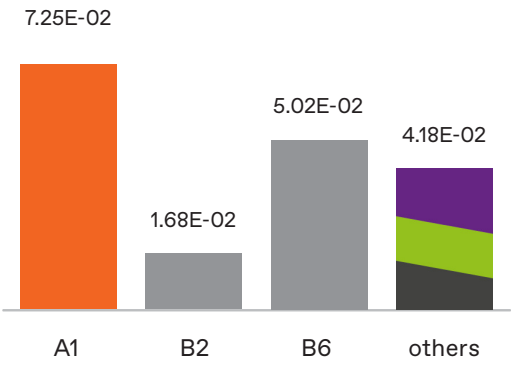
EP–marine



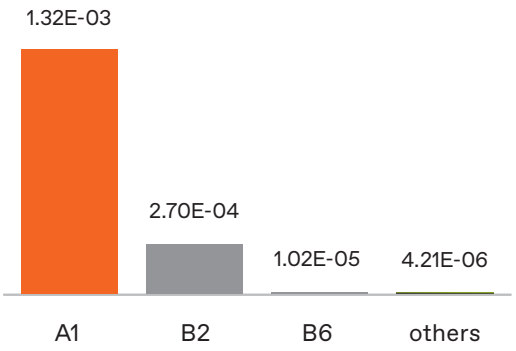
EP–terrestrial



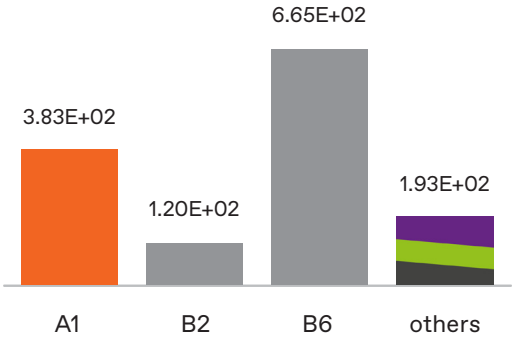
POCP



ADP–minerals metals



ADP–fossil



Use of resources

At this point the results for the use of resources are presented. These are divided into renewable and non-renewable energy resources, including primary energy and energy resources used as raw materials, secondary materials and fuels, and water. **Table 4: Indicators describing resource use by information module**

