KLEEMANN
Your 1st Choice in Lifts

KLEEMANN HELLAS S.A.

Environmental Product Declaration for Atlas RPH-R

In accordance with ISO 14025

Company

Founded in 1983 in Kilkis, Greece, KLEEMANN is one of the major lift companies in the European and global market, providing any type of residential or commercial passenger and freight lifts, escalators, moving walks, accessibility and marine solutions, parking systems and lift components.

Its distribution network expands to more than 100 countries, with a local presence in 15 of them.

KLEEMANN stands for innovation in design and technology, for flexibility and breakthrough thinking, for quality products and dedicated services and support.

Integrated manufacturing facilities, highly trained workforce, state-of-the-art IT systems and logistics support enable KLEEMANN to deliver reliable, highly personalized solutions, whatever the challenge.

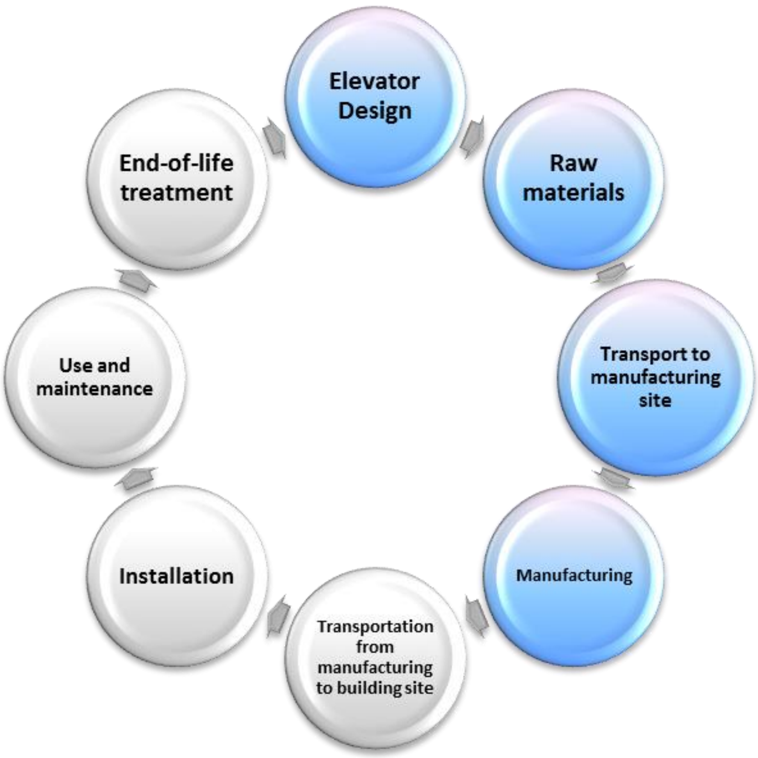
Since 2012, KLEEMANN implements an environmental management system (EMS) that is certified according to ISO 14001 and covers the production unit (office facilities and factories) in the industrial area of Kilkis. Dedicated to environmental protection, the company also applies the principles of eco-design products in accordance with ISO 14006. KLEEMANN is the first company in Greece which applies eco product design guidelines according to ISO 14006.

For more information about our company, visit www.kleemannlifts.com

Product

The increased awareness over the environmental protection, and the possible impacts associated with products, have increased interest in the development of methods to better understand and address these impacts. One of the techniques being developed for this purpose is life cycle assessment (LCA). LCA addresses the environmental aspects and potential environmental impacts throughout a product's life cycle from raw material acquisition through production, use, end-of-life treatment, recycling and final disposal.

Life Cycle Assessment



For the case of the lift industry, with the already indispensable products, due to the large vertical structuring, combining the design, the comfort, but also to cover further sensitive needs, such as an environmental approach, is a creative challenge.

