LED and Life Cycles

Life Cycle Environmental Concerns in Procurement of LED Light

Lindhqvist, Thomas

2018

LED and Life Cycles

Life Cycle Environmental Concerns in Procurement of LED Light

IIIEE | LUND UNIVERSITY

Thomas Lindhqvist

Partly funded by:

Interreg
Öresund-Kattegat-Skagerrak
European Regional Development Fund

EUROPEAN UNION

Lighting Metropolis

Research by:

MESPOM
Masters in Environmental Science, Policy, and Management

LUND UNIVERSITY

iiiee
THE INTERNATIONAL INSTITUTE FOR INDUSTRIAL ENVIRONMENTAL ECONOMICS

Cover photo by Håkan Rodhe.

Lindhqvist, Thomas. (2018). *LED and Life Cycles. Life Cycle Environmental Concerns in Procurement of LED light.* Lund: IIIEE.

ISBN 978-91-87357-35-0

Introduction

The development of LED light has been rapid in the last decade and it has become the most attractive lighting solution for many buyers. The reasons have to do with the high energy efficiency of these lamps as compared to the traditional incandescent lamps. As society is trying to cope with climate change threats and all the connected issues related to nature and life of people, all opportunities to save energy and other resources should be considered. But few solutions are without any less positive sides and this short publication will discuss what a change to LED light can mean and, especially, how procurers in organisations, such as local and regional authorities, as well as, larger enterprises can act in order to minimise the negative aspects of LED light and enhance the positive aspects.

The publication builds on three reports put together by students in the Master in Environmental Sciences, Policy and Management (MESPOM) Programme during their studies at Lund University. In their third semester, during the three years 2015-2017, the student groups attended the course Sustainable Environmental Development (SED) and contributed to the project Lighting Metropolis by studying questions related to the life cycle impacts of LED light and procurement of lighting solutions. These reports are available from Lund University and from Lighting Metropolis. The front pages of the reports are seen on the back cover of this report.

In this short guidance document we have selected the main messages for procurers and everyone else deciding about what light solutions to buy. All solutions are related to certain challenges, so the message is not one without negative, as well as positive, aspects. However, the future of the LED light seems to be bright and, for most situations, we haven't yet seen any serious contenders. This doesn't mean that in the future there won't be such alternatives, but a real challenger seems far away and LED lights have in the last years improved so that in almost all real situations it is difficult to see a competitor.

So the question rather becomes how to act in order to profit from the strengths of LED lights and how to minimise the weaker sides of such light solutions. This is also the purpose of this short publication.

The need for light

When procuring light, the first question is how much light you need. LED lights are energy efficient, but this is not a reason for having more light than you need. So the first question to ask is what light do you need. Good light is essential for the well-being, for work efficiency, as well as, for a number of other reasons. But you can also have light where you don't need it and when you don't need it.

The most essential question to ask is what light do you need and when do you need it.

LED light can also appear in many more shapes and be built into equipment and furniture in ways that were impossible or very difficult with more traditional light sources, so it is important to open the mind to new solutions in the cases when you are not bound by investment in existing light fittings.

Be open for new opportunities that are present with LED lights!

Quality is essential

LED lights like many other products have had a need for development before quality equipment became more readily available. Still LED lights may not always live up to the principal promises given by manufacturers concerning energy efficiency, life times, and quality of emitted light as concerns, for instance, colour rendering (cold and warm light).

When buying LED lights it is important to buy a quality that corresponds to your needs and expectations. Be sure to select products of good quality!

The life cycle of LED lights

Like all other products, LED lights need raw materials for the manufacturing and these raw materials have to be extracted and processed to be useful for the production. Raw materials are refined and used to manufacture the components of the light source and its fittings. These components are in the production facilities assembled and the

equipment is ready for the consumers. But first the products must be packaged and transported to distributors in the countries where they are sold and provided to the consumers. After being in use for hopefully several years the LED lights will have to be replaced and they become waste. As waste the products will either be recycled or discarded in landfills or waste incinerators. Thus the life cycle of the LED is terminated, but if recycled the materials will come to new usage again.