Indicator		PERE	PERM	PERT	PENRE	PENRM	PENRT	FW	SM	NRSF	RSF
Unit		MJ	MJ	MJ	MJ	MJ	MJ	m^3	kg	MJ	MJ
A1	UC1	4,28E+01	6,47E+00	4,93E+01	3,83E+02	0,00E+00	3,83E+02	3,81E-01	2,01E+00	0,00E+00	0,00E+00
	UC2	1,74E+01	2,59E+00	2,00E+01	1,55E+02	0,00E+00	1,55E+02	1,56E-01	8,03E-01	0,00E+00	0,00E+00
A2	UC1	3,52E-01	0,00E+00	3,52E-01	1,11E+01	0,00E+00	1,11E+01	4,13E-04	0,00E+00	0,00E+00	0,00E+00
	UC2	1,41E-01	0,00E+00	1,41E-01	4,45E+00	0,00E+00	4,45E+00	1,65E-04	0,00E+00	0,00E+00	0,00E+00
A3	UC1	6,25E+01	3,48E+01	9,73E+01	9,60E+01	6,79E-01	9,66E+01	2,50E-02	4,64E-01	0,00E+00	0,00E+00
	UC2	2,01E+01	1,39E+01	3,40E+01	4,00E+01	2,72E-01	4,03E+01	1,11E-02	1,86E-01	0,00E+00	0,00E+00
A1-A3	UC1	1,06E+02	4,13E+01	1,47E+02	4,90E+02	6,79E-01	4,91E+02	4,06E-01	2,47E+00	0,00E+00	0,00E+00
	UC2	3,76E+01	1,65E+01	5,41E+01	1,99E+02	2,72E-01	2,00E+02	1,67E-01	9,89E-01	0,00E+00	0,00E+00
A4	UC1	1,08E+00	0,00E+00	1,08E+00	1,93E+01	0,00E+00	1,93E+01	1,23E-03	0,00E+00	0,00E+00	0,00E+00
	UC2	4,30E-01	0,00E+00	4,30E-01	7,72E+00	0,00E+00	7,72E+00	4,92E-04	0,00E+00	0,00E+00	0,00E+00
A5	UC1	7,95E+00	-3,48E+01	-2,69E+01	1,90E+01	-6,79E-01	1,83E+01	1,02E-02	4,44E-04	0,00E+00	0,00E+00
	UC2	3,18E+00	-1,39E+01	-1,07E+01	7,60E+00	-2,72E-01	7,33E+00	4,07E-03	1,77E-04	0,00E+00	0,00E+00
B2	UC1	2,81E+01	0,00E+00	2,81E+01	1,20E+02	0,00E+00	1,20E+02	1,89E-01	3,09E-01	0,00E+00	0,00E+00
	UC2	1,12E+01	0,00E+00	1,12E+01	4,78E+01	0,00E+00	4,78E+01	7,54E-02	1,23E-01	0,00E+00	0,00E+00
B6	UC1	3,07E+02	0,00E+00	3,07E+02	6,66E+02	0,00E+00	6,66E+02	2,99E-01	0,00E+00	0,00E+00	0,00E+00
	UC2	1,70E+02	0,00E+00	1,70E+02	3,70E+02	0,00E+00	3,70E+02	1,66E-01	0,00E+00	0,00E+00	0,00E+00
C1	UC1	1,95E+01	0,00E+00	1,95E+01	4,23E+01	0,00E+00	4,23E+01	1,93E-02	3,47E-04	0,00E+00	0,00E+00
	UC2	7,78E+00	0,00E+00	7,78E+00	1,69E+01	0,00E+00	1,69E+01	7,71E-03	1,39E-04	0,00E+00	0,00E+00
C2	UC1	3,40E-02	0,00E+00	3,40E-02	5,92E-01	0,00E+00	5,92E-01	4,08E-05	0,00E+00	0,00E+00	0,00E+00
	UC2	1,36E-02	0,00E+00	1,36E-02	2,37E-01	0,00E+00	2,37E-01	1,63E-05	0,00E+00	0,00E+00	0,00E+00
C3	UC1	6,16E-02	0,00E+00	6,16E-02	6,97E-01	0,00E+00	6,97E-01	1,79E-04	0,00E+00	0,00E+00	0,00E+00
	UC2	2,46E-02	0,00E+00	2,46E-02	2,79E-01	0,00E+00	2,79E-01	7,14E-05	0,00E+00	0,00E+00	0,00E+00
C4	UC1	5,91E-01	-6,47E+00	-5,88E+00	3,84E+00	0,00E+00	3,84E+00	1,95E-02	0,00E+00	0,00E+00	0,00E+00
	UC2	2,36E-01	-2,59E+00	-2,35E+00	1,54E+00	0,00E+00	1,54E+00	7,80E-03	0,00E+00	0,00E+00	0,00E+00
D	UC1	2,23E+00	0,00E+00	2,23E+00	3,70E+00	0,00E+00	3,70E+00	2,00E-01	0,00E+00	0,00E+00	0,00E+00
	UC2	8,93E-01	0,00E+00	8,93E-01	1,48E+00	0,00E+00	1,48E+00	7,99E-02	0,00E+00	0,00E+00	0,00E+00

PERE
Use of renewable primary energy excluding renewable energy resources used as raw material

PERM
Use of renewable primary energy resources used as raw material

PERT
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw material)

PENRE
Use of non-renewable primary energy excluding non-renewable energy resources used as raw material

PENRM
Use of non-renewable primary energy resources used as raw material

PENRT
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw material)

SM
Use of secondary material

RSF
Use of renewable secondary fuels

NRSF
Use of non-renewable secondary fuels

FW
Net use of fresh water

Waste categories and output flows

Table 5: Waste indicators by information module. The table below provides information about the amount of disposed waste by information module per tkm, according to the categories established in the reference PCRs.