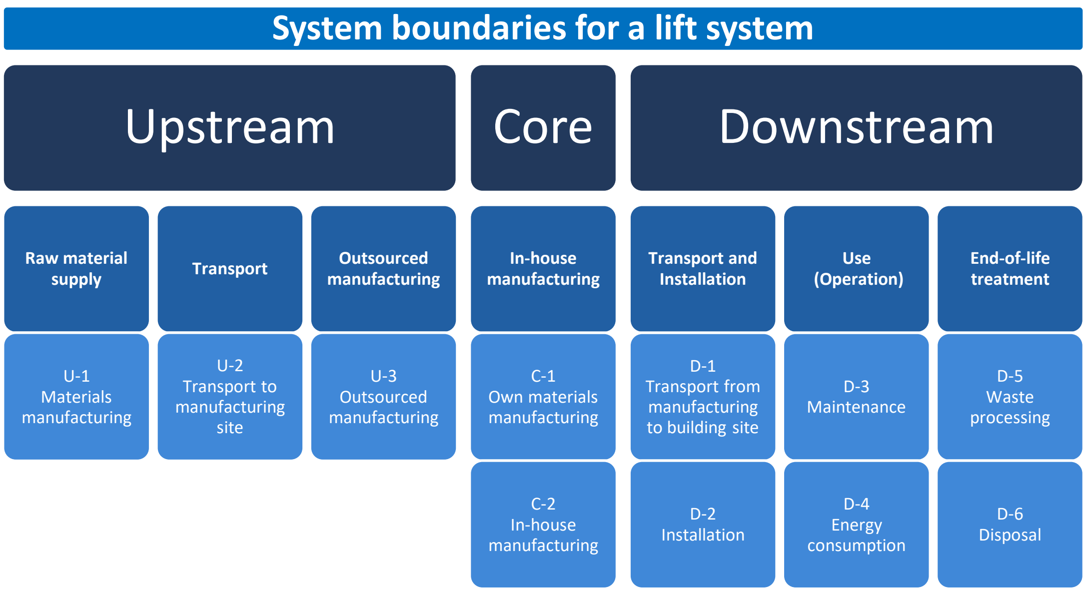
The strategic objective for our company is the sustainable development in full harmonization with the environmental protection, and also the development of the environmental superiority for our products. That aim could be achieved by introducing fundamental rules, criteria and mechanisms for the environmental protection, the prevention of pollution and the protection of human health. By that we ensure savings of natural resources and the gradual restoration of the environment which promotes its rational use and management.

Main goal is to redesign all of our products on the basis of eco-design process. Our policy is orientated towards 3 directions: nature, society, economy.

Following is presented the system boundaries for a lift system. That system is consisted of three general stages:

- Upstream processes (from cradle-to-gate)
- Core processes (from gate-to-gate)
- Downstream processes (from gate-to-grave)

According to the PCR these three life cycle stages and respective processes are split into more detailed modules, which are called information modules. Each of these modules covers all unit processes that are part of the life cycle of the lift system under declaration. The in-house production phase (information modules C-1 and C-2), including the production of spare parts, is considered as core processes, due to the direct influence of the manufacturer. Upstream processes include raw materials supply and manufacturing (U-1), transport (U-2), and outsourced manufacturing of components (U-3). Transportation to building construction site (D-1), installation (D-2), use phase concerning the energy consumption (D-4) and preventive maintenance (D-3), and finally the end-of-life treatment which includes the waste processing (D-5) and the possible disposal (D-6) are considered as downstream processes.



