ENVIRONMENTAL PRODUCT DECLARATION

evolution 100 | 200 | 300

Program	The International EPD® System EPD International AB www.environdec.com
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Valid until	2026-11-29
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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

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 and program operator
The International EPD® System

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S-P-01084

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Changes in the last review
Update and adaptation to EN 15804

Geographical scope of application
Europe

Reference year for underlying data
2020/21

Reference years of datasets
2016-2021

Product category rules (PCR)
EN 15804:2012 + A2:2019 as core PCR, PCR 2019:14 Construction Products, version 1.1, C-PCR-008 (TO PCR 2019:14) 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: Gorka Benito Alonso

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 14025:2006 ☐ 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 TK Elevator evolution 100/200/300 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. EPDs 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

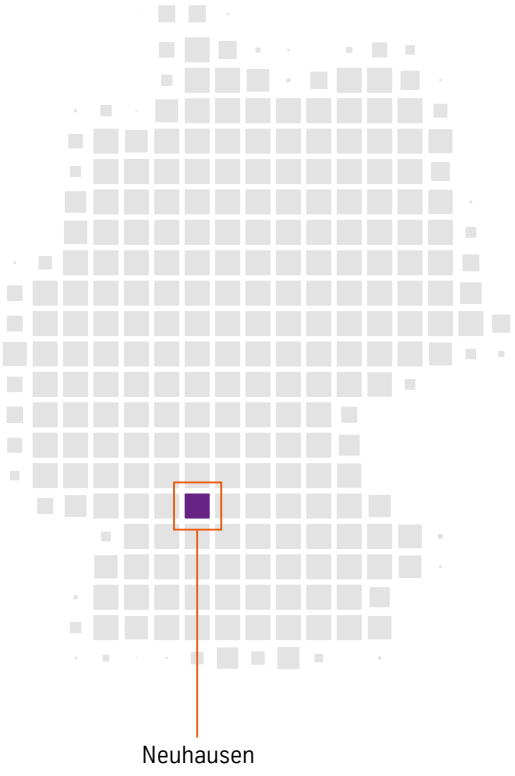
Environmental product declaration according to ISO 14025: Type III environmental declarations provide quantified environmental data using predetermined parameters.

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.

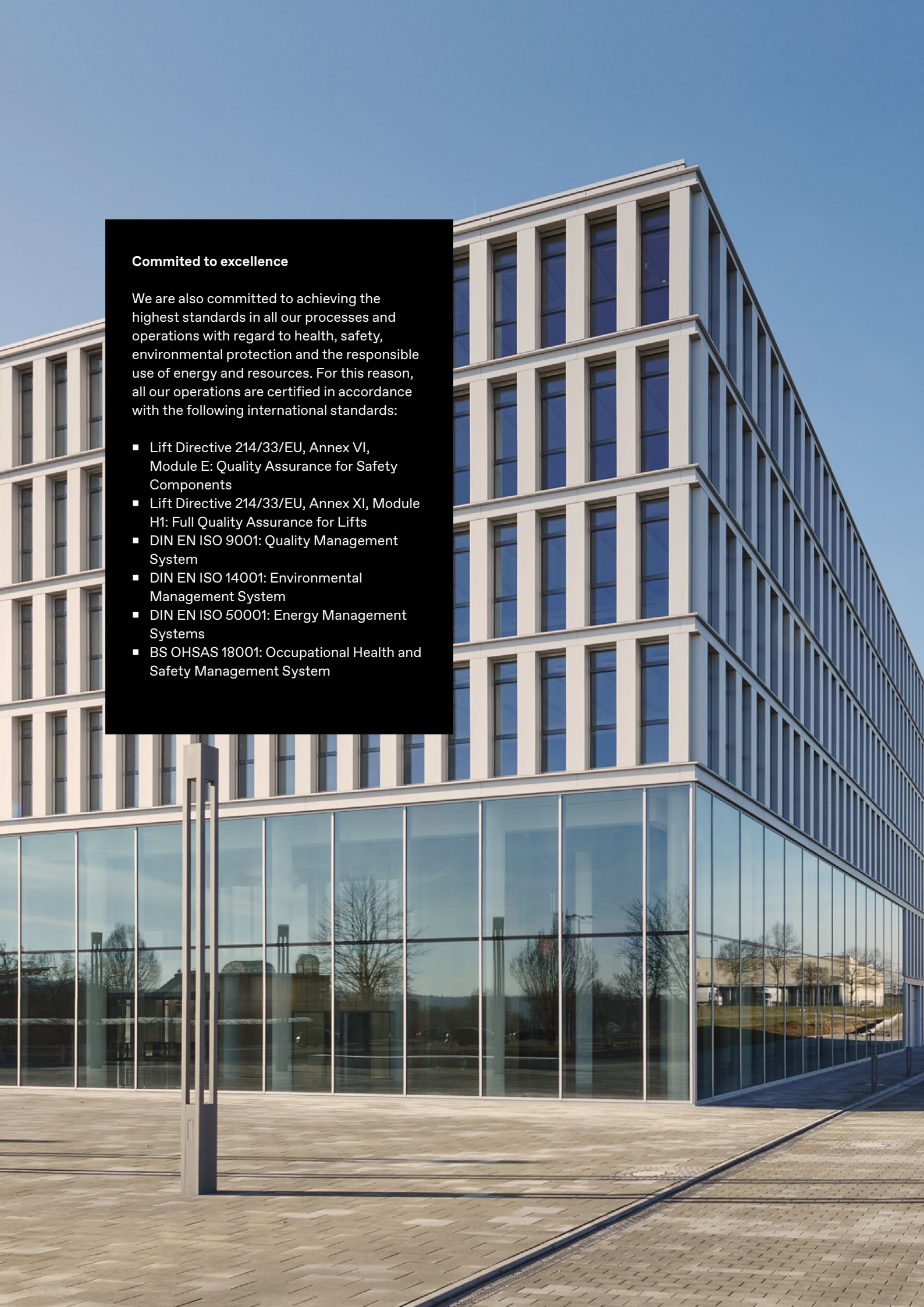
About TK Elevator



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 Neuhausen, Germany, produces evolution 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
- BS OHSAS 18001: Occupational Health and Safety Management System