Indicator		HWD	NHWD	RWD
Unit		kg	kg	kg
A1	UC1	1,07E-04	2,06E+00	3,77E-03
	UC2	4,28E-05	8,23E-01	1,51E-03
A2	UC1	3,42E-10	1,41E-03	1,53E-05
	UC2	1,37E-10	5,63E-04	6,12E-06
A3	UC1	1,74E-07	6,41E-01	3,99E-03
	UC2	6,94E-08	2,57E-01	1,60E-03
A1-A3	UC1	1,07E-04	2,70E+00	7,78E-03
	UC2	4,29E-05	1,08E+00	3,11E-03
A4	UC1	9,72E-10	2,87E-03	2,55E-05
	UC2	3,89E-10	1,15E-03	1,02E-05
A5	UC1	4,83E-09	8,73E-01	2,53E-03
	UC2	1,93E-09	3,49E-01	1,01E-03
B2	UC1	3,35E-06	4,92E-01	4,30E-03
	UC2	1,34E-06	1,97E-01	1,72E-03
B6	UC1	1,76E-07	4,72E-01	9,91E-02
	UC2	9,78E-08	2,62E-01	5,51E-02
C1	UC1	1,12E-08	3,01E-02	6,29E-03
	UC2	4,48E-09	1,21E-02	2,52E-03
C2	UC1	3,12E-11	9,18E-05	1,07E-06
	UC2	1,25E-11	3,67E-05	4,30E-07
C3	UC1	4,05E-11	1,99E-04	5,10E-06
	UC2	1,62E-11	7,96E-05	2,04E-06
C4	UC1	2,65E-08	5,88E+00	1,38E-04
	UC2	1,06E-08	2,35E+00	5,51E-05
D	UC1	1,63E-04	-4,41E-01	-1,89E-04
	UC2	6,53E-05	-1,76E-01	-7,55E-05

Table 6: Output flows The amounts of materials leaving the system boundary after reaching the end-of-waste state is reported in table below. Most part of the elevator materials are metals, with high recyclability. Organic materials used in packaging are considered to be directed to incineration. No components are reused after the end-of-waste state.

Indicator		CRE	MFR	MER	EEE	EET
Unit		MJ	MJ	m^3	kg	MJ
A1	UC1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	UC2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
A2	UC1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	UC2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
A3	UC1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	UC2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
A1-A3	UC1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	UC2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
A4	UC1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	UC2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
A5	UC1	0,00E+00	0,00E+00	9,03E+00	9,16E+00	2,65E+01
	UC2	0,00E+00	0,00E+00	3,61E+00	3,66E+00	1,06E+01
B2	UC1	0,00E+00	1,29E+00	3,30E-01	3,35E-01	9,70E-01
	UC2	0,00E+00	5,17E-01	1,32E-01	1,34E-01	3,88E-01
B6	UC1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	UC2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
C1	UC1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	UC2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
C2	UC1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	UC2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
C3	UC1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	UC2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
C4	UC1	0,00E+00	1,13E+01	0,00E+00	0,00E+00	0,00E+00
	UC2	0,00E+00	4,52E+00	0,00E+00	0,00E+00	0,00E+00

HWD Hazardous waste disposed

NHWD Non hazardous waste disposed

RWD Radioactive waste disposed

CRE Components for reuse

MFR Materials for recycling

MER Materials for energy recovery

EEE Exported energy Electrical

EET Exported energy Thermal

Analysis of results / conclusion

General observations
The product stage is the most important contributor to the overall burden of the assessed elevator over its entire life cycle in seven out of twelve analyzed categories (GWP-biogenic excluded). The use stage represents the second highest impact area, being the largest contributor to the remaining five categories. Module [D] results in benefits for almost all impact categories. In contrast, the construction and end-of-life stage have little relevance in terms of the environmental burden.

Product stage [A1] – Raw material supply
This information module is the information module with the highest contribution to the overall environmental burden of the assessed elevator in categories AP, OPD, EP (-marine and-terrestrial), POCP, ADP -minerals and metals, WDP, and the second most important one in GWP (-total and –fossil) and ADP-Fossil. Its high impact is mainly caused by the energy-intensive extraction and production processes of raw materials used for the different components of the elevator. The high level of the results is primarily produced by components made from carbon steel and other „Ferrous metals“, which represent close to 56 % of the total weight of the assessed elevator.

Nevertheless, in relative terms components with a high share of Electric and Electronics (based on their specific impact per kg) have the highest impact on the results and are therefore of major relevance in the product life cycle.

