



**PHILIPS**

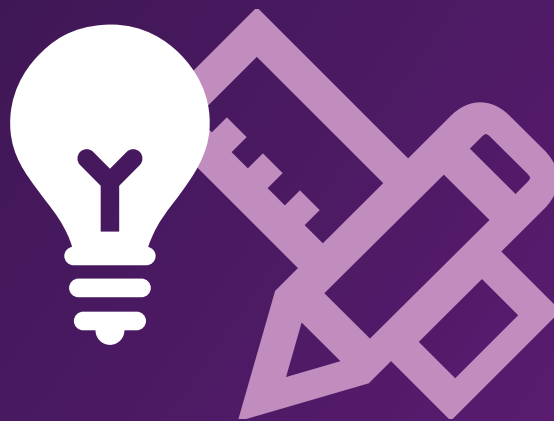
Managed Services

Circular lighting

Design

# The role of design in the circular economy

What requirements must be met for a product design to be circular? This white paper will explain what it means to be circular, examine the role of design in the circular economy, and reveal what matters most when designing a circular luminaire.



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## **1 Circular design** **3**

What is circular?	3
Why circular?	3
The role of design in a circular economy	4

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## **2 Five areas of interest in design** **5**

Modular	5
Upgrading	5
Maintenance	5
Disassembly	6
Recycling	6
Circular economy score	6

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## **3 More than design** **7**

<b>Sources</b>	<b>7</b>
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<b>Philips Circular lighting</b>	<b>7</b>
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# 1 Circular design

An increasing number of companies are working hard to make their products circular. What is the added value of design in a circular economy? Which conditions should a good circular design meet? How are these conditions applied in the luminaires from Philips Lighting? That is what this white paper is all about.

## What is circular?

The phrase circular economy is being used more and more often. But what does it mean? A definition that is often used around the world is the one from the Ellen MacArthur Foundation, which was established in 2010 to promote the transition to a global circular economy:

“**A circular economy is one that is restorative and regenerative by design, and which aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles.**”

([www.ellenmacarthurfoundation.org](http://www.ellenmacarthurfoundation.org))

According to the above definition, a circular economy has a great capacity for regeneration, and its main objective is to make optimal use of products, components and materials, letting them keep their value. In other words, a circular economy is a closed feedback loop in which there is no waste ([www.biobasedeconomy.nl](http://www.biobasedeconomy.nl)). Finding the best way to set up such a closed loop is the foundation of reverse logistics.

A distinction is made between circular systems with a biological and a technical cycle of materials. In a biological cycle, residue materials are safely returned to nature after they have been used. In a technical cycle, products and parts are designed to be suitable for reuse ([www.mvonderland.nl](http://www.mvonderland.nl)). To be able to sustain this last process, reverse logistics are essential.

## Why circular?

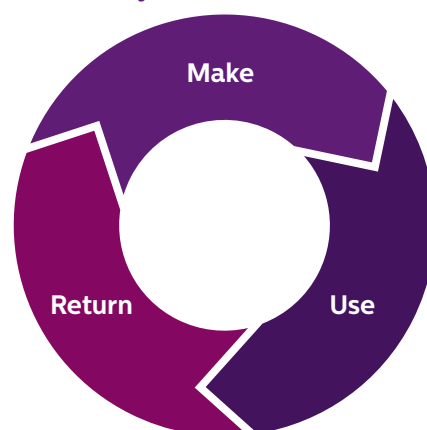
The current, linear method of production is using up raw materials and produces ever more waste. This is exhausting the planet's resources. As a result, more and more people are realizing that we need a non-linear economy.

The world's growing population is raising demand for raw materials and energy, while the availability of natural resources and fossil fuels is diminishing. We are seeing a worldwide growth of the middle class, which is estimated to include another three billion people in the next two decades (Ernst & Young, 2014, Driving growth - Middle class growth in emerging markets). Simply using up less raw materials is not enough. In addition, resource scarcity is driving up prices, which slows down the economy.

### Linear economy



### Circular economy





## The role of design in a circular economy

**A good circular design enables a product to have multiple life cycles, with minimal loss of value, quality and energy. In addition to this, a good circular design uses materials and components that can be reclaimed for reuse.**

The Ellen MacArthur Foundation describes circular design as “the improvements in material selection and product design (standardization and modularization of components, purer material flows, and design for easier disassembly)”. In the book *Products that last*, circular product design is explained by identifying five key points.