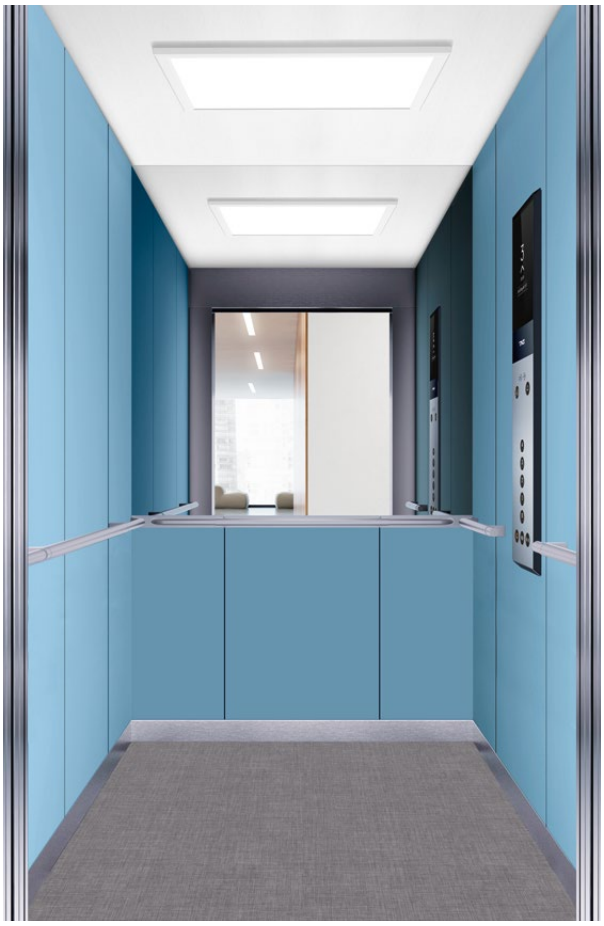
THE EVOLUTION ELEVATOR SYSTEM

The evolution 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 C, B and A design.

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
- Eco/high-speed mode
- Standardised energy recovery
- LED lighting (optional)
- Passive cooling of the control system
- Situational adjustment of ride quality and main landing

Next-level reliability
- Robust design
- High-quality materials
- Future-proof control system
- Efficient maintenance



The evolution 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 evolution elevator system

Table 1: Specification of assessed elevator according to the PCRs

evolution		
Index	**Representative values for reference unit**	**Application range of elevator model**
Type of installation	New installation	
Commercial name (type)	evolution 100 | 200 | 300	
Main purpose	Transport of passengers	
Type of elevator	Electric, without machine room (MRL)	-
Type of drive system	Gearless traction drive	-
Rated load [Q]	1,000 kg	630 up to 2,500 kg
Rated speed	1 m/s	1 m/s up to 3 m/s
Number of stops	5	up to 30
Travelled height	12 m	up to 100 m
Number of operating days per year	365	-
Applied usage category (UC) according to ISO 25745-2	2, 3 and 4	
Designed reference service life (RSL)	25 years	-
Geographic region of installation	Europe	

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

	UC2	UC3	UC4
TP (tkm)	301.81	724.34	2168.1

Representative installation
The reference for the underlying life cycle assessment (LCA) study was an elevator installed in a commercial building in Austria. Its configuration corresponds to the typical application range of the evolution 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 to mid rise commercial buildings (see table 2). The term “transportation performance (TP)” used to indicate the total amount of tkm is identical both in meaning and in calculation approach to the term “total number of FU” used in EPDs based on PCR 2015:05”.

Content declaration
A detailed composition of the reference elevator and packaging in quantitative terms according to the PCRs is set out in Figure 1 on page 11. This content declaration considers all life cycle phases and cut-off rules according to the PCRs.

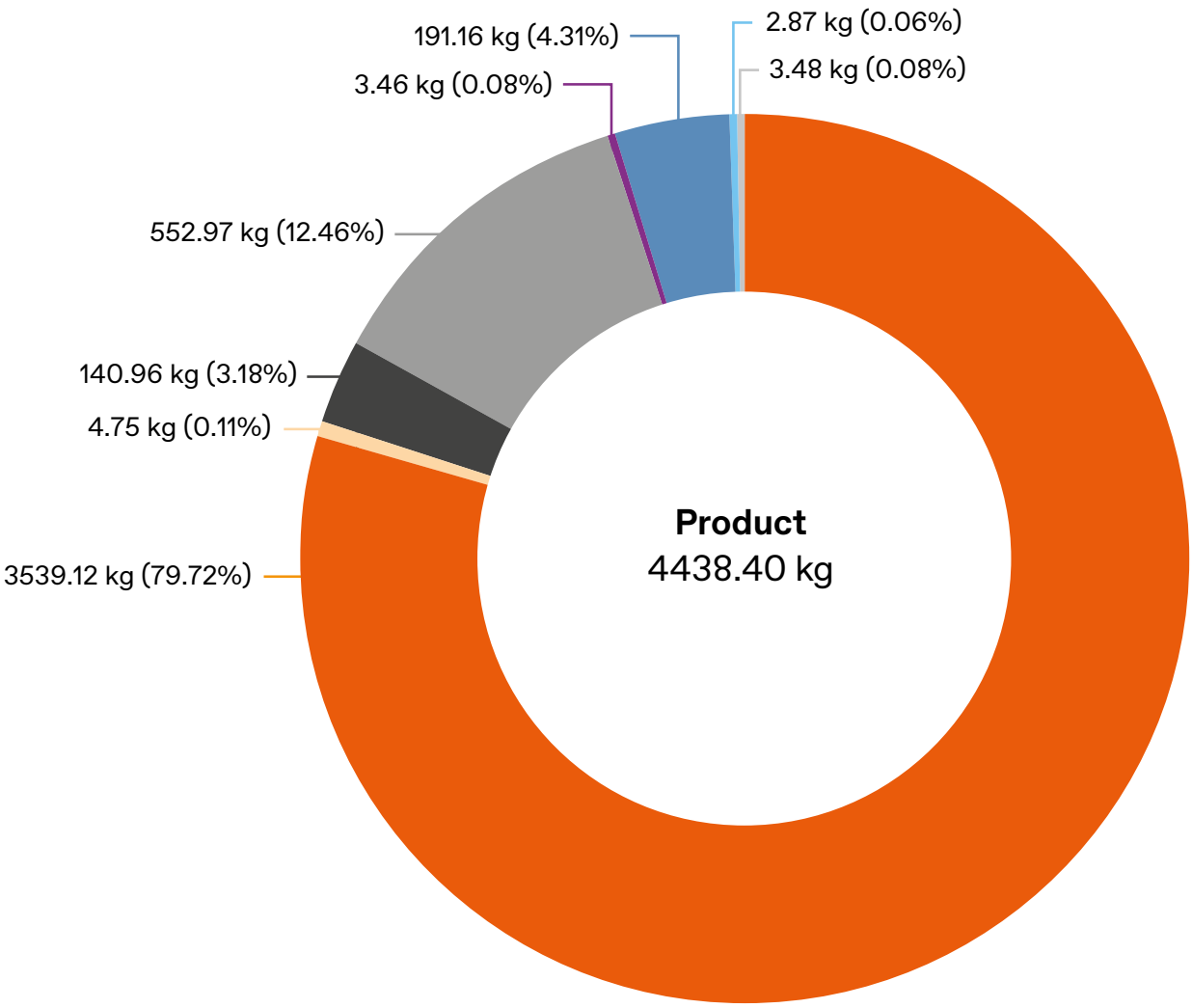
Almost 80% of the material the elevator is made of belongs to the material category of ferrous metals, followed by inorganic materials with more than 10%, electrics and electronics (4.31 %) and plastics and rubbers (3.18%) . The rest of the material categories account each for less than 1%.