[B6] Operational energy use
This information module is the information module with the highest contribution to the overall environmental burden of the assessed elevator for ADP- Fossil, GWP-fossil and GWP –total. It is the second most important contributor to AP, EP-freshwater, EP-marine, EP terrestrial and POCP. As a result, operation during the use phase thus also significantly influences overall environmental impact due to the consumed energy. Analysis of alternative use scenarios, in which the assessed elevator is operated in different locations, showed substantial differences in the overall results for most impact categories (GWP-total, GWP –fossil, ADP-fossil, AP, EP- terrestrial, EP- marine, POCP). These differences can be attributed to the variations between energy sources for different grid mixes. As a consequence, the choice of grid mix needs to be carefully considered.

[B2] Maintenance
This information module dominates the use phase for categories ODP, WDP and for category ADP, causing up to 99% of its burden. For these three categories, the production of spare components for the elevator for the whole service life is the most significant aspect of module [B2]. The same as for [A1], ferrous metals and electric and electronic equipment (see table 9) are the main contributors to this burden.

Potential for improvements
The use of ferrous metals, especially carbon steel, has a major effect on the [A1] and [B2] impacts. In context of Car, Rails, Fishplate & Mounting Material, Doors and Machine, components with optimized geometries could be developed in order to provide a weight reduction and therefore lower impacts. With reference to the ferrous metals, components made of organics, plastics and rubbers show lower impacts than of ferrous metals due to a major weight reduction. As a result, using these materials as an alternative – if feasible for their application – may achieve improved results. In addition, in terms of moving parts, the lower weight results in less energy demand and thus optimises B6 values.

Explanation of negative values GWP–biogenic for [A3]
The negative GWP–biogenic for [A3] is a result of the cradle-to-gate process of wood production, where wood absorbs CO_2 during its growth period (negative CO_2 balance). Release of this CO_2 is considered in [A5] when the packaging and decoration components are disposed of (positive CO_2 balance).

Scenarios and additional technical information

Allocations in [A3]

At TKEMS production site, the share of resources (energy and materials) and waste that is used for the production of a synergy elevator as specified in table 1 cannot be measured or calculated. The consumptions, inflows and outflows allocated to the reference unit are defined based on the annual figures for the overall facility and the number of elevator units produced in the year. Using the same approach, inputs and outputs at suppliers are allocated based on the weight of primary products delivered to TKES for the assembly of the assessed elevator.

Electricity grid mix in manufacturing [A3] and operation [B6]

The synergy elevator is produced at TKEMS site in Spain, with elevator components and materials coming from suppliers located in several European countries, mainly Spain, Germany and China. For the operational energy use, the average European grid mix is considered. Therefore electricity datasets for Germany, Spain, China and European average have been used in the study.

The table 7 reflects their environmental impact expressed in kg CO_2-eq/* kWh

Country	CO_2-eq/kWh
Germany	0.544
Spain	0.411
China	0.826
Europe (average)	0.401

Table 7 Information on electricity grid mixes

Transport to installation site [A4]

Road and sea transport is used to deliver synergy elevators to European and African destinations. An average distance has been calculated taking into account the countries where this elevator model is most frequently installed. The table 8 below summarizes A4 data.

Table 8: Data in context of transport to installation site summarizes A4 data

Type of vehicle	Distance	Capacity utilisation
Truck-trailer / Euro 4 / 34 to 40t gross weight / 27t payload capacity	1192 km	61%
Container ship / 5,000 to 200,000 dwt payload capacity / ocean going	274.4 km	70%

Maintenance [B2]

Preventive maintenance activities are scheduled activities, which ensure the proper operation of the elevator during its reference service life. The main inputs in this module are the transport of workers to the installation site, the electricity consumption during maintenance activities and the raw material extraction for spare parts. The tables 9 and 10 summarize these inputs.

Table 9 Data in context of preventive maintenance

Data	Value	Unit
Maintenance cycle and process	As in maintenance manual	
Annual electricity consumption by maintenance tools	27.85	kWh
Annual oil consumption	2	kg
Annual wax consumption	0.13	l
Transportation Distance to Disposal Site (packaging materials)	25.7	km
Annual diesel consumption for transport of workers	1.68	l

Table 10. Material content. Spare parts.

Material type	Weight in kg	Share of total in %
Ferrous metals	277.11	88.11%
Inorganic materials	19.16	6.09%
Plastics & Rubbers	12.71	4.04%
Non-ferrous metals	4.96	1.58%
Organic materials	0.36	0.12%
Other materials	0.2	0.06%
Overall	**314.50**	**100**

Energy consumption in operation [B6]

The synergy elevator annual energy consumption during operation has been calculated acc. to ISO 25745-2. For this study Usage categories 1 and 2 of ISO 25745-2 have been considered (between 50 and 125 trips per day) as they represents the most typical applications for this reference unit in low rise residential buildings. The annual energy consumptions are those indicated in table 11.