### Circular design

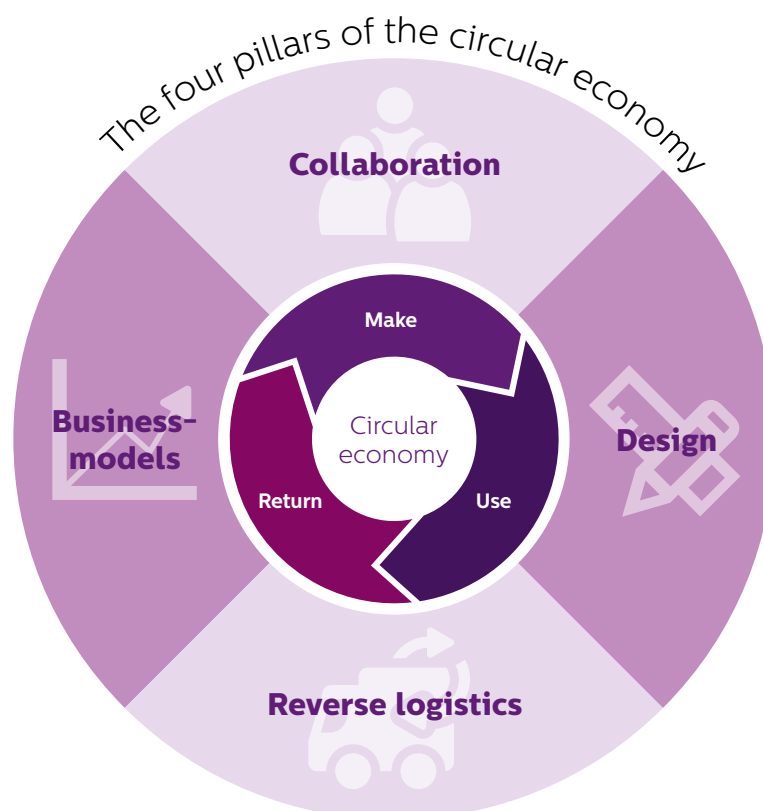
1. Elevates design to a systems level
2. Strives to maintain product integrity
3. Is about cycling at a different pace
4. Explores new relationships and experiences with products
5. Is driven by different business models

*(Bakker, Hollander, van Hinte, & Zijlstra, 2014)*

For design professionals, circular design implies a change of perspective from thinking linearly to thinking in a circular way.

In the past, designers have often not been concerned with what happens to a product when, at the end of its life cycle, it is returned to the manufacturer. But it is no longer enough to simply replace the materials used in a product for ones that are more recyclable- designers now have to think about the entire life cycle of a product, getting information from all partners to help them design a truly circular product.

The product life cycle looks like this:  
borrow raw materials > create product >  
reclaim raw materials > create product again  
([www.greatrecovery.org.uk](http://www.greatrecovery.org.uk)).



**The concept of design is one of the four pillars of the circular economy. The other three pillars are business models, collaboration and reverse logistics.**

# 2 Five areas of interest in design

Which aspects are important in designing a good circular product? In his study Product Design for a Circular Economy: A case study towards a circular luminaire, van den Berg (2014) mentions five major criteria. The product designers at Philips Lighting also keep these five points in mind when designing a circular luminaire, trying to have their design score as high as possible on each of these points.

## 1 Modular

Making products modular is often seen as a big challenge. For a long time, products – like lamps – were manufactured as cheaply as possible, which implies the use of many prefab elements purchased elsewhere. Modularity requires a change of perspective: the product can be more expensive, as long as it is also more sustainable. Modular designs combine the benefits of mass production with the benefits of bespoke solutions. In a modular design, points of attention are:

- **Independence.** It must be possible to manufacture all the parts of a product independently.
- **Multifunctional.** Ideally every component should be suitable for use in several products, so that special parts need not be made for each product. This also lowers the development costs.
- **Easy linking.** All parts must easily link together.

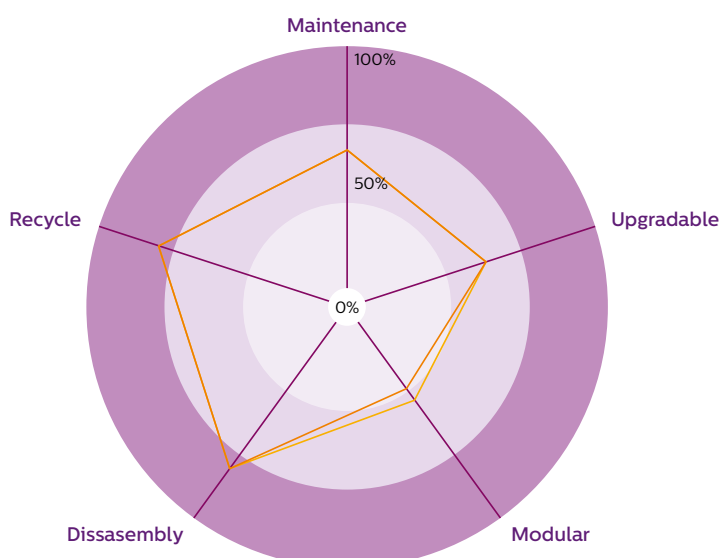
## 2 Upgrading

The degree to which a product can be upgraded determines how future-proof it is. A product can be upgraded esthetically but also technically, which improves the quality of the product. To make sure that a product is easy to upgrade, one thing is especially important:

- **Future-proof.** In order to design a product in such a way that it can be upgraded in the future, it is important to know as much as possible about what people will need in the future and what the technological possibilities will be at the time. That means it is very important to follow trends and developments closely.