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

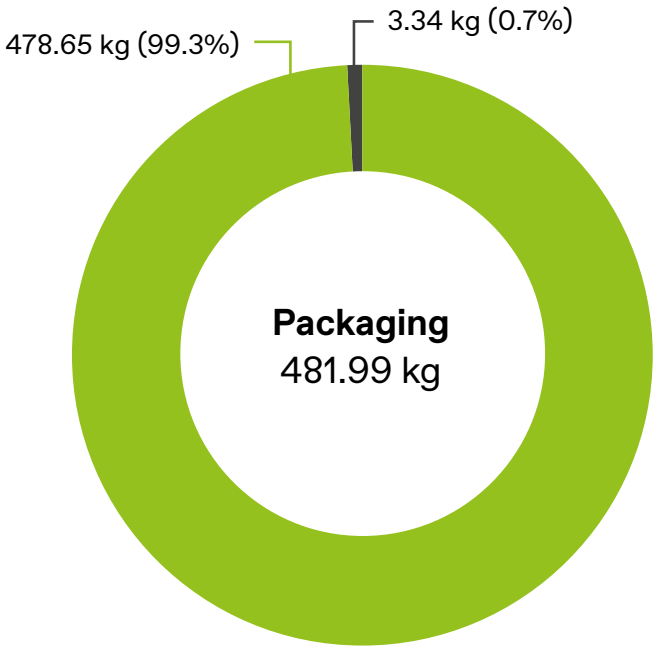
Substances in the SVHC list according to REACH directive are avoided as far as possible. Nevertheless, lead (CAS number 7439-92-1) and octamethylcyclotetrasiloxane (556-67-2) may be present above 0.1 % in weight in some articles used in the product.

The main material used for the packaging of the elevator is wood, that represents close to 100% of the overall packaging weight, and contains 227.9 kg of biogenic carbon.

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



- Ferrous metals
  carbon steel, stainless steel, galvanized steel, cast iron
- Non-ferrous metals
  aluminium
- Plastics and rubbers
- Inorganic materials
  concrete
- Organic materials
  cardboard, wood
- Lubricants and paint
- Electrics and electronics
  electrical cables, printed boards and electronic elements
- Batteries and accumulators
- Other materials



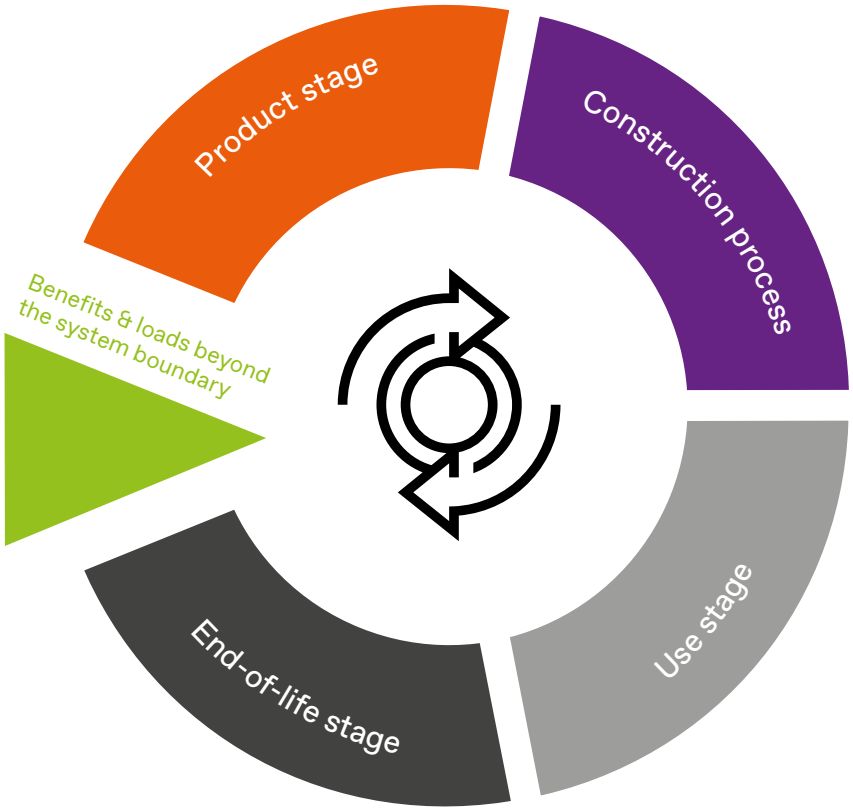
Life cycle assessment

According to the applicable PCRs, this EPD has a cradle-to-grave scope plus module D. Therefore it covers product, construction, use and end-of-life stages each consisting of further information modules, and the separate reporting on recycling and recovery. The resulting system boundaries are presented in the figure below:

Figure 2: Elevator 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 three analised UCs.

