Product Life Cycle Assessment - LCA

Electronic Control Gears (ECGs)

QUICKTRONIC INTELLIGENT DALI DIM T5 - QTi DALI 2X35/49/80 DIM

and

OPTOTRONIC Intelligent - OTi DALI 60/220…240/550 D LT2 L

This life-cycle assessment of electronic control gears (ECGs) 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 descriptions

An electronic control gear is a unit that is located between the power supply and one or more lamps respectively LED modules to provide them with an appropriate voltage or current.

The QUICKTRONIC INTELLIGENT (QTi) is an ECG for traditional lighting, especially for fluorescent and compact fluorescent lamps. It is dimmable and often used in industry, public buildings, shop lighting etc.

The OPTOTRONIC INTELLIGENT (OTi) is an ECG for LED modules.

Electrical data

	Unit	**Value**	
		QTi DALI DIM T5 2X35/49/80 DIM	**OTi DALI 60/220…240/550 D LT2 L**
Nominal voltage	V	220…240	220…240
Power loss during operation	W	8.0	5.0
Lifetime	h	100,000	50,000 (up to 100,000)
Weight	kg	0.370	0.205
Dimensions	mm	423 x 30 x 21	280 x 30 x 21

Material composition

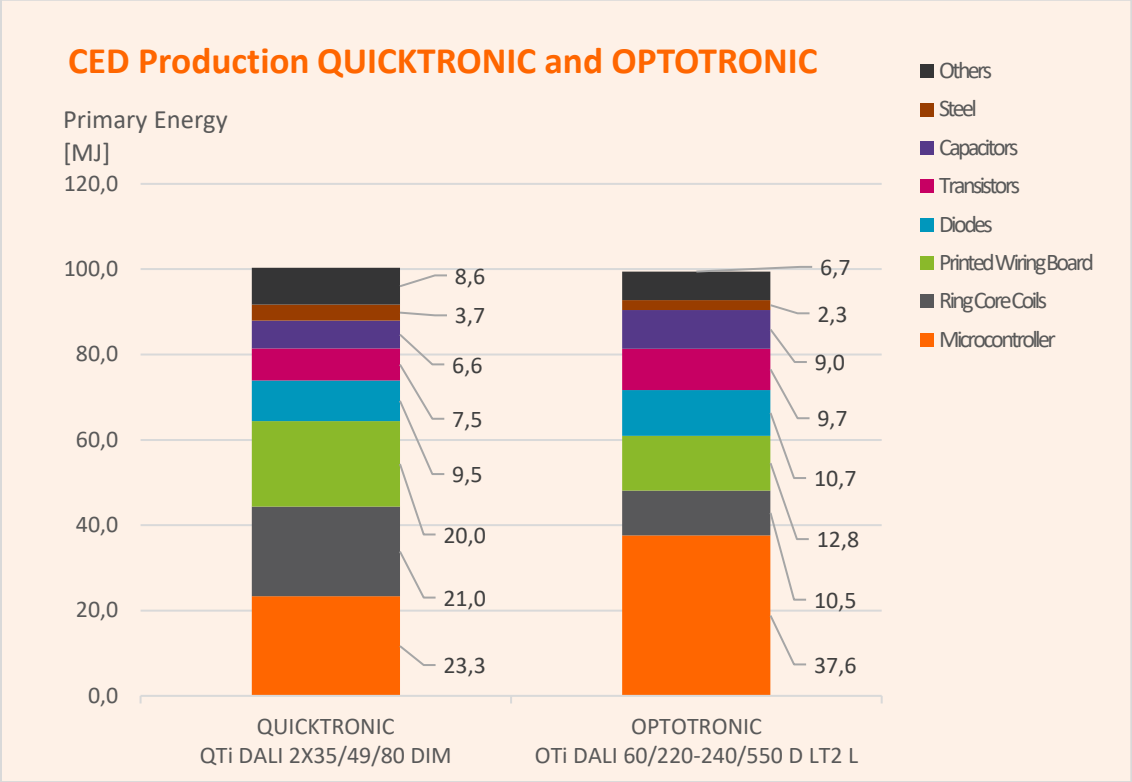
In order to consider the weight of the different materials especially in small components and components in compounds, the following values are calculated (rounded values).

MATERIAL	**WEIGHT**		**PERCENTAGE**	
	QTi	OTi	QTi	OTi
ELECTRONIC COMPONENTS	187.2 g	108.1 g	50.6 %	52.7 %
METAL COMPONENTS	135.0 g	85.0 g	36.5 %	41.5 %
TEHRMAL PADS	40.0 g	1.4 g	10.8 %	0.7 %
PLASTIC COMPONENTS	7.8 g	10.5 g	2.1 %	5.1 %
TOTAL	**370.0 g**	**205.0 g**	**100.0 %**	**100.0 %**

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. Production of the microcontroller, ring core coils and printed wiring board account for the majority of the energy required.



The CEDs of production are quite similar for the two compared ECGs. There are little differences in the allocation of the total energy demand during production.

Calculating CED during the usage phase

For the usage phase a lifespan of 50,000 hours has been assumed, resulting in a CED of 4,446 MJ_{Prim} for QUICKTRONIC and 2,779 for OPTOTRONIC by calculating with the German energy mix.

