



LIGHTINGEUROPE
THE VOICE OF THE LIGHTING INDUSTRY

Serviceable Luminaires in a Circular Economy

- White Paper -



1. Introduction – scope and objective of this White Paper

LightingEurope members have a long experience in dealing with aspects related to the circular economy. The industry has a solid track record in the areas of recycling, management of hazardous substances, improving efficiency and replacement of failing components for repair purposes.

The transformation brought by the shift to LED technology demands a careful assessment of which areas could be further improved to bring benefits to customers and the environment and last not least to strengthen the competitiveness of the sector.

This White Paper briefly introduces the concept of the circular economy and focuses on design for serviceability to assess its benefits; the last part discusses policy options which potentially could help transform the sector towards more “circular” products and services.

The focus of this White Paper is luminaires – the recommendations that are considered would apply to the finished luminaire and not to individual components.

LightingEurope members acknowledge that serviceability needs to be balanced with the necessity to ensure the safety of products and clear allocation of liability to the various actors in the value chain that will engage with the product during its life cycle.

Not all lighting products will be fully serviceable, due to their nature (e.g. luminaires for medical applications, emergency lighting). In this White Paper, a defined set of components is considered: LED module, control gear, lamp and sensor/network transceiver. Definitions are provided in the Glossary in the last part.

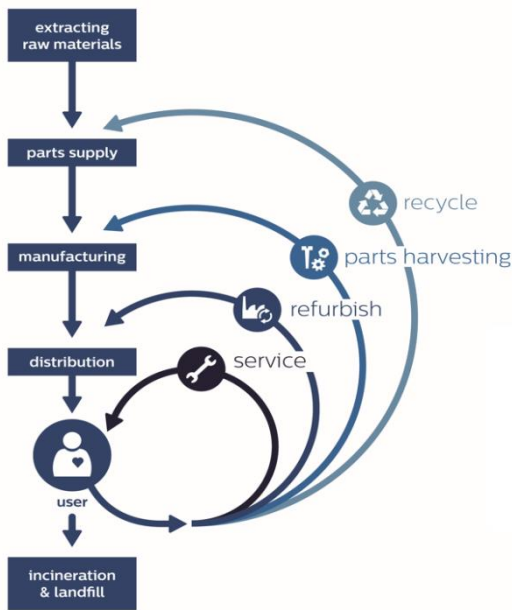
2. The circular economy as a business driver for Europe

The circular economy aims to decouple economic growth from the use of resources by using them more effectively. Products are designed and built as part of a value network where they will be used as long as feasible, then, depending on their characteristics, they can be reused, refurbished, upgraded or recycled. In a circular economy, the more effective use of products, components and materials is expected to lead to more value capture, both through cost savings and by developing new markets or growing existing ones. At the same time, significant environmental benefits are expected to be gained by reducing the use of resources, including energy, and minimizing waste and landfill.

In December 2015, the European Commission set in place a policy and regulatory framework, supporting “circular” products, services and business models. The EU Circular Economy Package includes an action plan to kick start legislation in many policy areas. This could potentially have a big impact on the lighting industry and, if managed well through market-enhancing policies, it could offer growth opportunities to the sector.

This policy initiative is the result of a widespread recognition of the potential of circular business models. For example, in 2015 **McKinsey released a report¹ which estimates that adopting circular economy principles would be a benefit to Europe on an environmental level and generate a net economic benefit of €1.8 trillion by 2030.**

The **Ellen MacArthur Foundation reports that an additional €320 billion of circular economy investment opportunities are available in the EU until 2025 if policy makers and industry take action.²**



PICTURE 1: the loops of the circular

The circular economy is typically described in terms of four concentric loops, as seen in picture 1.

Inner circles describe high value activities and processes and moving towards the outer circles residual value is extracted until a product is recycled.

The **four loops** presented here are:

1. **Services** - activities aiming at extending the technical and economic lifetime of products.
2. **Refurbish** – remanufacture products at end of life to sell them again.
3. **Parts harvesting** – recover valuable parts in products to sell/use them in other products.
4. **Recycling** – Recycle materials to bring them back into the economy.

3. Services and design for serviceability: value for the lighting industry

Serviceability refers to the ability to prolong the technical and economic lifetime of the product, after the product has been put into service. This paper will focus on **services** and **design** for serviceability and their potential for the lighting industry.