Environmental performance

Reference model	Atlas RPH-R
Type of installation	New
Type of lift	Traction, Electric operated passenger lift
Estimated lifetime	25 years
Nominal load	630kg
Nominal speed	1m/s
Travel	14.4m
Number of stops	3
Trips per day	100
Operating days per year	365
Daily travel time	0.2h
Geographical region of intended installation region	Europe
Building type	All

The function of a lift is the transportation of persons, freights or both. Based on this, the FU is defined as **the transportation of a load over a distance, expressed in tonne [t] over a kilometre [km] travelled, i.e. tonnekilometre [tkm]** over a vertical (or inclined) trajectory. In this regard, LCA results shall be presented per 1 [tkm]. To do so, first the total number of FU shall be calculated according to the formulas and predetermined parameters shown below in the following steps:

1. Calculation of the average car load $\%Q$ [t], where Q is the lift rated load [kg]:
   $\%Q = \frac{Q}{1000} \times [\text{Percentage from Table 3 of ISO 25745–2}] \Rightarrow \%Q = \frac{630}{1000} \cdot \frac{7.5}{100} \Rightarrow$
   $$\boxed{\%\boldsymbol{Q} = \mathbf{0.04725}\ [\boldsymbol{tonnes}]}$$

2. Calculation of the one-way average travel distance for target installation s_{av} [m], where s_{rc} is the one-way travel distance of the reference cycle according to ISO 25745-1 [m] (lift height):
   $s_{av} = s_{rc} \times [\text{Percentage from Table 2 of ISO 25745–2}] \Rightarrow s_{av} = 14.4 \cdot \frac{67}{100} \Rightarrow$
   $$\boxed{\boldsymbol{s_{av}} = \mathbf{9.648}\ [\boldsymbol{m}]}$$

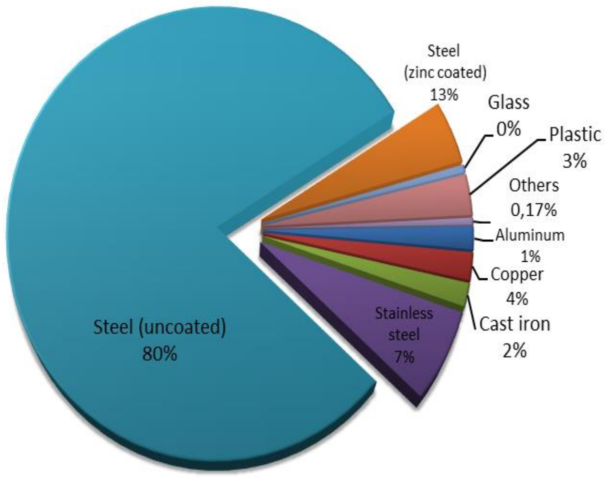
3. Calculation of the distance travelled by the lift during the service life s_{RSL} [km], where n_d is the number of trips per day according to the selected usage category (*defined in Table 1 of ISO 25745-2*) and d_{op} is the number of operating days per year. Finally, RSL is the designed service life [years] declared for the lift:
   $s_{RSL} = \frac{s_{av}}{1000} \times n_d \times d_{op} \times RSL \Rightarrow s_{RSL} = \frac{9.648}{1000} \cdot 100 \cdot 365 \cdot 25 \Rightarrow$
   $$\boxed{\boldsymbol{s_{RSL}} = \mathbf{8803.8}\ [\boldsymbol{km}]}$$

4. Ultimately, calculation of the number of FU [tkm]:
   $FU = \%Q \times s_{RSL} \Rightarrow FU = 0.04725 \cdot 8803.8 \Rightarrow$
   $$\boxed{\boldsymbol{FU} = \mathbf{415.98}[\boldsymbol{tkm}]}$$

