Product Life Cycle Assessment - LCA

HBO 12000 W/CHL

This life-cycle assessment of the HBO 12000 W/CHL 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.

Product description

ams OSRAM HBO lamps are mercury short-arc lamps for professional and industrial applications. The discussed HBO 12000 W /CHL is used as microlithography lamp in the production process of LCD systems.

Electrical and optical data

	Unit	Value
Nominal wattage	W	12,000
Nominal voltage	V	112
Nominal current	A	107
Lifespan	h	2,500
Weight	kg	3.1
Dimensions	mm	Diameter 124, Length 500

Material composition

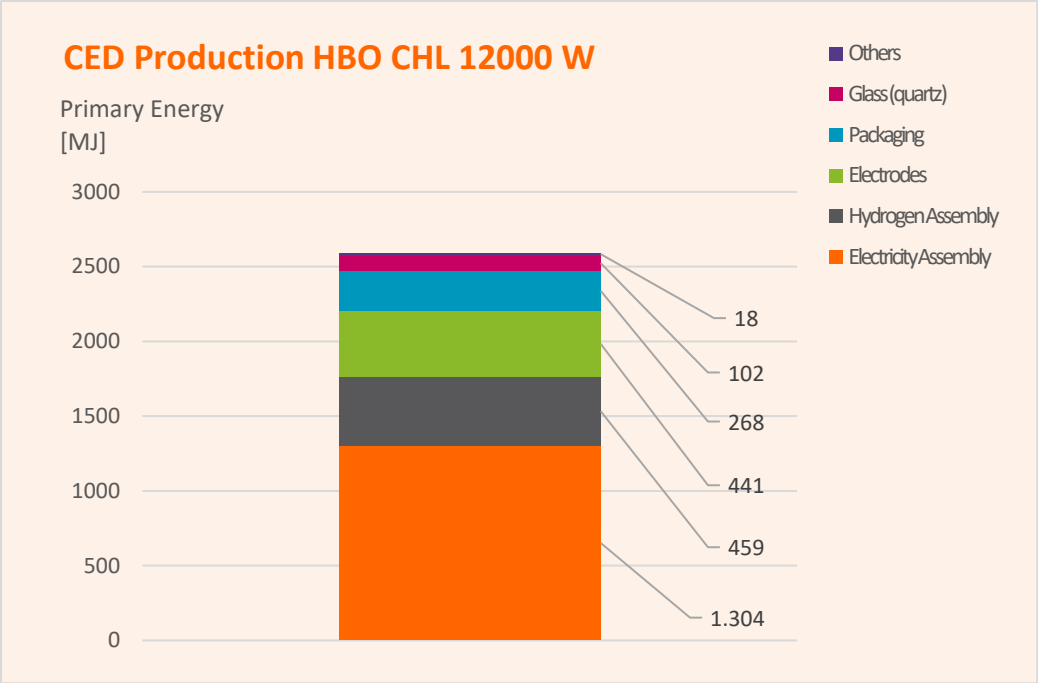
In order to consider the weight of the different materials especially in small components and components in compounds, the following values are calculated (rounded values).

MATERIAL	WEIGHT	PERCENTAGE
NON-FERROUS METAL	1,808 g	25.2 %
GLASS (QUARTZ)	1,245 g	17.4 %
OTHER	83 g	1.2 %
PACKAGING	4,027 g	56.2 %
TOTAL	**7,164 g**	**100.0 %**

HBO lamps need liquid mercury (Hg) for operation. The assessed lamp contains 49g 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 HBO accounts for half of the overall energy required during the production phase.



Calculating CED during the usage phase

For the usage phase a lifespan of 2,500 hours has been assumed, resulting in a CED of 333,450 MJ_{Prim} by calculating with the German energy mix.

1.)	Electrical power consumption during life (2,500 hours)	12,000 W_{El} * 2,500 h = 30,000 kWh_{El}
2.)	Energy mix (includes average power plant efficiency)	1 kWh_{El} requires 3.0875 kWh_{Prim}
3.)	Cumulative energy demand	30,000 kWh_{El} * 3.0875 kWh_{Prim}/kWh_{El} = 92,625 kWh_{Prim} 92,625 kWh_{Prim} * 3.6 MJ_{Prim}/kWh_{Prim} = 333,450 MJ_{Prim}

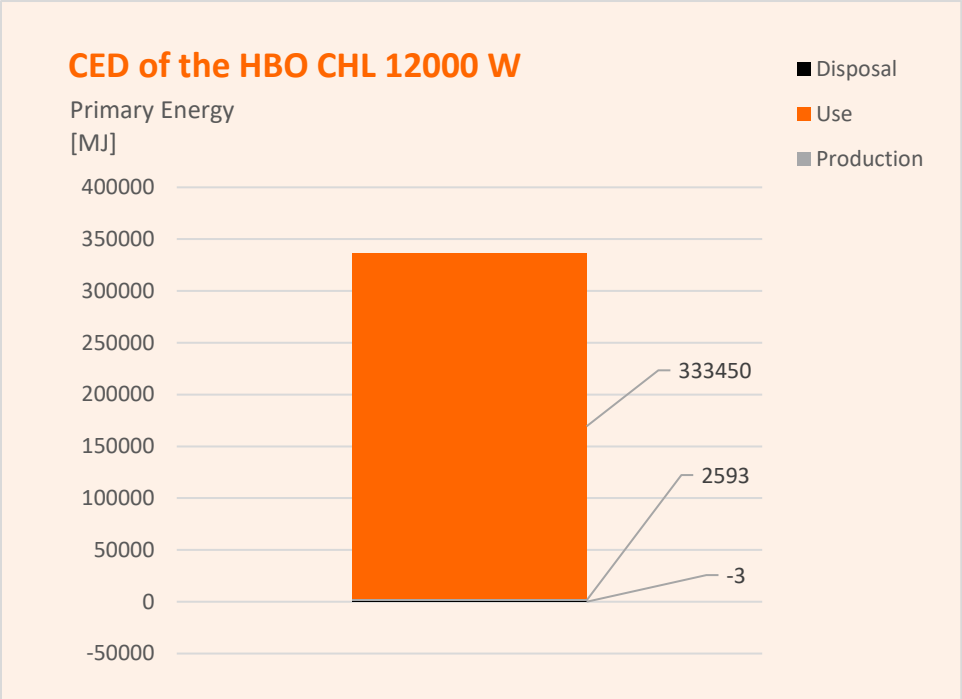
Disposal phase

In this assessment, only the incineration of base 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 non-ferrous metal parts of the product.

The mercury used in production is 100% recycled mercury in the required purity. HBO lamps have to be taken back and recycled in the EU and other countries. According 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 HBO

The following diagram shows the results of the lifecycle assessment of the HBO 12000 W/CHL. Analysis shows that over 99% of the energy is consumed during the usage phase. In the end-of-life phase, there is in relation to the overall CED a negligible benefit (-0.001%) from energy recovery through the re-use of metal components and waste incineration.



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	2,593	333,450	-3
Global Warming Potential (GWP)	kg CO_2 eq.	139	18,383	7
Acidification Potential (AP)	kg SO_2 eq.	0.16	27.33	0.00
Eutrophication Potential (EP)	Kg PO_4 eq.	0.02	4.37	0.00
Photochemical Ozone Creation Potential (POCP)	Kg Ethane eq.	0.02	1.89	0.00
Human Toxicity Potential (HTP)	Kg DCB eq.	3.99	619.53	-0.05
Abiotic Depletion Potential (ADP) (fossil)	MJ	1,877	178,995	-2