Table 11: Calculated annual energy consumption

Usage category (acc to ISO 25745-2)	Calculated annual energy consumption [kWh]
1	738
2	1025

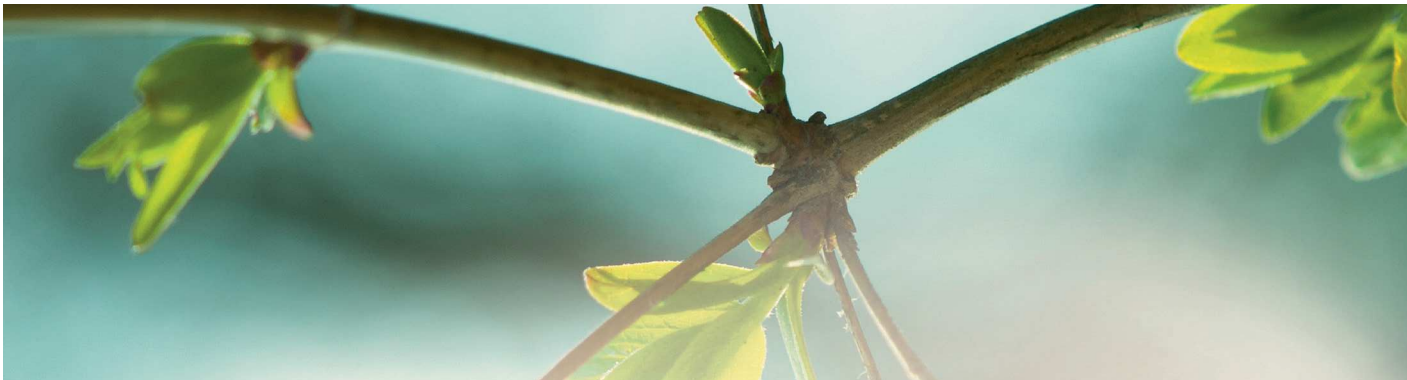
End-of-life [C2-C4]

The elevator is mainly composed by metallic materials, with high recyclability and high recycling ratios in European countries. Plastics are considered to be disposed at waste incineration facilities, and the rest of materials are considered as landfilled.

Net benefits in module D are calculated based on the metals directed to recovery using a net flow calculation acc. to EN15804, taking into account the input and outflows of recycled materials.

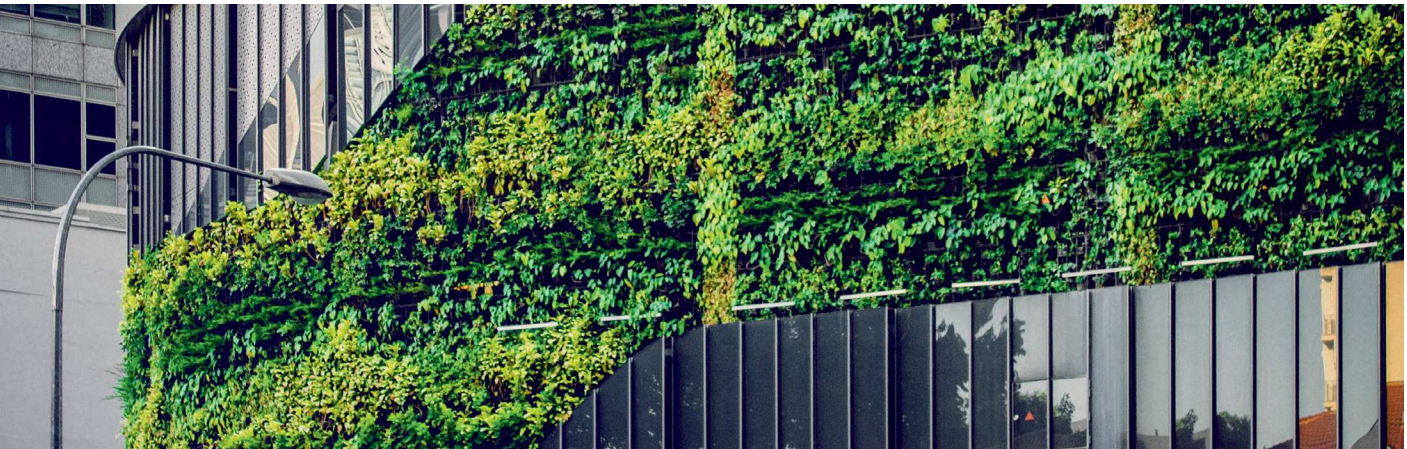
Table 12: Information about end-of-life processes