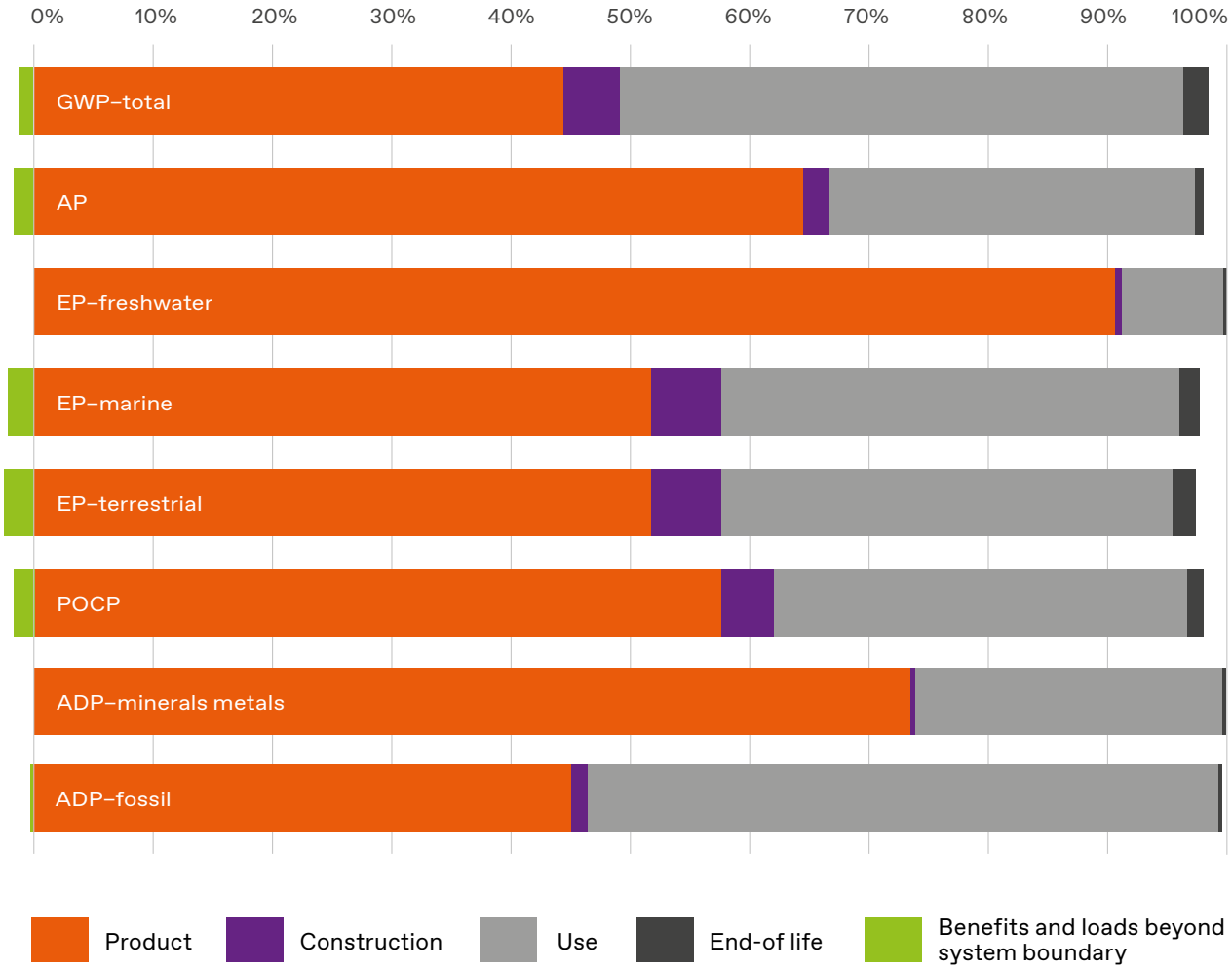
Potential environmental impacts

Table 3: Impact category results by information module

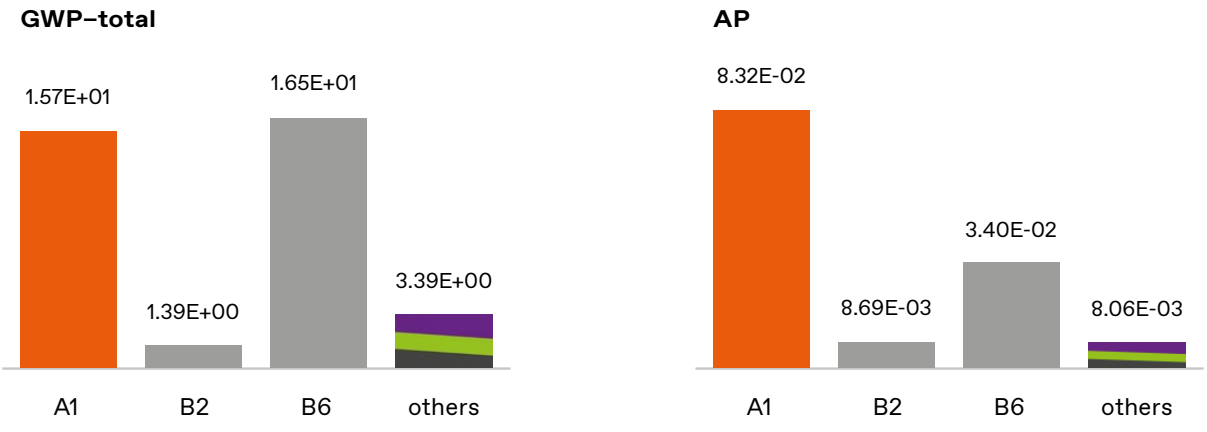
Information module	Usage category	GWP–total	GWP–fossil	GWP–biogenic	ODP	AP	EP–freshwater	EP–freshwater	EP–marine	EP–terrestrial	POCP	ADP–minerals metals	ADP–fossil	WDP
		kg CO_2 eq.	kg CO_2 eq.	kg CO_2 eq.	kg CFC-11 eq.	Mol of H+ eq.	kg P eq.	kg PO_4 eq.	kg N eq.	Mol N eq.	kg NMVOC eq.	kg Sb eq.	MJ, net cal. value	m^3 world eq.
A1	UC2	3.76E+01	3.75E+01	3.63E-02	3.85E-08	2.00E-01	1.20E-03	3.67E-03	2.47E-02	2.64E-01	8.74E-02	1.66E-03	4.17E+02	1.20E+02
	UC3	1.57E+01	1.56E+01	1.51E-02	1.60E-08	8.32E-02	4.99E-04	1.53E-03	1.03E-02	1.10E-01	3.64E-02	6.91E-04	1.74E+02	4.99E+01
	UC4	5.23E+00	5.23E+00	5.05E-03	5.36E-09	2.78E-02	1.67E-04	5.11E-04	3.44E-03	3.68E-02	1.22E-02	2.31E-04	5.81E+01	1.67E+01
A2	UC2	8.05E-01	7.65E-01	3.38E-02	9.76E-17	2.30E-03	2.27E-06	6.96E-06	1.05E-03	1.17E-02	2.06E-03	5.82E-08	1.02E+01	6.63E-03
	UC3	3.35E-01	3.19E-01	1.41E-02	4.07E-17	9.57E-04	9.45E-07	2.90E-06	4.36E-04	4.89E-03	8.59E-04	2.42E-08	4.24E+00	2.76E-03
	UC4	1.12E-01	1.07E-01	4.70E-03	1.36E-17	3.20E-04	3.16E-07	9.69E-07	1.46E-04	1.63E-03	2.87E-04	8.10E-09	1.42E+00	9.24E-04
A3	UC2	2.16E+00	4.52E+00	-2.37E+00	5.24E-14	1.36E-02	2.65E-05	8.13E-05	3.83E-03	3.96E-02	1.22E-02	2.05E-06	2.18E+02	8.09E-01
	UC3	8.99E-01	1.88E+00	-9.86E-01	2.19E-14	5.66E-03	1.10E-05	3.39E-05	1.60E-03	1.65E-02	5.09E-03	8.54E-07	9.10E+01	3.37E-01
	UC4	3.00E-01	6.29E-01	-3.29E-01	7.30E-15	1.89E-03	3.69E-06	1.13E-05	5.33E-04	5.51E-03	1.70E-03	2.85E-07	3.04E+01	1.13E-01
A1-A3	UC2	4.05E+01	4.28E+01	-2.30E+00	3.85E-08	2.16E-01	1.23E-03	3.76E-03	2.96E-02	3.15E-01	1.02E-01	1.66E-03	6.46E+02	1.21E+02
	UC3	1.69E+01	1.78E+01	-9.57E-01	1.60E-08	8.98E-02	5.11E-04	1.57E-03	1.23E-02	1.31E-01	4.23E-02	6.91E-04	2.69E+02	5.03E+01
	UC4	5.64E+00	5.96E+00	-3.20E-01	5.36E-09	3.00E-02	1.71E-04	5.24E-04	4.12E-03	4.39E-02	1.41E-02	2.31E-04	8.99E+01	1.68E+01
A4	UC2	1.14E+00	1.08E+00	4.82E-02	1.40E-16	6.18E-03	3.24E-06	9.94E-06	3.02E-03	3.34E-02	5.82E-03	8.31E-08	1.45E+01	9.48E-03
	UC3	4.74E-01	4.50E-01	2.01E-02	5.81E-17	2.57E-03	1.35E-06	4.14E-06	1.26E-03	1.39E-02	2.42E-03	3.46E-08	6.06E+00	3.95E-03
	UC4	1.58E-01	1.50E-01	6.71E-03	1.94E-17	8.60E-04	4.51E-07	1.38E-06	4.21E-04	4.66E-03	8.10E-04	1.16E-08	2.02E+00	1.32E-03
A5	UC2	3.36E+00	1.92E-01	3.17E+00	8.80E-16	8.08E-04	3.05E-06	1.60E-05	2.84E-04	3.03E-03	1.28E-03	2.16E-06	2.31E+00	2.11E-01
	UC3	1.40E+00	7.99E-02	1.32E+00	3.67E-16	3.37E-04	1.27E-06	6.68E-06	1.18E-04	1.26E-03	5.35E-04	9.01E-07	9.61E-01	8.78E-02
	UC4	4.68E-01	2.67E-02	4.41E-01	1.23E-16	1.13E-04	4.24E-07	2.23E-06	3.96E-05	4.22E-04	1.79E-04	3.01E-07	3.21E-01	2.93E-02
B2	UC2	3.34E+00	3.21E+00	1.12E-01	1.78E-10	2.09E-02	9.25E-06	2.84E-05	2.46E-03	2.66E-02	8.23E-03	5.67E-04	5.63E+01	2.02E+00
