Product Life Cycle Assessment - LCA

Metal halide lamp
Lok-it! HTI 1000/PS

This life-cycle assessment of the Lok-it! HTI 1000/PS comprises the entire life of a product, from raw material extraction and acquisition, through material production and manufacturing, to use and end of life treatment including recycling and final disposal.

The method for these analyses was an assessment following *in principle* the international standards ISO 14040 and 14044. Apart from the primary energy consumption the impact on the environment was evaluated in specific categories. The LCA was calculated with the life cycle modelling program GaBi.

ams OSRAM Lok-It! Power Series (PS) Lamps offer all the benefits of traditional Lok-it! lamps, while providing higher output in a more compact, yet thermally resistant design. The Power Series family also offers versatility to ensure you have the right lamp for your application. Lamps designated as “Brilliant” offer exceptional color rendering, making them ideal for applications, like theatres, where color quality is critical. The “Blue” designation provides bright white light at 7500K, providing the punch needed to cut through colors on the stage.

Electrical and optical data

Lok-it! HTI 1000/PS	**Unit**	**Value**
Nominal wattage	W	1,000
Nominal voltage	V	85.0
Nominal current	A	11.8
Lifespan	h	750
Nominal luminous flux	lm	120,000
Color temperature	K	6,000
Weight	kg	0.205
Dimensions	mm	Diameter 27.0, length 125.0

Material composition

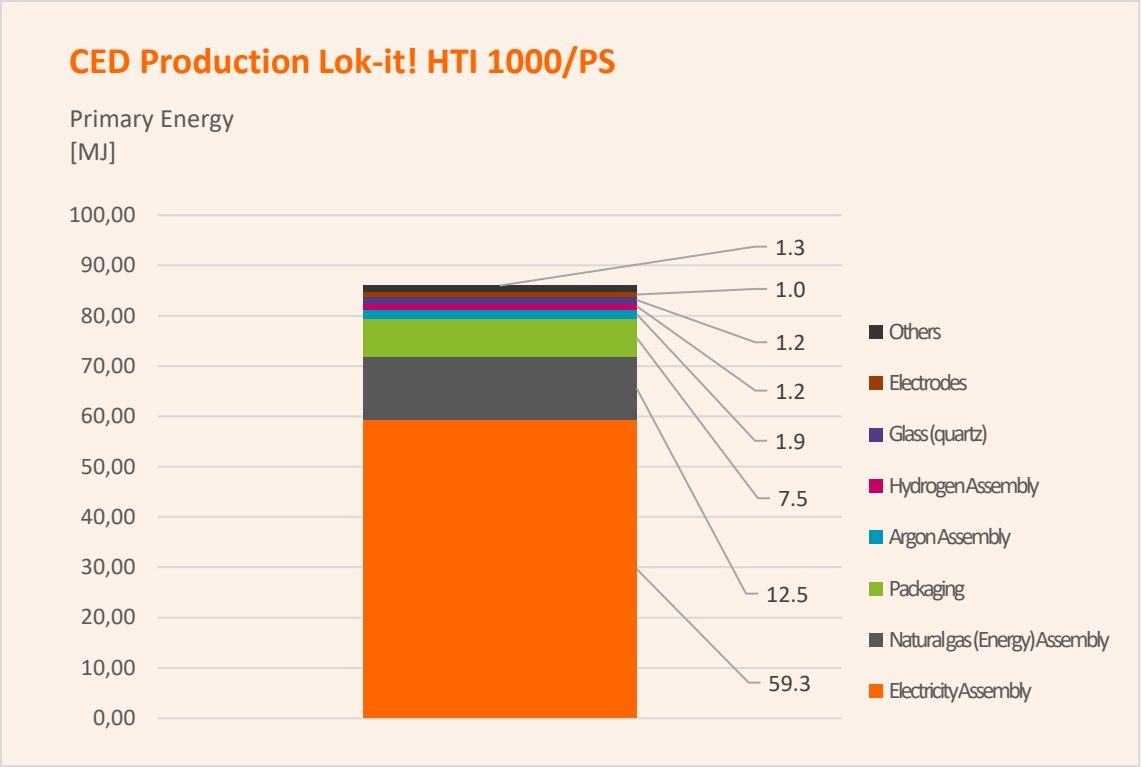
In order to consider the weight of the different materials especially in small components and components in compounds, the following values are calculated (rounded values).

MATERIAL	**WEIGHT**	**PERCENTAGE**
STEATITE (CERAMICS?)	31.9 g	15.6 %
GLASS (QUARTZ)	14.6 g	7.1 %
NON-FERROUS METAL	3.1 g	1.5 %
SILICONE DIOXIDE	3.0 g	1.5 %
CEMENT	1.8 g	0.9 %
FERROUS METAL	1.6 g	0.8 %
PACKAGING	149.0 g	72.7 %
TOTAL	**205.0 g**	**100.0 %**

HTI lamps need liquid mercury (Hg) for operation. The assessed lamp contains 0.08 g which remains in the lamp during the whole operational life. It is not evaporating during use. The lamps are exclusively handled, installed and operated by trained professionals.

Determining CED during the production phase

To determine the amount of energy needed in the manufacturing phase, all the materials used, their masses and production steps are considered. During this phase, transportation of the major components is also taken into account. The cumulative energy demand during the production phase is shown in the diagram below. The electricity consumption for the assembly of the HTI accounts for the majority of the overall energy required during the production phase.