There are a couple of issues that you should think about in order to manage the life cycle of the LED light in the most sustainable way. Some of these concerns can be addressed directly by the buying organisations and on the existing markets of today. Other issues will need concerted action by governments and, most probably, to be successful recognition on EU level and similar. Below we will point to the impacts from the various stages of the life cycle and propose how actors in municipalities and similar organisations can contribute to minimise the life cycle impact of the LED lights they are procuring and using. More details can be found in the report from the end of 2016 – *Circle of Light. The impact of the LED lifecycle*.

LED light in life cycle assessments

Life Cycle Assessment (LCA) is a method to measure the total environmental impact of a product from raw material extraction to end-of-life, when the product is discarded as not functioning any more. LCAs and other studies of LED lights and other light sources reveal a lot of the impacts that are created. We can learn that the light efficacy (light output per unit of energy consumed) has improved considerably for the LED lights. In the year 2010 the light efficacy was already clearly better as compared with incandescent and halogen light. Some three years later, it was also comparable to compact fluorescent light (CFL). Today in 2018 we can expect LED lights to have more or less the double efficacy as CFL. LED lights can also be expected to have considerably longer useful life periods as compared to other light sources.

To conduct good assessments of the whole life cycle of light sources requires data that typically is not readily available and maybe is not well known at all. It also demands comparison between various types of environmental impacts that hardly are comparable, and the approaches in assessment methods only represent the best choices with present knowledge.

Raw material extraction

A LED light bulb contains mainly well-known materials that have a multitude of uses in the modern society. For many such products aluminium and plastics are dominant materials. Other non-ferrous metals are used in much lower amounts, for instance gold and silver for metal reflectors and contacts. What has been focused in the debate is instead materials used in very tiny quantities and especially the so called rare earth elements (REEs). These have a special role in the emittance of light and various such REEs are used in the LEDs to render the various colours. While REEs are only used in very tiny amounts in LEDs, actually considerably less than for Compact Fluorescent Light sources, they are today almost exclusively mined in the northern part of China under environmental and social conditions that raise concerns for the environment, as well as, for the health of the workers. China has also showed that it has a considerable control over the present supply. Even if such elements are available in many other countries, it will take efforts and time to secure alternative supplies.

Solway in France showed that they have recycling technology to recycle rare earth elements from compact fluorescent lights, but the process was closed because of lacking profitability when the prices of such materials from China went down after a period of higher prices.

What we know is that these rare earth elements and other materials, in particular various metals, can be recycled from various light sources, including LED lights. However, this is today not profitable and in order to save such materials, and decrease environmental and social impacts from the raw material extraction and processing we need concerted policy interventions on national and international level.

Local authorities and similar organisations will not individually have opportunities to influence the end-of-life treatment of LED lights so that they are more successfully recycled and rare elements are extracted, but they can put pressure on the national governments and the EU.

The costs for such measures to be implemented are not very high, but governments need to feel an urgency to make the decisions.

Production of lights sources, transports and distribution

These parts of the life cycle of LED lights are compared to the other stages of much lower environmental and social significance.

Usage

LED lights promise considerable advantages when it comes to lighting efficacy, that is, the energy consumed for getting a specified light output. LED lights are also offering better durability and can be used for considerably longer time periods. This is an advantage not only because it postpones the procurement of new light bulbs, but also because it prolongs the periods between the physical changing of the light bulbs. In many public buildings the cost of changing light sources can be as much a question about the cost of having people changing the light bulbs, as the cost of the light bulbs themselves. This is in particular true when you need to climb high ladders to reach the light fittings.

There are considerable energy expenses and costs related to replacement of the light bulbs that can be saved by a shift to LED light, but to benefit from these you need to secure quality products that live up to energy specifications and announced life times. You need to be cautious in selecting quality products that provide you with the energy efficacy and durability you are looking for.