Services can include the following activities:

- Repair and preventive maintenance of Hardware components or software. For example, replace a broken LED module or update the driver software to remove a bug.
- Replacement of (hardware) components or software for better performance. For example: mount a new LED module with better efficacy.
- Replacement of (hardware) components or software for different specifications. For example, mount a new LED module with less flux or higher color temperature (Late stage re-configuration)

¹ McKinsey, “Growth within: A circular economy vision for a competitive Europe”, June 2015. Available at: <http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/growth-within-a-circular-economy-vision-for-a-competitive-europe>

² Ellen MacArthur Foundation, “Achieving growth within”, Feb 2017. Available at: <https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Achieving-Growth-Within-20-01-17.pdf>

- Replacement of (hardware) components or software to add more functionalities. For example, mount a new lamp with connectivity or update the software of the driver to support a new sensor.
- Increase the luminaire functionality by adding a component. For example, mount a presence sensor to the connectivity plug

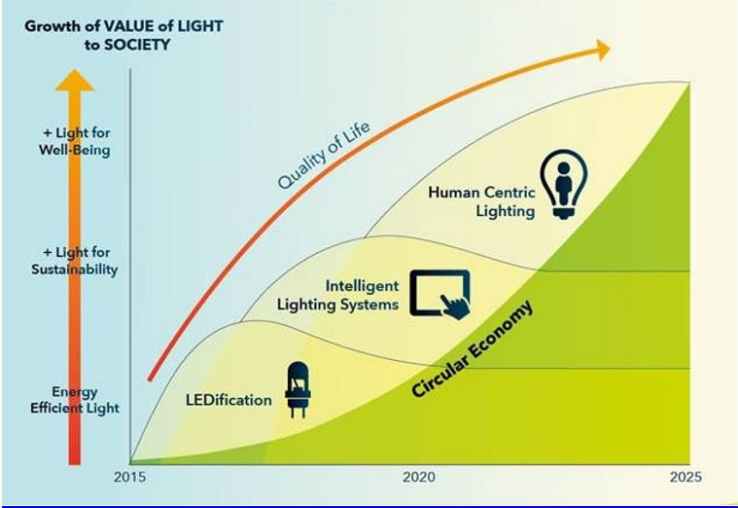
The assumption is that activities are executed by professionals (installers, service engineers, building managers) and may in some cases be executed by non-expert end users.

Design is a crucial aspect to enable the services mentioned above. Design for serviceability must ensure that components and software are replaceable; in other words, it must be feasible and practical for a professional to replace the component or software after the luminaire has been put into service. A replaceable component and software must be identifiable, accessible and removable without damaging the component or the luminaire.

Improving the serviceability of lighting products brings numerous benefits to the customers, the environment and the economy:

- Luminaires can be repaired and have a longer technical lifetime thereby improving the material efficiency of the sector and reducing waste.
- Luminaires can be upgraded to improve their performance resulting in greater energy savings. E.g.: a more efficient LED module is installed or a presence sensor is added to the luminaire.
- Luminaires can be “future-proofed” and enjoy a longer economic lifetime. Thanks to regular upgrades, luminaires remain a state-of-the-art infrastructure and respond to the evolving needs of customers. E.g.: a connectivity plug enables transforming existing fixtures into a connected lighting system and avoids the full replacement of obsolete luminaires.
- Serviceable luminaires enable new business models and create new jobs. E.g.: new opportunities arise for professionals offering monitoring, maintenance, data analytics etc.
- Serviceable luminaires increase the proximity of manufacturers to their customers and allow them to offer products and services addressing different needs.


By improving design for serviceability, the lighting industry can contribute concretely to the EU circular economy agenda. This is fully aligned with the Strategic Roadmap 2025 of LightingEurope, where the circular economy supports growth in intelligent lighting systems and human centric lighting.

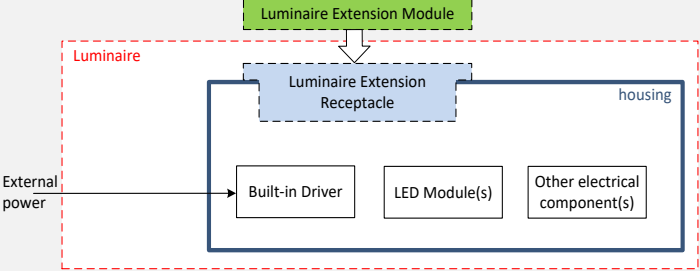


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Luminaires in the market today vary widely in terms of their serviceability. Below are some examples illustrating different degrees of serviceability.