	UC3	1.39E+00	1.34E+00	4.67E-02	7.43E-11	8.69E-03	3.85E-06	1.18E-05	1.03E-03	1.11E-02	3.43E-03	2.36E-04	2.34E+01	8.43E-01
	UC4	4.65E-01	4.47E-01	1.56E-02	2.48E-11	2.90E-03	1.29E-06	3.95E-06	3.42E-04	3.71E-03	1.15E-03	7.90E-05	7.83E+00	2.82E-01
B6	UC2	2.61E+01	2.59E+01	2.20E-01	6.19E-13	5.38E-02	6.94E-05	2.13E-04	1.28E-02	1.34E-01	3.47E-02	7.61E-06	4.60E+02	4.15E+00
	UC3	1.65E+01	1.63E+01	1.39E-01	3.91E-13	3.40E-02	4.38E-05	1.35E-04	8.07E-03	8.48E-02	2.19E-02	4.81E-06	2.91E+02	2.62E+00
	UC4	9.08E+00	8.99E+00	7.64E-02	2.15E-13	1.87E-02	2.41E-05	7.40E-05	4.44E-03	4.67E-02	1.21E-02	2.65E-06	1.60E+02	1.44E+00
C1	UC2	9.73E-02	9.66E-02	5.62E-04	1.24E-15	2.27E-04	1.98E-07	6.08E-07	4.80E-05	5.05E-04	1.52E-04	3.20E-08	1.48E+00	1.03E-01
	UC3	4.05E-02	4.03E-02	2.34E-04	5.16E-16	9.47E-05	8.26E-08	2.54E-07	2.00E-05	2.11E-04	6.35E-05	1.34E-08	6.17E-01	4.30E-02
	UC4	1.35E-02	1.35E-02	7.83E-05	1.72E-16	3.16E-05	2.76E-08	8.47E-08	6.68E-06	7.03E-05	2.12E-05	4.46E-09	2.06E-01	1.44E-02
C2	UC2	1.49E-01	1.48E-01	6.46E-03	2.90E-17	5.43E-04	4.37E-07	1.44E-06	2.53E-04	2.82E-03	4.90E-04	1.30E-08	1.96E+00	1.37E-03
	UC3	6.47E-02	6.15E-02	2.69E-03	1.21E-17	2.26E-04	1.82E-07	6.01E-07	1.05E-04	1.17E-03	2.04E-04	5.43E-09	8.17E-01	5.69E-04
	UC4	2.16E-02	2.05E-02	8.99E-04	4.04E-18	7.56E-05	6.08E-08	2.01E-07	3.52E-05	3.92E-04	6.82E-05	1.82E-09	2.73E-01	1.90E-04
C3	UC2	3.96E-02	3.93E-02	1.01E-04	1.75E-16	3.66E-04	8.94E-08	2.74E-07	1.81E-04	1.99E-03	5.26E-04	4.33E-08	7.40E-01	6.59E-03
	UC3	1.65E-02	1.64E-02	4.20E-05	7.29E-17	1.52E-04	3.72E-08	1.14E-07	7.54E-05	8.29E-04	2.19E-04	1.80E-08	3.09E-01	2.75E-03
	UC4	5.51E-03	5.46E-03	1.40E-05	2.44E-17	5.09E-05	1.24E-08	3.82E-08	2.52E-05	2.77E-04	7.32E-05	6.02E-09	1.03E-01	9.18E-04
C4	UC2	1.64E+00	7.62E-01	8.82E-01	2.00E-13	1.04E-03	8.57E-07	4.26E-06	3.84E-04	4.74E-03	1.01E-03	7.63E-09	1.33E+00	2.71E-01
	UC3	6.85E-01	3.17E-01	3.68E-01	8.33E-14	4.34E-04	3.57E-07	1.78E-06	1.60E-04	1.98E-03	4.23E-04	3.18E-09	5.55E-01	1.13E-01
	UC4	2.29E-01	1.06E-01	1.23E-01	2.78E-14	1.45E-04	1.19E-07	5.93E-07	5.35E-05	6.60E-04	1.41E-04	1.06E-09	1.86E-01	3.78E-02
D	UC2	-1.26E+00	-1.27E+00	7.11E-03	2.35E-14	-5.69E-03	-1.45E-07	-4.80E-06	-1.31E-03	-1.49E-02	-3.25E-03	7.27E-06	-3.87E+00	7.86E+00
	UC3	-5.24E-01	-5.27E-01	2.96E-03	9.78E-15	-2.37E-03	-6.03E-08	-2.00E-06	-5.46E-04	-6.20E-03	-1.36E-03	3.03E-06	-1.61E+00	3.28E+00
	UC4	-1.75E-01	-1.76E-01	9.90E-04	3.27E-15	-7.92E-04	-2.02E-08	-6.69E-07	-1.82E-04	-2.07E-03	-4.53E-04	1.01E-06	-5.39E-01	1.09E+00

Impact category results by life cycle stage per FU

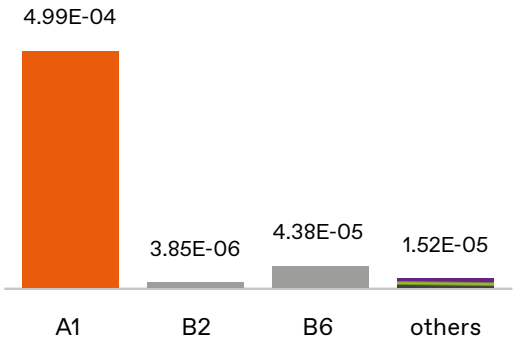
Figure 3: Impact category results by life cycle stage (in %) shows the share of the different life cycle stages for the most relevant impact categories in percentages, resulting in a sum of 100%. It is based on UC3.



