Dedicated to People Flow™

KONE TRAVELMASTER™ 110

Environmental Product Declaration

Environmental Product Declaration

What is an EPD?

The Environmental Product Declaration (EPD) provides you as a KONE customer with information on the environmental performance of KONE products and services. The Environmental Product Declaration is carried out according to the ISO 14025 standard. In addition, the ISO 14001 Environmental Management System is implemented in several KONE units. For the latest updated information on KONE's Corporate Responsibility including Environmental Management, see www.us.kone.com.

Environmental performance

A Life Cycle Assessment (LCA) is a tool for assessing the environmental impacts associated with a product, process or service throughout its life cycle. The LCA of the KONE TravelMaster 110 Escalator was applied in compliance with the requirements of the ISO 14040 and ISO 14044 standards.

Functional Unit
The function of an escalator is to give people access to multi-storey buildings. The functional unit is 3,281 feet (1 km) distance travelled by the escalator.

System Boundaries
The Life Cycle Assessment covers the important environmental aspects for raw material production, component manufacturing, transportation, installation, delivery, use, maintenance, and end-of-life (i.e. also known as cradle-to-grave assessment). These environmental aspects include the consumption of raw materials and energy resources as well as emissions and waste generation.

Product description	
Escalator type:	KONE TravelMaster 110 Escalator
Segment:	Commercial
Rise:	14.8 ft (4.5 m)
Inclination:	30°
Step width:	39.4 in (1000 mm)
Speed:	1.6 ft/s (0.5 m/s)
Running direction:	50% upwards, 50% downwards
Operation:	14 hours/day, 6 days/week, 52 weeks/year, 15 years
Maximum capacity:	6000 persons/hour for 1.6 ft/s (0.5 m/s)
Weight of passenger:	165.3 lbs (75 kg) (average value)
Maximum step load:	220.5 lbs (100 kg) (related to maximum capacity)
Usage load profile:	0h-100%; 0.5h-75%; 1.0-50%; 10h-25%; 2.5h - 0%
Equivalent step load:	55.1 lbs (25 kg)
Manufacturer:	KONE Inc.

The Life Cycle Assessment is based on an estimated lifetime of 15 years for the reference escalator, TravelMaster 110 operating 14 hours per day, 6 days per week and 52 weeks per year. A Chinese national mix of energy has been used for calculating emissions during the life cycle.

The total global recycling rate for metals is assumed to be 95%. Metals are recovered as scrap from manufacturing processes and from end-of-life treatment.

The data used in the Life Cycle Assessment is collected from the manufacturer and the suppliers as well as LCA databases. If no suitable data was available, the expert opinion or the best estimation was used.

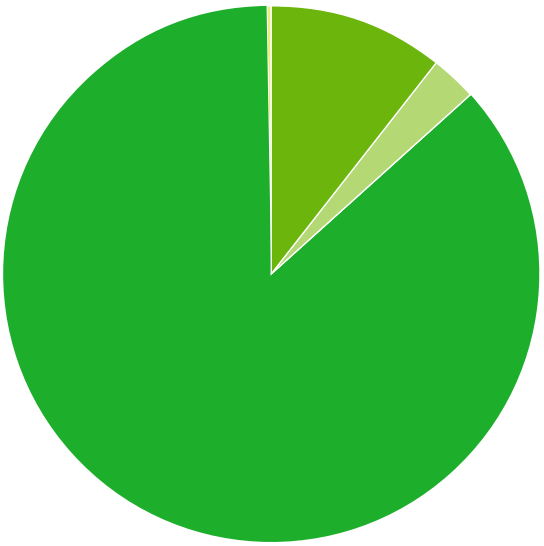
The most significant environmental impacts of the life-cycle inventory

About 92% of carbon dioxide (CO_2) emissions, 93% of nitrogen oxide (NO_x) emissions and 96% of sulphur oxide (SO_x) emissions are generated during the use stage. By comparison, during material production, carbon dioxide emissions are 6%, and during component manufacturing the total carbon dioxide emission is 1%. About 91% of the total primary energy is consumed during the use stage.

