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Contact:
daizhong.su@ntu.ac.uk

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Developing sustainable lighting using eco-design tools

By using design tools to increase sustainability at every stage of production, researchers have developed a new eco-light. The light, which uses low wattage LEDs and recycled plastic, has a substantially lower environmental impact than the traditional equivalent LED lights.

Lighting accounts for a large amount of Europe's electricity consumption[1]. In addition to environmental impacts from the use of lighting products, there are impacts from material extraction, production, transport and disposal at the end of the product's life. Integration of environmental assessment tools into the design phase of lighting products could lead to improvements in their environmental performance.

In this study, researchers developed an eco-light, using eco-design tools at each stage from conception to evaluation, minimising environmental impact throughout its lifecycle. The research demonstrates the step-by-step process of integrating these tools into the design process for eco-lighting products. It was supported by the CIP Eco-Innovation programme and two projects funded under the EU's Seventh Framework Programme[2].

Before production begins, both mandatory and voluntary regulations can help formulate the Product Design Specifications by identifying the minimum energy efficiency level and the permitted materials and substances. Examples of mandatory regulations are the Energy related Products and the Energy Labelling Directive the Restriction of Hazardous Substances (RoHS) regulation and the Waste Electrical and Electronic Equipment (WEEE) Directive. Examples of voluntary regulations include the Ecolabel and Green Public Procurement.

In the conceptual design phase, software based tools are used to develop, evaluate and refine the design concept. Such tools have been developed for use by product designers and simulate scenarios for different materials, transport modes and industrial processes. In the detailed design phase, software-based analytical tools perform a thorough environmental impact assessment of the product using data on materials and manufacturing to produce a lifecycle analysis (LCA). This considers the manufacturing, use and distribution stages, but not the end-of-life stage.

This study reports on the conceptual and detailed design stage whilst the product design specifications are reported in a separate study[3]. An initial design was conceived consisting of elements including highly efficient 3 Watt LEDs, recycled polyethylene terephthalate (PET) for the housing and cable tubing, aluminium heat sinks to cool the LEDs and installation of all electronic components in one tray to facilitate repair and updating.

The researchers conducted a detailed environmental impact assessment and compared the eco-light with a traditional light in terms of Okala points, a technical parameter that compares LCA results of different impact categories for lighting products. The newly developed eco-light had a smaller environmental impact than the traditional product: 14.3 Okala points for the eco-light compared to 16.1 Okala points for the traditional light. The eco-light gained this environmental advantage mainly through the choice of materials for manufacture, such as the highly efficient LEDs and recycled PET.

Of the lifecycle stages, transport and distribution produced the greatest environmental impact (73% of total impact for the eco-light), indicating room for improvement in this area. In comparison, the use phase had a relatively small impact (23.1% of total impact) due to the high efficiency of the LEDs. The study's authors conclude that further work is needed to fully optimise such eco-lights and the research team aims to focus on design for disassembly, light fit for purpose, dematerialisation and maximising light performance. Nevertheless, this study provides an excellent example of effective use of eco-design tools in the lighting sector.

1. ADEME (2005) Énergie et patrimoine communal. http://www2.ademe.fr/servlet/%20getDoc?cid96&m3&id48956&p1P (accessed 01.02.13.)
2. http://www.cyc-led.eu/home.php and http://www.myecocost.eu
3. See Casamayor, J.L., 2011. Product Design Specification of the Eco-lighting Product. Research Report. ADMEC, Nottingham Trent University, UK.