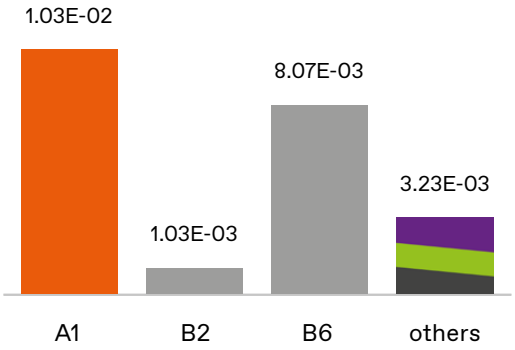
In **Figure 4: Comparison of impacts of main contributors**, the impact results of the two largest contributors [A1 and B6] to the overall results are compared with each other and the sum of the rest of the information modules.



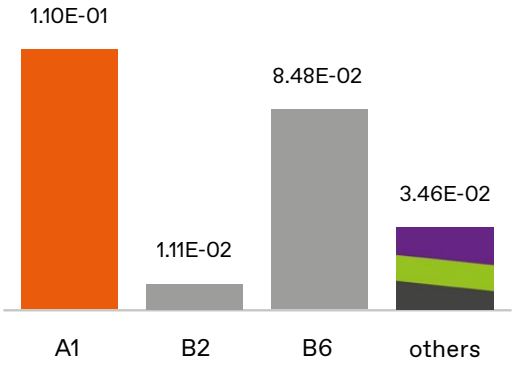
EP–freshwater



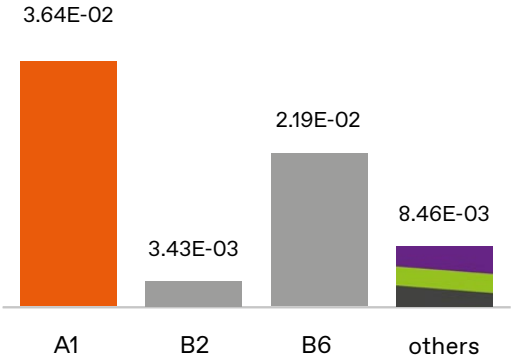
EP–marine



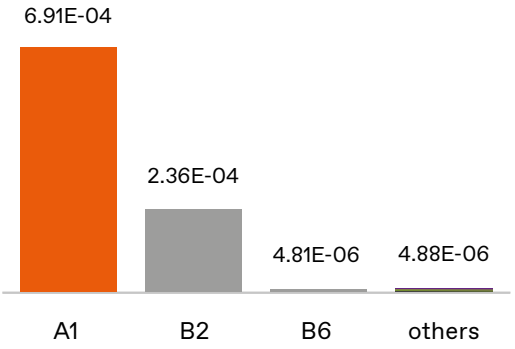
EP–terrestrial



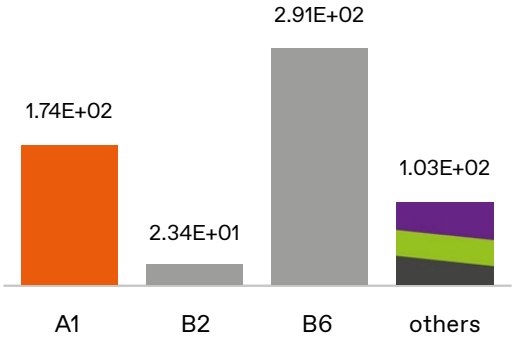
POCP



ADP–minerals metals



ADP–fossil



A1
Raw materials supply

B2
Maintenance

B6
Operational energy use

others
sum-up of all remaining information modules

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	UC2	2.76E+01	0.00E+00	2.76E+01	4.18E+02	0.00E+00	4.18E+02	2.81E+00	1.49E+00	0.00E+00	0.00E+00
	UC3	1.15E+01	0.00E+00	1.15E+01	1.74E+02	0.00E+00	1.74E+02	1.17E+00	6.22E-01	0.00E+00	0.00E+00
	UC4	3.85E+00	0.00E+00	3.85E+00	5.81E+01	0.00E+00	5.81E+01	3.91E-01	2.08E-01	0.00E+00	0.00E+00
A2	UC2	5.68E-01	0.00E+00	5.68E-01	1.02E+01	0.00E+00	1.02E+01	6.50E-04	0.00E+00	0.00E+00	0.00E+00
	UC3	2.36E-01	0.00E+00	2.36E-01	4.24E+00	0.00E+00	4.24E+00	2.71E-04	0.00E+00	0.00E+00	0.00E+00
	UC4	7.90E-02	0.00E+00	7.90E-02	1.42E+00	0.00E+00	1.42E+00	9.04E-05	0.00E+00	0.00E+00	0.00E+00
A3	UC2	5.73E+01	3.01E+01	8.75E+01	2.18E+02	4.39E+00	2.23E+02	2.50E-02	0.00E+00	0.00E+00	0.00E+00
	UC3	2.39E+01	1.26E+01	3.64E+01	9.10E+01	1.83E+00	9.29E+01	1.04E-02	0.00E+00	0.00E+00	0.00E+00
	UC4	7.98E+00	4.19E+00	1.22E+01	3.04E+01	6.11E-01	3.10E+01	3.48E-03	0.00E+00	0.00E+00	0.00E+00
A1-A3	UC2	8.55E+01	3.01E+01	1.16E+02	6.46E+02	4.39E+00	6.51E+02	2.84E+00	1.49E+00	0.00E+00	0.00E+00
	UC3	3.56E+01	1.26E+01	4.82E+01	2.69E+02	1.83E+00	2.71E+02	1.18E+00	6.22E-01	0.00E+00	0.00E+00
	UC4	1.19E+01	4.19E+00	1.61E+01	9.00E+01	6.11E-01	9.06E+01	3.95E-01	2.08E-01	0.00E+00	0.00E+00
A4	UC2	8.11E-01	0.00E+00	8.11E-01	1.45E+01	0.00E+00	1.45E+01	9.28E-04	0.00E+00	0.00E+00	0.00E+00
	UC3	3.38E-01	0.00E+00	3.38E-01	6.06E+00	0.00E+00	6.06E+00	3.87E-04	0.00E+00	0.00E+00	0.00E+00
	UC4	1.13E-01	0.00E+00	1.13E-01	2.02E+00	0.00E+00	2.02E+00	1.29E-04	0.00E+00	0.00E+00	0.00E+00
A5	UC2	3.13E-01	-3.01E+01	-2.98E+01	2.78E+00	-4.39E+00	-1.61E+00	2.16E-03	1.73E-03	0.00E+00	0.00E+00
	UC3	1.31E-01	-1.26E+01	-1.24E+01	1.16E+00	-1.83E+00	-6.72E-01	8.99E-04	7.22E-04	0.00E+00	0.00E+00
	UC4	4.36E-02	-4.19E+00	-4.15E+00	3.86E-01	-6.11E-01	-2.24E-01	3.00E-04	2.41E-04	0.00E+00	0.00E+00
B2	UC2	8.40E+00	0.00E+00	8.40E+00	5.63E+01	0.00E+00	5.63E+01	4.79E-02	2.42E-01	0.00E+00	0.00E+00
	UC3	3.50E+00	0.00E+00	3.50E+00	2.35E+01	0.00E+00	2.35E+01	2.00E-02	1.01E-01	0.00E+00	0.00E+00
	UC4	1.17E+00	0.00E+00	1.17E+00	7.84E+00	0.00E+00	7.84E+00	6.67E-03	3.38E-02	0.00E+00	0.00E+00
B6	UC2	2.12E+02	0.00E+00	2.12E+02	4.60E+02	0.00E+00	4.60E+02	2.07E-01	0.00E+00	0.00E+00	0.00E+00
	UC3	1.34E+02	0.00E+00	1.34E+02	2.91E+02	0.00E+00	2.91E+02	1.30E-01	0.00E+00	0.00E+00	0.00E+00
	UC4	7.37E+01	0.00E+00	7.37E+01	1.60E+02	0.00E+00	1.60E+02	7.18E-02	0.00E+00	0.00E+00	0.00E+00