Processes	Unit	Amount kg/kg
Collection process	Kg collected separatedly	1
	Kg collected with mixed construction waste	0
Recovery system	kg for reuse	0
	kg for recycling	0.56
	Kg for energy recovery	0.19
Disposal	Kg for final deposition	0.24



Glossary

Glossary				
Impact category	Abbreviation	Unit	Characterisation method	Description
Global Warming Potential (100 years)	GWP-total	kg CO_2-eq.	Baseline model of 100 years of the IPCC based on IPCC2013	The global warming potential (GWP) is a relative measure of how much heat a greenhouse gets trapped in the atmosphere. It is indicated in kg of CO_2-equivalents for a specified time horizon.
Global Warming Potential biogenic, fossil, land use and land use change	GWP-fossil GWP-biogenic GWP-luluc			These are subsets of the total GWP covering the biogenic, fossil, and land use related part of the GWP. These three add up to the main climate change impact.
Ozone depletion potential	ODP	kg CFC-11 eq.	Steady-state ODPs, WMO 2014	Ozone Depletion Potential characterizes the destructive effects on the stratospheric ozone layer of anthropogenic emissions of ozone depleting substances (ODS), mainly chlorofluorocarbons (CFCs) and nitrogen oxides (NOX). It is calculated over a time horizon of 100 years.
Acidification potential	AP	Mol of H+ eq	Accumulated Exceedance, Seppäla et al., 2008	The acidification potential describes the acid deposition in plants, soils and surface waters caused by the conversion of air pollutants in acid. It is calculated as Mol of H+ eq.
Eutrophication aquatic freshwater	EP-freshwater	kg P eq	EUTREND model, Struijs et al., 2009b as implemented in ReCiPe	Aquatic eutrophication is the undesired enrichment of waters with nutrients. It induces the growth of plants and algae, which may result in oxygen depletion. At an excessive level it affects the biological balance of affected waters Aquatic eutrophication potential is measured in kg of PO4-eq (freshwater) and kg of N eq (marine water).
Eutrophication aquatic marine	EP-marine	kg N eq.		



Glossary				
Impact category	Abbreviation	Unit	Characterisation method	Description
Eutrophication, terrestrial	EP terrestrial	Mol N eq.	Accumulated Exceedance, Seppäla et al., 2008	Terrestrial eutrophication is the undesired enrichment of soils with nutrients. It may increase the susceptibility of plants to diseases and pests, as cause degradation of plant stability. If the nitrification level exceeds the amounts of nitrogen necessary for a maximum harvest, it can lead to an enrichment of nitrate which can cause increased nitrate content in groundwater. Terrestrial eutrophication is expressed as Accumulated Exceedance in MOL N.
Photochemical ozone formation	POCP	kg NMVOC eq.	LOTOS-EUROS, Van Zelm et al., 2008, as applied in ReCiPe	Photochemical ozone creation potential (also referred to as photochemical smog) quantifies the creation of ozone on ground-level where it is considered as a pollutant, while in the high levels of the atmosphere it protects against ultraviolet (UV) light. Ozone on lower levels is a harm to human health and can for example cause inflamed airways or damage lungs. It is expressed in kg of NMVOC -equivalents.
Abiotic depletion potential for non fossil resources	ADP-minerals and metals	kg Sb eq	CML 2002, Guinée et al., 2002 and van Oers et al 2002	Abiotic resources are natural resources which are regarded as non-living. Their current rate of depletion by humans is not considered sustainable and is cause for concern due to their scarcity. The depletion of abiotic resources is reflected in two separate impact categories: Elements, such as iron ore, indicated in kg of Sb-equivalents; and Fossil fuels, for example, crude oil indicated in MJNCV.
Abiotic depletion for fossil resources potentia	ADP-fossil	MJ, net calorific value		

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