1.)	Electrical power consumption during life 50,000 hours; QTi (OTi)	8 W_{El} (5 W_{El})* 50,000 h = 400 kWh_{El} (250 kWh_{El})
2.)	Energy mix (includes average power plant efficiency)	1 kWh_{El} requires 3.0875 kWh_{Prim}
3.)	Cumulative energy demand	400 (250) kWh_{El} * 3.0875 kWh_{Prim}/kWh_{El} = 1,235 kWh_{Prim} 772 kWh_{Prim} 1,235 (772) kWh_{Prim} * 3.6 MJ_{Prim}/kWh_{Prim} = 4,446 MJ_{Prim} (2,779 MJ_{Prim})

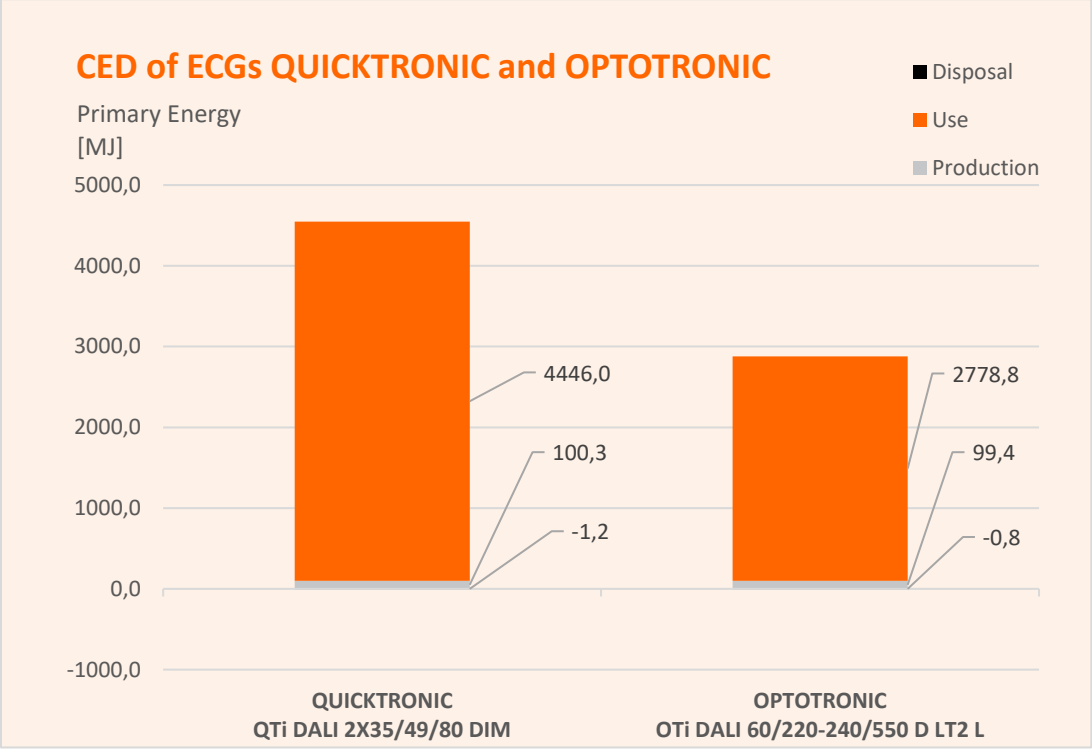
Disposal phase

Electronic control gears are directly or indirectly in the scope of take back regulations e.g. the European Directive 2012/19/EU. In the EU 75 % of the materials and products taken back in the responsibility of the producers shall be recovered, 55 % shall be prepared for re-use and recycled. Due to missing data about the real and specific take-back rates for the assessed control gears, a worst case scenario has been used for the calculation. Therefore only the recycling of the metal housing is taken into account. During this process, a small amount of energy can be recovered.

CED (Cumulative Energy Demand) of the ECGs

The following diagram shows the results of the lifecycle assessment of the QTi DALI 2X35/49/80 DIM and the OTi DALI 60/220-240/550 D LT2 L. Analysis shows that over 96% of the energy is consumed during the usage phase. In the end-of-life phase, there is a small benefit from energy recovery (-0.03%) through the re-use of housing components.

In the following diagram the ECGs QUICKTRONIC INTELLIGENT DALI DIM T5 and OPTOTRONIC INTELLIGENT DIM DALI are compared. To ensure comparability, a lifespan of 50,000 h for the usage phase is assumed for both.



In the graph above we see that the QUICKTRONIC ECG has a higher overall CED. This is due to higher power loss during operation with traditional fluorescent lamps. 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. 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

The usage phase for the ECG was modelled without GaBi. Therefore, the environmental impacts during the usage phase are not taken into account.

Impact Category	Unit	Production	Usage	Disposal
Cumulative Energy Demand (CED)	MJ	100	-	-1
Global Warming Potential (GWP)	kg CO_2 eq.	6.63	-	-0.11
Acidification Potential (AP)	kg SO_2 eq.	0.034	-	0.000
Eutrophication Potential (EP)	Kg PO_4 eq.	0.00248	-	-0.00002

Photochemical Ozone Creation Potential (POCP)	Kg Ethane eq.	0.00376	-	-0.00005
Human Toxicity Potential (HTP)	Kg DCB eq.	2.13	-	-0.01
Abiotic Depletion Potential (ADP) (fossil)	MJ	84	-	-1