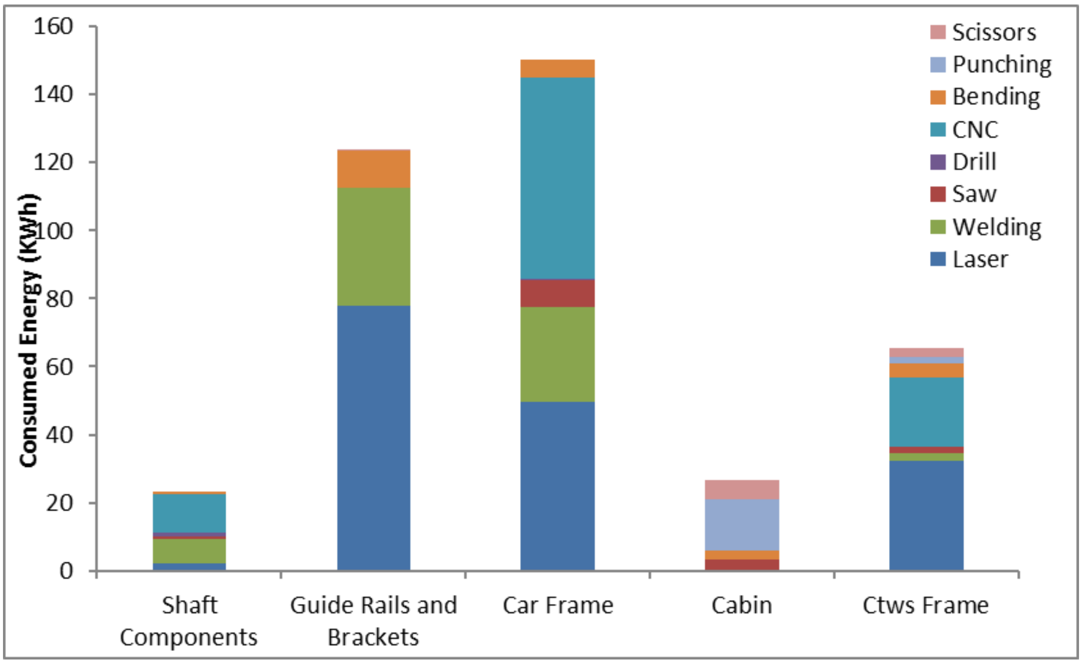
Use of resources

Gathered data about the materials used are presented on the following table. In addition to these materials are also taken into account 28kg of paint and 2lt of lubricants.

Material	Weight (kg)	Weight (%)
Metals	**3490**	**95.85**
Aluminum	*59*	*1.62*
Cast iron	*61*	*1.67*
Copper	*71.5*	*1.96*
Stainless steel	*240*	*6.59*
Steel (uncoated)	*2895*	*79.51*
Steel (zinc coated)	*163.5*	*4.49*
Glass	**19.2**	**0.53**
PVC	**51**	**1.4**
PP	**15**	**0.41**
PE	**24**	**0.66**
Nylon	**10**	**0.27**
Polyurethane	**2**	**0.05**
Plastics (mix)	**4**	**0.11**
LED	**2**	**0.05**
Battery	**4**	**0.11**
Printed wiring board	**2**	**0.05**
Others	**17.8**	**0.49**
TOTAL	**3641**	**100.00**

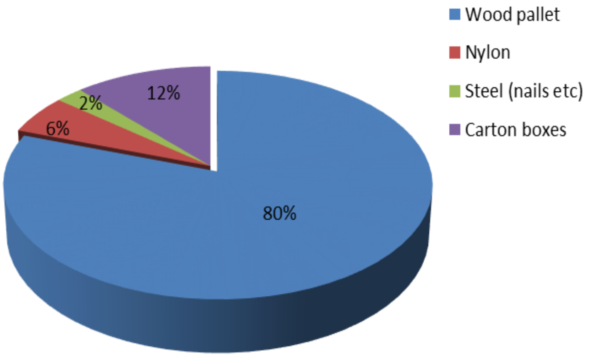


Below are presented the manufacturing processes through which each component and the individual parts of the product are made. The facilities of the company have been amended as to the production line (lean flow), which ensures low stocks and flexibility at the same time.



For the packaging of products wood, nylon, nails and cartons are used. The packaging for by-product required is listed below:

Material	Mass [kg]
Wood pallet	241
Nylon	16.8
Steel (nails etc)	7
Carton boxes	35



Potential environmental impact

The results of this study illustrate the environmental impact of the product Atlas RPH – R lifecycle. It is also possible to devise again the study and with other methods of analysis. Software SimaPro® was used in order to illustrate the analysis.