Downlight – Non-serviceable

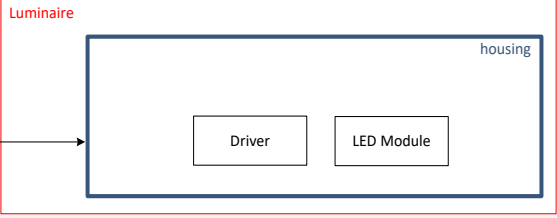




The luminaire is sealed for life. Components cannot be replaced and the functionality of the luminaire cannot be extended.

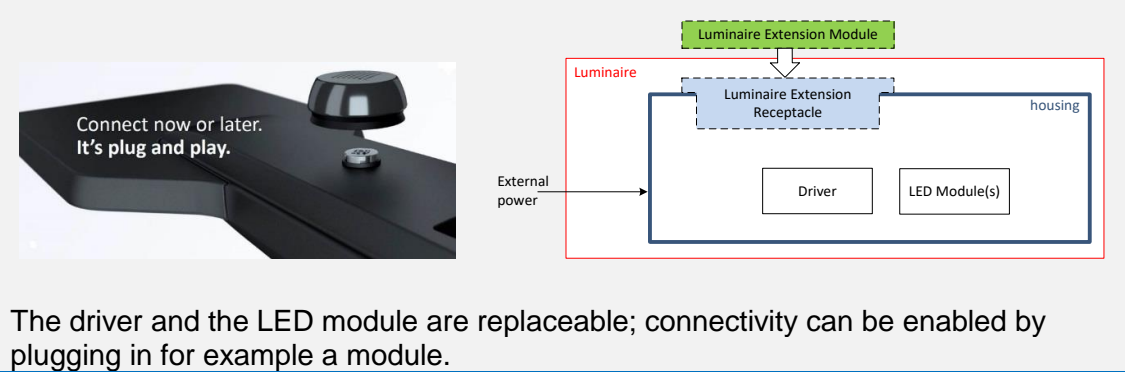
Troffer – serviceable luminaire





The driver and the LED module are replaceable.

Outdoor luminaire with connectivity plug



4. EU policies: could they support the serviceability of luminaires?

The EU action plan for the Circular Economy lists several regulatory measures that encourage the serviceability of luminaires, including the possibility to introduce mandatory product design and marking requirements under the Ecodesign Directive or to create economic incentives under extended producer responsibility. The European Commission's standardization request M/543 calls for the definition of parameters and methods to assess, among other factors, the upgradeability and ability to repair products and for the ability to access or remove certain components to facilitate repair.

LightingEurope members believe that the EU Circular Economy policy can have a positive impact on promoting serviceability, also in terms of demand-side measures that will help create new markets and stimulate customer demand for longer-life serviceable products. **LightingEurope believes it is too early to introduce regulatory requirements at this stage.** The lighting industry will continue to explore and implement, on a voluntary basis, the following options as a mean to promoting serviceable luminaires.

A first step could be providing information about the serviceability of **luminaires according to their design characteristics**. With such an information scheme, customers could easily identify luminaires allowing easy replacement of components and upgrade to new functionalities.

Such an information scheme could be initiated by the industry in cooperation with standardization bodies to agree on definitions (e.g. CEN/CENELEC). Standardization work would be limited to developing definitions for the description of the information and would not imply standardization of components' form factors and interfaces. In the medium term, as serviceable luminaires become increasingly common, market forces may require some form of standardization to reduce the variety of replaceable components offered. Such decisions should be left to market players and would not require involvement of EU institutions.

The information on serviceability would apply to luminaires, not components or systems. Moreover, it would refer only to luminaires that fall under the forthcoming EU Single Lighting Regulation, basically restricting this requirement to luminaires for general lighting (excluded: coloured light sources, luminaires for military/nuclear/medical applications luminaires for stage lighting emergency lighting). **In the future, the serviceability information could also be included (partly or fully) in EU legislation. The Single Lighting Regulation is an option that could be considered but is probably too early at this stage.** While any requirements would have to take into account the specifics of certain luminaires that may limit their serviceability (safety,

special use conditions), in general incorporating the serviceability information in future EU legislation could have two main purposes:

- Set information requirements for manufacturers about the serviceability of their luminaires;
- Promote the use of serviceable luminaires versus the use of sealed for life luminaires

Public procurement should also be considered in conjunction with the serviceability information to promote serviceable products.

Just like lighting products on the market today, **serviceable luminaires need to be safe for customers and professionals.** This aspect needs to be taken into account when determining the extent to which a product can be serviced and by whom. The legal framework governing product safety and guarantees should also be reviewed to ensure that liability and compliance with applicable rules and norms is allocated correctly to the various actors in the supply chain who will engage with the product during its lifecycle.