C1	UC2	4.19E-01	0.00E+00	4.19E-01	1.48E+00	0.00E+00	1.48E+00	2.67E-03	2.31E-03	0.00E+00	0.00E+00
	UC3	1.74E-01	0.00E+00	1.74E-01	6.17E-01	0.00E+00	6.17E-01	1.11E-03	9.63E-04	0.00E+00	0.00E+00
	UC4	5.83E-02	0.00E+00	5.83E-02	2.06E-01	0.00E+00	2.06E-01	3.72E-04	3.22E-04	0.00E+00	0.00E+00
C2	UC2	1.21E-01	0.00E+00	1.21E-01	2.11E+00	0.00E+00	2.11E+00	1.39E-04	0.00E+00	0.00E+00	0.00E+00
	UC3	5.05E-02	0.00E+00	5.05E-02	8.81E-01	0.00E+00	8.81E-01	5.79E-05	0.00E+00	0.00E+00	0.00E+00
	UC4	1.69E-02	0.00E+00	1.69E-02	2.94E-01	0.00E+00	2.94E-01	1.93E-05	0.00E+00	0.00E+00	0.00E+00
C3	UC2	6.54E-02	0.00E+00	6.54E-02	7.40E-01	0.00E+00	7.40E-01	1.92E-04	0.00E+00	0.00E+00	0.00E+00
	UC3	2.72E-02	0.00E+00	2.72E-02	3.08E-01	0.00E+00	3.08E-01	7.99E-05	0.00E+00	0.00E+00	0.00E+00
	UC4	9.10E-03	0.00E+00	9.10E-03	1.03E-01	0.00E+00	1.03E-01	2.67E-05	0.00E+00	0.00E+00	0.00E+00
C4	UC2	9.71E-02	0.00E+00	9.71E-02	8.56E-01	0.00E+00	8.56E-01	1.75E-04	0.00E+00	0.00E+00	0.00E+00
	UC3	4.05E-02	0.00E+00	4.05E-02	3.57E-01	0.00E+00	3.57E-01	7.27E-05	0.00E+00	0.00E+00	0.00E+00
	UC4	1.35E-02	0.00E+00	1.35E-02	1.19E-01	0.00E+00	1.19E-01	2.43E-05	0.00E+00	0.00E+00	0.00E+00
D	UC2	-6.04E-01	0.00E+00	-6.04E-01	-1.41E+01	0.00E+00	-1.41E+01	1.72E-01	0.00E+00	0.00E+00	0.00E+00
	UC3	-2.52E-01	0.00E+00	-2.52E-01	-5.86E+00	0.00E+00	-5.86E+00	7.15E-02	0.00E+00	0.00E+00	0.00E+00
	UC4	-8.41E-02	0.00E+00	-8.41E-02	-1.96E+00	0.00E+00	-1.96E+00	2.39E-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 provides information about the amount of disposed waste by information module per tkm, according to the categories established in the reference PCRs.

Table 6: Output flows reports the amounts of materials leaving the system boundary after reaching the end-of-waste state. 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		HWD	NHWD	RWD
Unit		kg	kg	kg
A1	UC2	5.67E-05	2.13E+00	2.60E-03
	UC3	2.36E-05	8.87E-01	1.08E-03
	UC4	7.90E-06	2.96E-01	3.62E-04
A2	UC2	5.13E-10	1.51E-03	1.23E-05
	UC3	2.14E-10	6.30E-04	5.13E-06
	UC4	7.14E-11	2.11E-04	1.71E-06
A3	UC2	6.87E-08	4.08E-01	5.40E-03
	UC3	2.86E-08	1.70E-01	2.25E-03
	UC4	9.57E-09	5.68E-02	7.51E-04
A1-A3	UC2	5.68E-05	2.54E+00	8.01E-03
	UC3	2.37E-05	1.06E+00	3.34E-03
	UC4	7.90E-06	3.53E-01	1.12E-03
A4	UC2	7.33E-10	2.16E-03	1.76E-05
	UC3	3.06E-10	9.01E-04	7.34E-06
	UC4	1.02E-10	3.01E-04	2.45E-06
A5	UC2	4.88E-10	5.47E-01	7.08E-05
	UC3	2.03E-10	2.28E-01	2.95E-05
	UC4	6.79E-11	7.62E-02	9.85E-06
B2	UC2	4.56E-06	4.96E-01	4.64E-04
	UC3	1.90E-06	2.07E-01	1.93E-04
	UC4	6.35E-07	6.91E-02	6.46E-05
B6	UC2	1.22E-07	3.26E-01	6.86E-02
	UC3	7.68E-08	2.06E-01	4.33E-02
	UC4	4.23E-08	1.13E-01	2.38E-02
C1	UC2	4.67E-10	2.16E-03	1.27E-04
	UC3	1.95E-10	9.02E-04	5.27E-05
	UC4	6.50E-11	3.01E-04	1.76E-05
C2	UC2	1.04E-10	3.09E-04	3.57E-06
	UC3	4.32E-11	1.29E-04	1.49E-06
	UC4	1.44E-11	4.30E-05	4.97E-07
C3	UC2	4.30E-11	2.13E-04	5.45E-06
	UC3	1.79E-11	8.88E-05	2.27E-06
	UC4	5.99E-12	2.97E-05	7.59E-07
C4	UC2	4.37E-09	9.55E-01	1.93E-05
	UC3	1.05E-08	2.29E+00	4.63E-05
	UC4	1.46E-09	3.19E-01	6.45E-06
D	UC2	1.17E-05	-4.15E-01	2.68E-04
	UC3	4.88E-06	-1.73E-01	1.11E-04
	UC4	1.63E-06	-5.78E-02	3.72E-05