Life cycle impact assessment results for EPD (2013) V1.02 and CML-IA baseline V3.03 / EU25 are shown below for each stage, normalized by the tonne-kilometer functional unit.

Table 1: EPD (2013) V1.02 results by life cycle phase.

Impact category	Unit	Upstream	Core	Downstream	Total
Acidification (fate not incl.)	kg SO_2 eq	1.87E-01	4.36E-03	2.88E-01	4.79E-01
Eutrophication	kg PO_4--- eq	1.30E-01	7.33E-03	7.64E-03	1.45E-01
Global warming (GWP100a)	kg CO_2 eq	2.48E+01	7.58E-01	3.47E+01	6.03E+01
Photochemical oxidation	kg C_2H_4 eq	1.30E-02	1.92E-04	1.50E-02	2.82E-02
Ozone layer depletion (ODP)	kg CFC-11 eq	1.95E-06	5.56E-08	3.97E-08	2.04E-06
Abiotic depletion	kg Sb eq	1.34E-03	2.61E-07	1.07E-06	1.34E-03

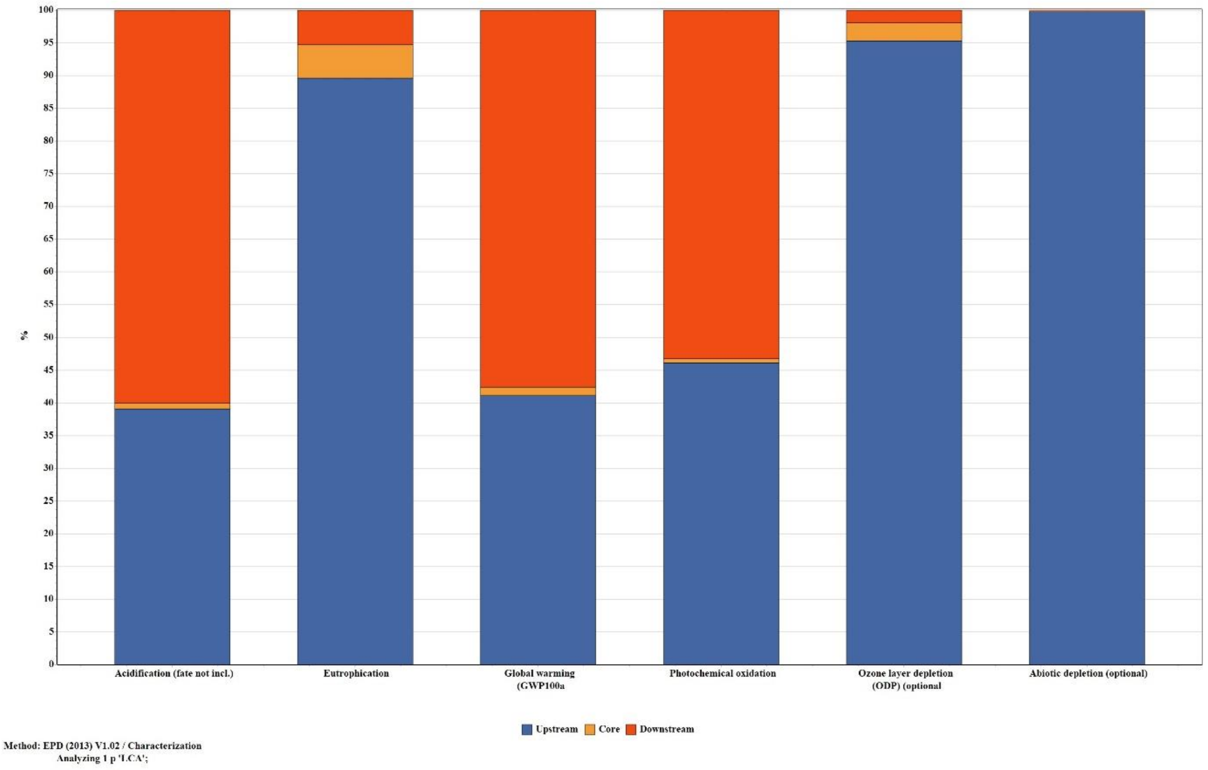
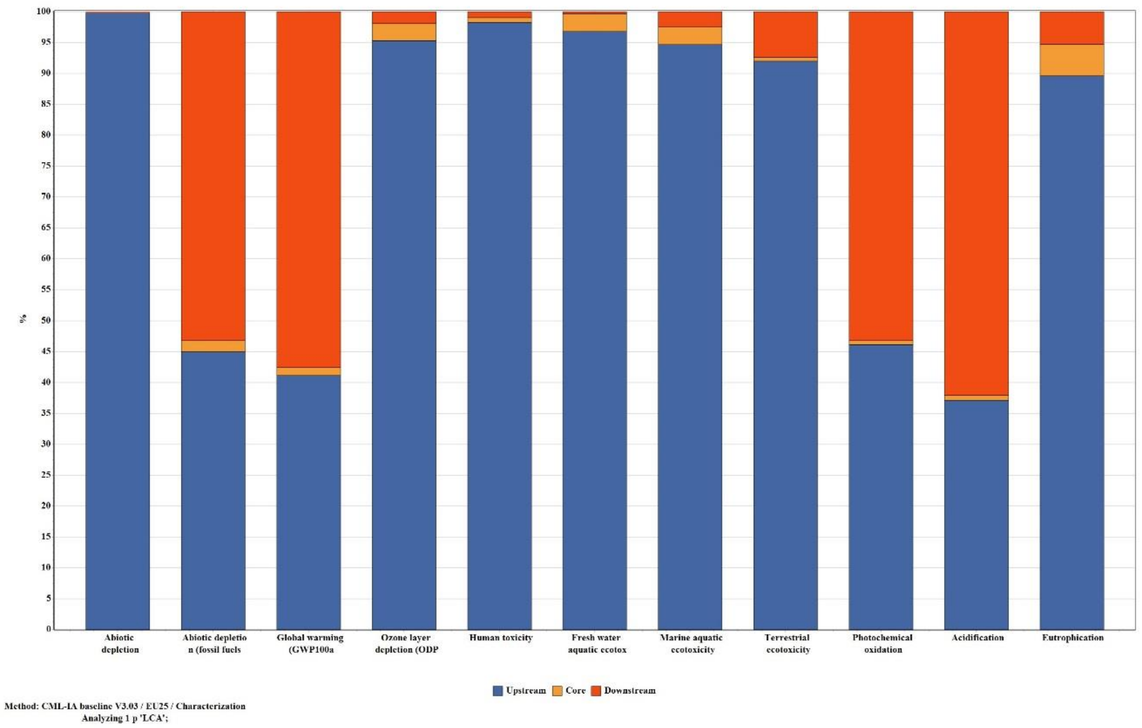


Table 2: CML-IA baseline V3.03 / EU25 results by life cycle phase.