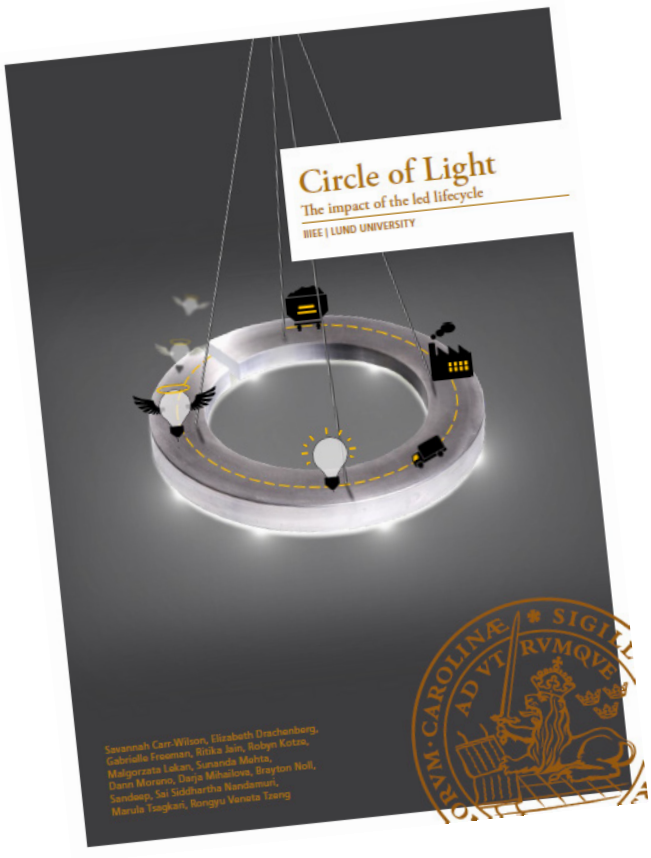
Select products of good quality to get the efficiency, quality and durability you are looking for.

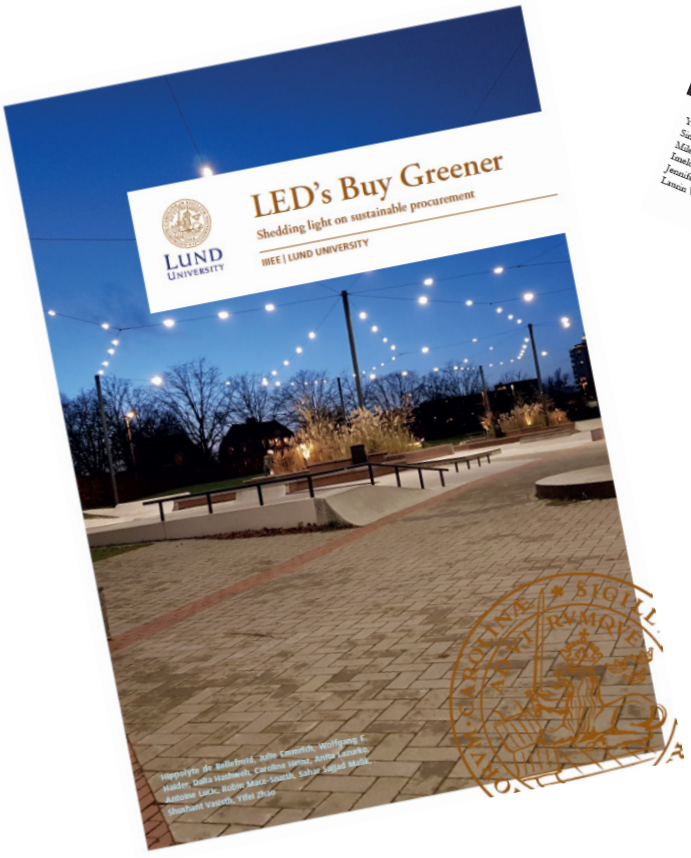
You can read more about these issues in the reports published by the IIIEE during the Lighting Metropolis project. They are available from the web-site of the project and also from IIIEE and Lund University.

International Institute of Industrial Environmental Economics [IIIEE]. (2015). *LED's Light the Future. Showcasing models of innovative lighting solutions.* Lund: IIIEE.

International Institute of Industrial Environmental Economics [IIIEE]. (2016). *Circle of Light. The impact of the LED lifecycle.* Lund: IIIEE.

International Institute of Industrial Environmental Economics [IIIEE]. (2017). *LED's Buy Greener. Shedding light on sustainable procurement.* Lund: IIIEE.





LUND UNIVERSITY

iiiee
THE INTERNATIONAL INSTITUTE FOR INDUSTRIAL ENVIRONMENTAL ECONOMICS

www.iiiee.lu.se

LUND UNIVERSITY
International Institute for Industrial Environmental Economics

P.O. Box 196, Tegnérsplatsen 4
SE-221 00 Lund, Sweden
Tel +46 46 222 02 00
www.iiiee.lu.se