Indicator		CRE	MFR	MER	EEE	EET
Unit		MJ	MJ	m^3	kg	MJ
A1	UC2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
A2	UC2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
A3	UC2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
A1-A3	UC2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
A4	UC2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
A5	UC2	0.00E+00	0.00E+00	8.78E-01	7.28E-01	2.11E+00
	UC3	0.00E+00	0.00E+00	3.66E-01	3.04E-01	8.80E-01
	UC4	0.00E+00	0.00E+00	1.22E-01	1.01E-01	2.94E-01
B2	UC2	0.00E+00	6.92E-01	5.50E-02	5.60E-02	1.62E-01
	UC3	0.00E+00	2.88E-01	2.29E-02	2.33E-02	6.76E-02
	UC4	0.00E+00	9.63E-02	7.66E-03	7.79E-03	2.26E-02
B6	UC2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C1	UC2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C2	UC2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C3	UC2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	UC4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C4	UC2	0.00E+00	1.21E+01	0.00E+00	0.00E+00	0.00E+00
	UC3	0.00E+00	5.05E+00	0.00E+00	0.00E+00	0.00E+00
	UC4	0.00E+00	1.69E+00	0.00E+00	0.00E+00	0.00E+00
D	UC2	0.00E+00	-1.41E+01	1.72E-01	0.00E+00	0.00E+00
	UC3	0.00E+00	-5.86E+00	7.15E-02	0.00E+00	0.00E+00
	UC4	0.00E+00	-1.96E+00	2.39E-02	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

EEE Exported energy Thermal

Analysis of results / conclusion

General observations
The upstream stage is the most important contributor to the overall burden of the assessed elevator over its entire life cycle. With the exception of GWP-biogenic, the values for all impact categories exceed 40 %, while the value for ADP elements is even close to 60 %. The downstream stage represents the second highest impact area. Module [D] results in benefits for almost all impact categories. In contrast, the construction and end-of-life stage have very little or no relevance in terms of the environmental burden.

[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 OPD, AP, EP (–freshwater, –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 80 % of the total weight of the assessed elevator. Nevertheless, in relative terms, components with a high share of Electrics & electronics (based on their specific impact per kg) have the highest impact on results and are therefore also of major relevance in the assessed 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, 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 and ADP–minerals and metals, causing more than 95% of its burden. Therefore, 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 Counterweight, Car, Rails, Fishplate & Mounting Material and Doors, 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 is disposed of (positive CO_2 balance).

Scenarios and additional technical information

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

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

Table 7: Information on electricity grid mixes reflects their environmental impact expressed in kg CO_2-eq/kWh

Country	CO_2-eq/kWh
Germany	0.544
Spain	0.411
France	0.103
Europe (average)	0.401

Transport to installation site [A4]

Road transport is used to deliver evolution elevators to European destinations. An average distance has been calculated taking into account the countries where this elevator model is most frequently installed.

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	1231 km	61%

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

Processes	Value	Unit
Maintenance cycle and process	as in maintenance manual	
Annual electricity consumption by maintenance tools	1	kWh
Annual oil consumption	1.46	kg
Annual cleaning wax consumption	2	l
Transportation Distance to Disposal Site (packaging materials)	100	km
Annual diesel consumption for transport of workers	5.76	l

Table 10: Material content of spare parts

Material type	Weight in kg	Share of total in %
Ferrous metals	240.88	70.67
Electrics & electronics	56.47	16.57
Plastics & rubbers	38.64	11.34
Other materials	2.64	0.77
Non-ferrous metals	2.2	0.65
Overall	**341.88**	**100**

Energy consumption in operation [B6]

The evolution elevator annual energy consumption during operation has been calculated acc. to ISO 25745-2. For this study Usage categories 2, 3 and 4 of ISO 25745-2 have been considered (between 125 and 750 trips per day) as they represents the most typical applications for this reference unit in low to mid rise commercial 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]
2	785.78
3	1190.54
4	1961.28

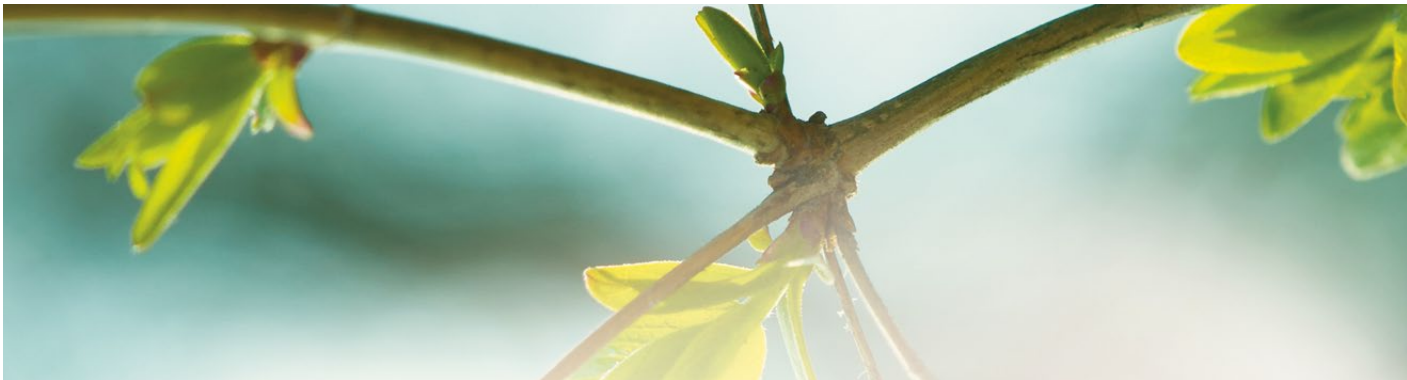
End-of-life [C2-C4]

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 according to EN15804, taking into account the input and outflows of recycled materials. Table 12 summarizes the relevant information about the end-of-life phase.

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	0.82
	kg for energy recovery	0.08
Disposal	kg for final deposition	0.1



Glossary

Glossary				
Impact category	Abbreviation	Unit	Characterisation method	Description
Global Warming Potential (100 years)	GWP	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			
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., 2009 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 eq.
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		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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