Total primary energy and emissions to air		
	Values are calculated per escalator, with a reference operation of 1 km (3,281 ft)	Values are calculated per escalator in the whole life cycle
Total primary energy	36.4 MJ	4,290,495 MJ
Emissions to air		
CO_2	5.1 lbs (2.32 kg)	602,867 (273,456 kg)
NO_x	19 lbs (8.65E-03 kg)	2,246.5 lbs (1,019 kg)
SO_x	4 lbs (1.83E-02 kg)	4,766.4 lbs (2,162 kg)
Particulates	4 lbs (1.84E-03 kg)	478.4 (217 kg)

The impact assessment phase of an LCA evaluates the significance of potential environmental impacts throughout the life cycle of the product. The shares of the total environmental impacts of the life-cycle stages have been calculated using the Eco-Indicator 99 (H,A) method and the factors of the CML-Impact Assessment method. The absolute values of the impact assessment are not highly relevant because the main purpose is to compare the relative differences between products or processes.

The shares of the total environmental impacts of the life-cycle stages



The stage of the life cycle	EI99 value-%
Material production	7.1
Component manufacturing	2.7
Delivery	0.004
Installation	0.02
Use	89.9
Maintenance	0.07
End-of-life treatment	0.1

The most significant environmental aspects of the escalator are fossil fuels, particularly hard coal and crude oil, and air emissions, particularly carbon dioxide, nitrogen oxides, sulfur oxides and particulates. The impact categories included are global warming, eutrophication, photochemical oxidation and acidification.

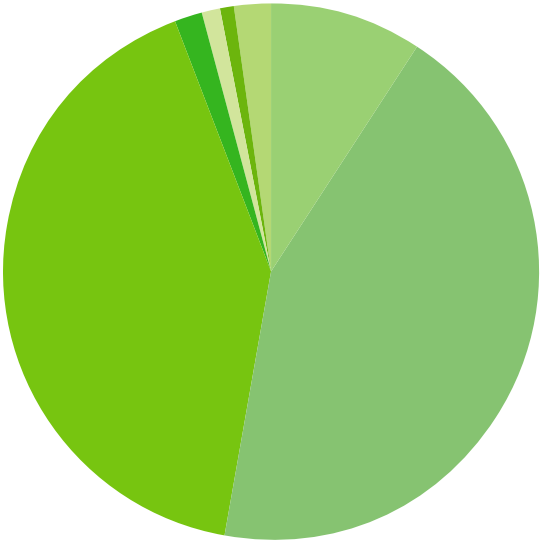
Emissions expressed in terms of environmental impact categories			
Category of impact	Equivalent unit	Values are calculated per escalator, with a reference operation of 1 km	Values are calculated per escalator in the whole life cycle
Global warming (GWP100)	lbs (kg) CO_2 eq.	6 (2.71)	704,758 (319,673)
Eutrophication	lbs (kg) PO4 eq.	2.5 (1.14) E-03	298 (135)
Photochemical oxidation	lbs (kg) ethylene eq.	21.9 (9.93) E-04	258 (117)
Acidification	lbs (kg) SO2 eq.	5.7 (2.61) E-02	6,795 (3,082)

* Values are calculated according to the factors of CML-Impact Assessment method.

The Life Cycle Assessment shows that most of the environmental impacts of an escalator life cycle are caused by the electricity used for operating the escalator during the use stage.

Additional environmental information

Product material content
The KONE TravelMaster 110 escalator is mainly composed of zinc coated and uncoated steel and aluminum.



Material	Weight (%)
Aluminum	8.8
Steel	41.5
Steel, zinc coated	39.2
Other metals	1.7
Plastics	1.0
Glass	5.7
Others	2.0

The product does not contain asbestos, paints containing lead or cadmium pigments, capacitors containing PCBs or PCTs, ozone layer depleting chemicals such as CFCs, or chlorinated solvents. Mercury is not used in applications other than lighting. Cadmium stabilizers are not used in plastics.

11.24 lbs (5.1kg) VOC emissions are released during the life cycle of the escalator. The main sources of VOCs are material production (82%), component manufacturing (7%) and use stage (11%).

Recycling description

The end of life of the escalator is multi-metal scrap recycling. The metals, which represent about 91% of the escalator material weight, are recyclable. When metals are recycled there is a clear reduction in environmental impacts, primarily because the recycling of metals lowers the demand for primary metals as raw materials. Plastics can be used for energy recovery or disposed of in landfills.

Packaging includes wood (42%), plywood (49%) and plastics and others (9%). Wood and plywood can be recycled or used for energy recovery. Plastics can be used for energy recovery or disposed of in landfills.