The lighting industry has a strong track record in designing and replacing safely components in the pre-LED era; similarly, it can manage the transition to luminaires which can be upgraded with an array of different components. In this regard, it is essential to clearly communicate the technical specifications of the luminaires and components and the conditions under which they can operate.

5. First steps to building serviceability information requirements for luminaires

The serviceability of luminaires relates to the components - **Components to be considered are: LED module; control gear; lamp and sensor/network transceiver.**

The characteristics of the components of the luminaires mentioned above can be combined to share information about luminaire serviceability. This would consider different aspects of serviceability, including ease of component exchange, connectivity and luminaire programmability (see glossary for all definitions).

The table below exemplifies how to define different degrees of serviceability for components:

Characteristics	Comment	Replaceable component	Plug & Play component
Replaceable	It is feasible and practical for a professional to replace the component after the luminaire has been put into service. It must be identifiable, accessible and removable without damaging the component or the luminaire	YES	YES
Electrical click	All electrical connections are established in a single action.	NO	YES
Foolproof replacement	Mistakes while replacing the component are practically not possible, even for a non-expert.	NO	YES
No safety risk	Component can be replaced without safety risk.	NO	YES
Tool less mounting	After the component has been made accessible, the component can be attached to the Luminaire without tools.	NO	YES
Functional click	All (TBD) functionality is automatically established while mounting the component.	NO	YES

Manufacturers will be free to offer guarantees regarding spare parts availability and the possibility to upgrade software for a defined period; such characteristics of components should not be defined by legislation.

Moreover, it will be entirely left to manufacturers whether they want to opt for proprietary solutions or standardized solutions for the replacement of hardware components and software.

Luminaire Serviceability Information - examples

Component exchange		Options
	Components cannot be replaced	Sealed-for-life
	At least one component can be replaced	Replace Ready
	At least one component is Plug & Play	(Plug & Play)
Connectivity		
	Luminaire is not connectable	Non-Connectable
	Luminaire is connectable	Connectable
Programmability		
	Luminaire is not programmable	Non-Programmable
	Luminaire is programmable	Programmable

Example 1: TLED



Serviceability
Lamp is Plug & Play
Luminaire is not connectable
Luminaire is not programmable

Example 2: Outdoor Luminaire with connectivity plug

Serviceability
Components can be replaced
Luminaire is connectable

NFC)))



Luminaire is programmable

Example 3: Night light



Serviceability
Components cannot be replaced
Luminaire is not connectable
Luminaire is not programmable

6. Glossary

- LED module (IEC - DRAFT IEC 60050-845 Ed2) LED light source either with at least one PCB cap or without any cap, incorporating at least one LED package.
- Control gear (IEC - DRAFT IEC 60050-845 Ed2) unit inserted between the electrical supply and at least one light source, which serves to supply the light source(s) with its (their) rated voltage or rated current, and may consist of one or more separate components.
- Lamp (IEC - DRAFT IEC 60050-845 Ed2) electric light source provided with at least one cap.
- Cap (base) (IEC - DRAFT IEC 60050-845 Ed2) part of a lamp which provides connection to the electrical supply by means of a lamp holder or lamp connector and, in most cases, also serves to retain the lamp in the lamp holder.
- Replaceable component - A component is replaceable if it is feasible and practical for a professional to replace the component after the luminaire has been put into service. A replaceable component must be identifiable, accessible and removable without damaging the component or the luminaire.
- Plug & Play component – A Plug & Play component meets all the requirements of a Replaceable component. Moreover, when replaced, all the electrical connections of such component are established in a single action. Mistakes while replacing the component are practically not possible, even for a non-expert. The component can be replaced without safety risk. After the components has been made accessible, the user can attach the component to the Luminaire without tools. All (TBD) functionality is automatically established while mounting the component.
- Sealed-for-Life Luminaire - A luminaire which does not hold neither any Replaceable components, nor any Plug & Play components.
- Replace Ready Luminaire - A Luminaire is Replace Ready if it holds at least one Replaceable component.
- Plug & Play Luminaire - A Luminaire is Plug & Play if it holds at least one Plug & Play component.
- Connectable luminaire - A Luminaire is Connectable if it features a digital, bi-directional data connection (wired or wireless) to a system outside the luminaire which can be used during normal operation. This connection can for example be used to add a sensor to the luminaire or to interface with an external data network. Examples: Zigbee, WIFI, DALI, PoE, Bluetooth, 3/4G
- Programmable luminaire - A luminaire which features a means to download the software of at least one component. This can be by means of for example DALI, NFC, WIFI, Zigbee, Ethernet, PLC.