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LIGHTING IN ARCHITECTURE

#132

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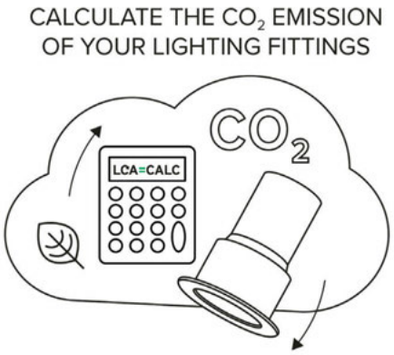
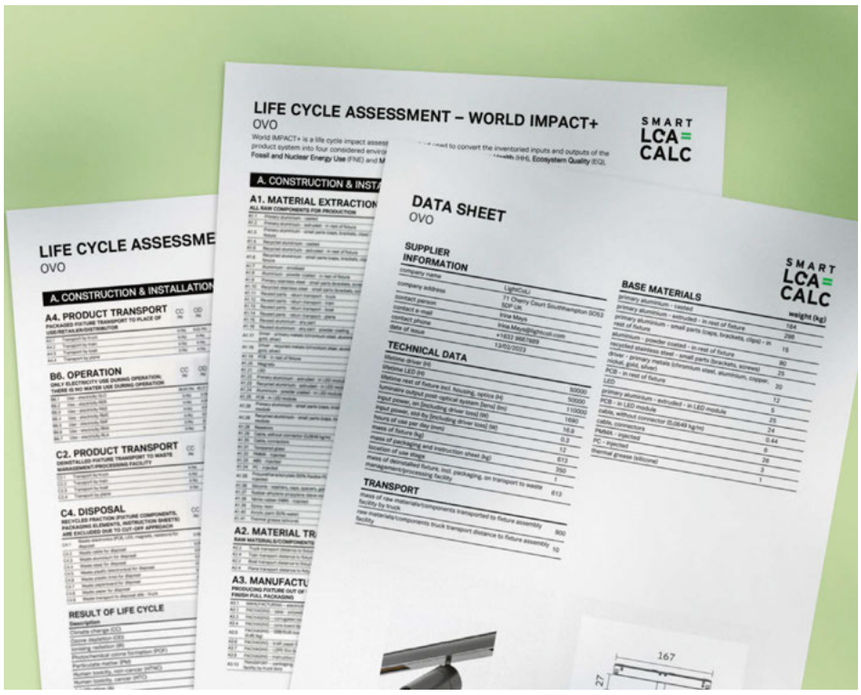
COMMENT
TIPHAINE TREINS

Life Cycle Assessments

Lighting designer Tiphaine Treins has created a new tool to calculate the environmental footprint of lighting fixtures. Here, she tells us all about the LCA-CALC.

LCA-CALC enables lighting specialists to calculate the environmental footprint of all lighting fittings easily and affordably. The idea behind it was to democratise lighting eco-design metrics for designers, suppliers and lighting specialists, thereby moving the lighting industry forward towards a more environmentally friendly future.
My design work prioritises ecologically friendly and transparent workmanship. As an eco-lighting innovator, I want to understand and scientifically quantify the environmental impact of each installation. However, my exploration of eco-design in lighting fittings revealed a lack of clarity about which materials have the least environmental impact. I was unable to know with precision which material is best to use. For example, is it best to use recycled aluminium or plastic? When proposing a fitting designed to be reused for two or three times to a client, I had no means to scientifically quantify the environmental impact savings of that fitting. I was also unable to precisely compare the environmental impact of different products. For example, I couldn't compare a more efficient luminaire to a less efficient one with a longer lifetime warranty.
The answer to these questions, and more, is found through a life cycle assessment (LCA). An LCA is a technique used to assess the environmental footprint associated with a product over its life cycle, from raw material extraction to manufacture, distribution, use and final disposal. No standardised or accessible system to calculate the lifecycle of a luminaire currently exists. Currently, a lighting designer desiring to understand a luminaire's life cycle is faced with multiple challenges. Performing the LCA in-house for a supplier requires hiring an expensive LCA analyst who will require costly database and software licenses. Moreover, the life cycle assessment methodology, though globally standardised, can be applied differently by different analyst and multiple regional guidelines complicate the process and necessitate specific skills and know-how to get a relevant LCA. Conducting a life cycle assessment, therefore, is often cost prohibitive. Lighting suppliers have the option of outsourcing the life cycle assessment. However, this route means that even the most minor change to the fittings requires a new – and expensive – calculation.
LCA-CALC was born out of my frustrations with the inability to obtain reliable, scientific, and usable eco-design metrics at a reasonable cost, combined with a desire to innovate and move the lighting industry towards a zero-waste future.
I partnered with the International Reference Center for Life Cycle Assessment and Sustainable Transition (CIRAIG) to build LCA-CALC. CIRAIG is a cutting-edge life cycle assessment research centre that develops metrics necessary for a transition to an eco-friendly society and is affiliated with Polytechnique Montreal. This made the partnership an obvious and fruitful fit. Using CIRAIG's expertise, I created the first accessible and affordable tool to assess the environmental footprint of all lighting fittings (exterior, interior, decorative fittings).
LCA-CALC is an online platform that easily calculates the environmental footprint of all lighting fittings using the European Footprint 3.0 (EF3) and IMPACT World+ life cycle impact assessment (LCIA) methods. LCA-CALC considers the production of the materials, manufacture of the fixtures,