Impact category	Unit	Total	Upstream	Core	Downstream
Abiotic depletion	kg Sb eq	1.34E-03	1.34E-03	2.61E-07	1.07E-06
Abiotic depletion (fossil fuels)	MJ	6.33E+02	2.85E+02	1.12E+01	3.37E+02
Global warming (GWP100a)	kg CO_2 eq	6.03E+01	2.48E+01	7.58E-01	3.47E+01
Ozone layer depletion (ODP)	kg CFC-11 eq	2.04E-06	1.95E-06	5.56E-08	3.97E-08
Human toxicity	kg 1,4-DB eq	1.11E+02	1.09E+02	8.75E-01	1.06E+00
Fresh water aquatic ecotox.	kg 1,4-DB eq	4.50E+01	4.35E+01	1.28E+00	1.51E-01
Marine aquatic ecotoxicity	kg 1,4-DB eq	1.25E+05	1.18E+05	3.58E+03	3.08E+03
Terrestrial ecotoxicity	kg 1,4-DB eq	3.75E-01	3.45E-01	2.30E-03	2.77E-02
Photochemical oxidation	kg C_2H_4 eq	2.82E-02	1.30E-02	1.92E-04	1.50E-02
Acidification	kg SO_2 eq	5.26E-01	1.95E-01	4.66E-03	3.27E-01
Eutrophication	kg PO_4--- eq	1.45E-01	1.30E-01	7.33E-03	7.64E-03