Calculating CED during the usage phase

For the usage phase a lifespan of 750 hours has been assumed, resulting in a CED of 8,336 MJ_{Prim} by calculating with the German energy mix.

1.)	Electrical power consumption during life (750 hours)	1,000 W_{El} * 750 h = 750 kWh_{El}
2.)	Energy mix (includes average power plant efficiency)	1 kWh_{El} requires 3.0875 kWh_{Prim}
3.)	Cumulative energy demand	750 kWh_{El} * 3.0875 kWh_{Prim}/kWh_{El} = 2315.625 kWh_{Prim} 2315.625 kWh_{Prim} * 3.6 MJ_{Prim}/kWh_{Prim} = 8336.25 MJ_{Prim}

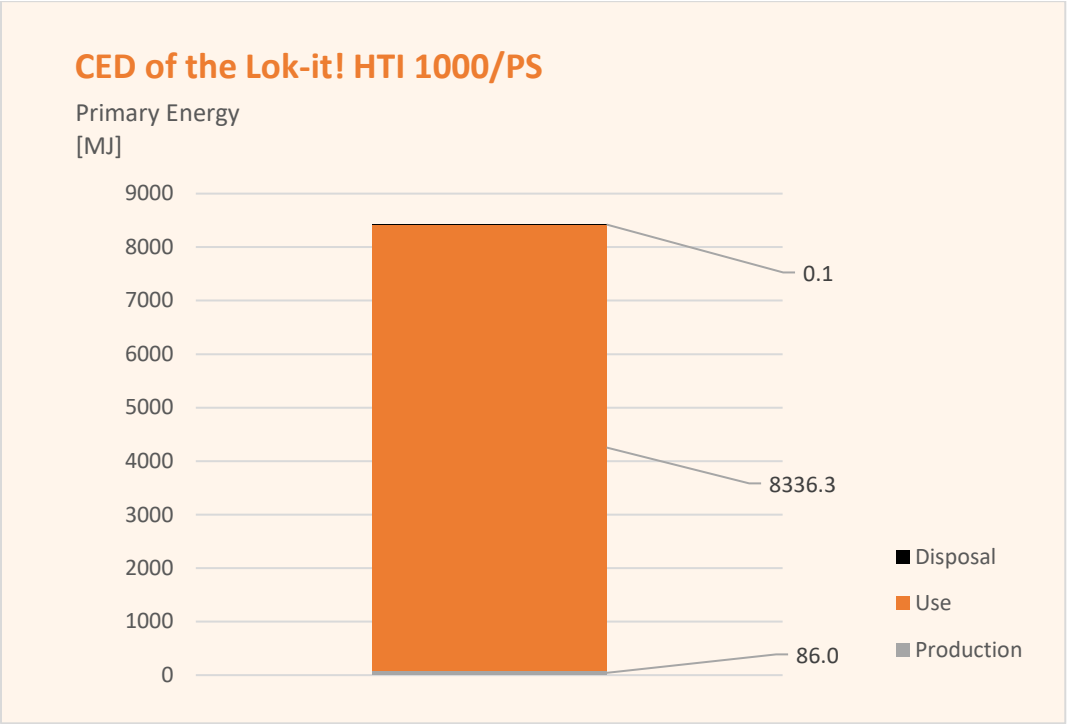
Disposal phase

In this assessment, only the incineration of steatite, cement and packaging in a municipal waste-to-energy plant is assumed. This represents the worst-case scenario. During this process, a small amount of energy can be recovered. A much higher amount of energy recovery and further environmental benefits are obtained by recycling the steel parts and electrodes of the product.

The mercury used in production is 100% recycled mercury in the required purity. HTI lamps have to be taken back and recycled in the EU and other countries. According to the EU Directive 2012/19/EU end-of-life lamps have to be collected, recycled and treated to remove mercury. The mercury is then recycled or disposed of in a safe way following the national legal requirements. Therefore, the mercury used for the lamp is not taken into consideration for the assessment.

CED (Cumulative Energy Demand) of the HTI

The following diagram shows the results of the lifecycle assessment of the Lok-it! HTI 1000/PS. Analysis shows that over 98% of the energy is consumed during the usage phase.



Considering that most of the energy demand of lighting products is during the usage phase, it is strongly recommended to focus on energy efficient systems with a high efficacy (lm/W). This improves the environmental performance and reduces the overall impact of a lighting system. Therefore, with optimizations in the usage phase the highest CED savings can be achieved.

Environmental impacts of all lifecycle phases

Impact Category	Unit	Production	Usage	Disposal
Cumulative Energy Demand (CED)	MJ	86.0	8,336.3	0.1
Global Warming Potential (GWP)	kg CO_2 eq.	4.0	459.6	0.4
Acidification Potential (AP)	kg SO_2 eq.	0.01	0.68	0.00
Eutrophication Potential (EP)	Kg PO_4 eq.	0.001	0.109	0.000
Photochemical Ozone Creation Potential (POCP)	Kg Ethane eq.	0.001	0.047	0.000
Human Toxicity Potential (HTP)	Kg DCB eq.	0.4	15.5	0.0
Abiotic Depletion Potential (ADP) (fossil)	MJ	54	4,475	0