distribution, use and end-of-life for each fixture.
LCA is the general methodology used to assess the environmental footprint of products, it is governed by the ISO 14040-44 standards. There are four phases to an LCA study: the goal and scope definition, the life cycle inventory (LCI) analysis, the life cycle impact assessment (LCIA) and the interpretation of the results.
To obtain the relevant results, the user inputs data into the online platform. Required data includes the list of materials and their respective amounts, manufacturing, distribution, use and end-of-life information. LCA-CALC also requires light output, driver power, fitting and components lifetime and electricity consumption during use and stand-by data.
LCA-CALC uses an in-house methodology to assess the life cycle of LED light fixtures as no European guidance for developing lighting fitting environmental product declarations has yet been made available. Once it is published, LCA-CALC will align with it. Until that time, the environmental footprint of the light fixture is related to the functional unit of "providing 1,000 lumens for 50,000 hours", as this period corresponds to the average lighting fitting lifetime and warranty.
LCA-CALC uses datasets from the widely used life cycle inventory database ecoinvent v3.8 to analyse the background processes, namely the production and manufacturing of the materials and components used, transportation, electricity generation and waste treatment. It considers the average global context for materials, transportation, and waste treatment, and can apply different specific regional electricity grid mixes for the use stage.
LCA-CALC can also calculate the life cycle assessment of fittings designed with a circular economy model. The tool can consider the reuse of components and includes data on recycled materials. For the latter, the approach used is consistent with the ecoinvent system model, which considers that all burdens associated with the collection, sorting and recycling of the used material are allocated to the recycled material and the life cycle that uses it.
The environmental footprint obtained with either the EF 3.0 or IMPACT World+ methods consists of a broad range of environmental indicators. EF3.0 provides 16 midpoint indicators, including the carbon footprint in kg of CO2 equivalents, while IMPACT World+ provides two endpoint indicators (Human health and Ecosystem quality) and two midpoint indicators (Fossil/nuclear energy and Mineral resources), with the endpoint indicators aggregate several midpoint indicators, thus facilitating the interpretation of the results for eco-design purposes.
LCA-CALC provides the following environmental metrics on the life cycle of lighting fittings:
• the carbon footprint.
• the environmental footprint made up of the 16 midpoint indicators of the EF 3.0 LCIA method.
• the environmental footprint is made up of the two endpoint indicators and two midpoint indicators of the IMPACT World+ LCIA method.
The LCIA results are displayed neatly in a digestible and actionable report. Moreover, the LCA-CALC platform user interface allows the user to store all relevant data and metrics and the platform provides online support for users.
LCA-CALC is the first tool of its kind for the lighting industry. Other attempts, such as the CIBSE's TM66 have been made to create environmental metrics for lighting. Whereas TM66 only provides recommendations for design and manufacture of circular products, LCA-CALC is a widely applicable and in-depth life cycle quantitative assessment tool for all fixtures, new and reused, circular or not.
Designed to be user-friendly, flexible, and accessible and affordable for lighting suppliers and designers who wish to prioritise transparent and eco-friendly manufacturing and design, LCA-CALC is currently operating in beta, with the launch for a limited number of users slated for April 2023.
To join the LCA-CALC waitlist and gain the earliest access to the platform register your interest at:
www.lca-calc.com/join-waitlist