Waste production

Key element in the final stage of the life cycle is the ability to facilitate and the fullest possible recycling percentage of the product. This model has been designed in such a way that its different materials can be dismantled and separated easily in various categories for the process of recycling.

KLEEMANN lifts comprise a high percentage of metal, alloy steel, cast iron, aluminum alloy and copper that can be recycled directly as scrap. Recycled metals reduce the environmental impact of the system.

All plastic materials are almost 3% of the elevator and most of them after dismantling can be collected separately in order to get recycled. In core part, company is collecting plastic materials and they are sent to specialized companies for their recycle.

Special treatment is required about the lead batteries while dismantling, since lead is considered as a hazardous waste. During the in-house manufacturing (core), batteries are collected separately and follows their recycle by specialized companies. Concerning the lighting, most of our cabins are using LED lighting and except the energy saving, by this way is also achieved the lack of hazardous materials as mercury which is included in fluorescent lamps. Rest of electronic and electromechanical components waste are collected and also treated separately.

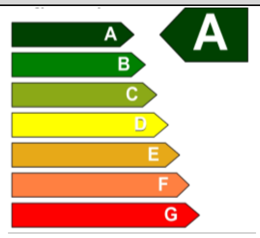
Only 2lt of lubricants is needed for the traction lift. During maintenance/repair the used material can be collected and sent to the corresponding recycling facility.

Packaging includes mostly wood (80%), steel (2%), carton boxes (12%) and plastics (6%). All of them can be directly recycled.

Additional information

It has to be pointed out, on the basis of surveys which have been carried out on this field, that the maximum impact on the environment can be observed in the consumption period. Showing the catalytic role has for the products of lifts. More specifically, if a product has usage duration of 25-30 years the use phase would be responsible for 75% of the whole environmental impact, whereas the same phase would only represent 50% of the environmental bill if it had a reduced life of 10 years. On the other hand, an increased product life will always reduce the impact of the materials phase, because the number of functional units served will increase.

Following the methodology of ISO 25745-2, the results are:

	Atlas RPH-R
Nominal load [kg]	630
Nominal speed [m/s]	1
Operating days per year	365
Idle power [W]	30
Specific running energy average running cycle [mWh/(kg·m)]	0.89
Usage category according to ISO 25745-2	2
Total energy consumption per year [kWh]	582
Energy efficiency class according to ISO 25745-2	

Mandatory statements

The results are evaluated through the method of EPD (2013) V1.02. This method is the successor of EPD (2008) and is to be used for the creation of Environmental Product Declarations (EPDs), as published on the website of the Swedish Environmental Management Council (SEMC). All impact categories are taken directly from the CML-IA baseline method (eutrophication, global warming and photochemical oxidation) and CML-IA non-baseline method (acification). Also, CML-IA baseline V3.03 / EU25 was used for a more detailed analysis over several sub-categories. This method has been proposed by a group of scientists under the lead of CML (Center of Environmental Science of Leiden University). It includes a set of impact categories and characterization methods for the impact assessment step. The impact assessment method implemented as CML-IA methodology is defined for the midpoint approach. Normalization is provided but there is neither weighting nor addition.

EPDs within the same product category but from different programmes may not be comparable.

References

General Programme Instructions of the International EPD® System. Version 2.01.

PCR Lifts (Elevators), Version 1.0, 2015:05, 2015-10-14

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