Sensitivity analysis

Electricity consumption of the escalator during the use stage with different operating modes affects the environmental results remarkably: the standby mode decreases the total environmental impact by 10% and the stopped mode by 18%.

Operational mode	Operational hours/year [h]*	Energy consumption/ year [kWh]
Continuously running*	4,370	13,580 kWh
Standby speed without passenger load	4,370	12,070 kWh
Stopped without passenger load	3,750	10,880 kWh

***Continuously running:** 14 h/day operation, 6 days/week, 52 weeks/year
Standby speed without passengers: 12 h/day operation 1.6 f/s (0.5 m/s), 2 h/day operation .6 f/s (0.2 m/s), 6 days/week, 52 weeks/year
Stopped without passengers: 12 h/day operation, 2 h/day no operation, 6 days/week, 52 weeks/year

Disclaimer: the stop and go functionality is used for comparison purposes, but this option is not available in the U.S.

When conducting a life-cycle assessment it is important to note that the location of the product while in use will impact the calculations. Such that, compared to the reference case in China, in the U.S. the impact decreases by approximately 48%. In Europe, the decrease is approximately 57% and in the Middle East by approximately 19%. This is caused by the different fuel mix used for electricity production in the varying countries.

Glossary

Acidification potential
Chemical alternation of the environment, resulting in hydrogen ions being produced more rapidly than they are dispersed or neutralized, occurs mainly through fallout of sulfur and nitrogen compounds from combustion processes. Acidification can be harmful to terrestrial and aquatic life.
CML-Impact Assessment Method
The CML methodology is based on midpoint modeling (problem-oriented method). Pollutants are allocated to impact categories.
Eco-Indicator 99 (H,A) (EI99)
Damage factors in the hierarchism perspective. Pollutants are allocated to impact categories and are normalized by dividing the national total impact potentials. The environmental effects are then assigned to "damage categories" which include the effects on human health, the quality of an ecosystem, and the fossil and mineral resources.
Eutrophication potential
Enrichment of bodies of water by nitrates and phosphates from organic material or the surface runoff, increases the growth of aquatic plants and can produce algal blooms that deoxygenate water and smother other aquatic life.
Exponential notation (E)
A way of writing numbers that accommodates values too large or small to be conveniently written in standard decimal notation, e.g. 7.21E-04 kg is equal to 0.000721 kg.
Functional unit
The quantified performance of a product system for use as a reference unit.
Global warming potential (GWP100)
The index used to translate the level of emissions of various gases into a common measurement to compare their contributions to the absorption by the atmosphere of infrared radiation. Greenhouse gases are converted to CO_2 equivalents with GWP factors, using factors for a 100-year interval (GWP100).
Ozone depletion potential (ODP)
The index used to translate the level of emissions of various substances into a common measure to compare their contribution to the breakdown of the ozone layer. ODPs are calculated as the change that would result from the emission of 2.2 lbs (1 kg) of a substance to that from emission of 2.2 lbs (1 kg) of CFC-11 (a freon).
Photochemical oxidation
The index used to translate the level of emissions of various gases into a common measurement to compare their contributions to the change of ground-level ozone concentration. POCPs are calculated as the change that would result from the emission of 2.2 lbs (1 kg) of a gas to that from emission of 2.2 lbs (1 kg) of ethylene.
Recycling rate
Metals recovered as scrap from manufacturing processes and scrap from end-of-life.
Volatile organic compounds (VOC)
A wide group of organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize into the atmosphere. VOCs cause various environmental impacts that depend on the specific set of compounds released. Mainly VOCs contribute to photochemical oxidation and respiratory organics.

This document has been developed in collaboration with VTT, Technical Research Centre of Finland. VTT is a contract research organization involved in many international assignments. With its more than 2700 employees, VTT provides a wide range of technology and applied research services for its clients, private companies, institutions and the public sector. VTT is striving to improve the well-being of society and to enhance the technical and economic performance of its clients.

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ISO 14040: Environmental management. Life-cycle assessment. Principles and framework. 2006-12-18.

ISO 14044: Environmental management. Life-cycle assessment. Requirements and guidelines. 2006-12-18.

The Life Cycle Assessment of KONE TravelMaster 110 Escalator. Research report No VTT-R-02318-10. VTT. Espoo, Finland 2010.

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SF2920 Rev 0411
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