At Philips Lighting, circular luminaires are designed to be relatively easy to upgrade in the future. Luminaires emit a certain amount of light and a certain color temperature. Designing luminaires in a smart way makes it easy to adjust them to emit more or less light, or another temperature of light.

Philips Lighting is also adding components to the design of every luminaire that will make it easier in the future to add a sensor to the product. In the case of outdoor lighting, adding a sensor is one way to make ‘regular’ lights ‘smart’.



## An example of circular design Philips Pacific LED Circular Economy ready luminaire

With the Philips Pacific LED Circular Economy ready luminaire, Philips Lighting has introduced the first circular economy ready series of luminaires. It was designed to use natural resources in a much more effective and regenerative way, closing the material loop in line with the principles of a circular economy.

Thanks to its modular assembly and design, maintenance is easy, and the luminaires are simple to upgrade. Philips Pacific LED Circular Economy ready luminaire offers optimal performance throughout its lifetime, and end-of-contract management is straightforward. The luminaires can be repurposed in several environmentally friendly ways: in a circular lighting contract; to the secondhand market; via extraction of spare parts; and eventually into recycled materials.

### 3 Maintenance

The degree to which a product can be repaired and serviced determines its reliability and its technical life span. Philips Lighting engages external parties to execute the maintenance and possible repairs of its circular luminaires. Such parties must, however, be able to perform the maintenance in the first place. In this respect, therefore, the structure of a luminaire is very important.

### 4 Disassembly

For a product to be easy to repair and recycle, it must be easy to disassemble. Some points of attention in this respect are:

**Reversible connections.** A connection must always be reversible. If it isn't, repairing or replacing parts will not be possible.

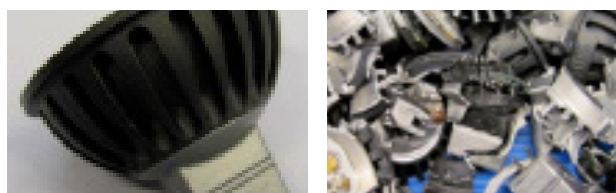
**In one piece.** Make sure that recyclable parts like a PCB (printed circuit board) can be removed as a single unit.

**Equal parts.** When a product is disassembled, for example by a shredder, it is best if the product can be separated into parts that are relatively similar and that are equal in size (at least 1cm).

**Stiffness.** Choose the right amount of stiffness to avoid components folding. This can be done in the component itself and in the surrounding parts.

**Connections.** Avoid fixed connections as much as possible. The connections should come apart under recycling conditions (in a shredder).

This can be achieved, for example, with break lines alongside screw connections.



The photos above show a Philips Lighting MR16 low-voltage lamp without break lines. When it is recycled, the PCB breaks off at random places. The housing will often still be attached to the PCB.



Adding break lines, as was done in the lamp above, makes the housing come apart along those break lines, so that the PCB is released from the housing.

## 5 Recycling

The original materials used in a product must be easy to recycle. That means that a designer must make choices about:

**The kind of materials.** Some materials are easier to recycle than others. For example, some relatively cheap forms of aluminum are almost impossible to recycle. In general, it is better to choose “pure” materials that are made up of a single raw material. Of course, prohibited materials should never be used.

**The amount of materials.** The fewer material used, the better. Aim to keep the weight of the finished product as low as possible.

**Using different materials.** The lower the number of different materials used, the easier it will be to recycle a product.

**The use of coatings.** Coatings protect a material, but they also make recycling it more difficult. This means that an optimal balance must be achieved between a product’s recyclability and its durability and looks. There are coatings that are compatible with the materials used and that therefore make the product easier to recycle.

## 6 Circular economy score

Every current and new product from Philips Lighting is valued using the circular economy (CE) scorecard (van den Berg, 2014), which consists of:

**Service:** maintenance and upgradability

**Re-manufacturing:** modularity and disassembly

**Reclaiming:** recycling

This score shows how circular a product is. Philips Lighting regularly organizes workshops in its factories to explain the CE tool, and to validate it and continue its development.

	Service		Re-manufacturing		Reclaiming	Weighted total
	Maintenance	Upgradability	Modularity	Disassembly	Recycling	
Product 1	50%	65%	44%	25%	81%	51%
	56%		34%			
Product 2	70%	85%	58%	75%	38%	64%
	68%		67%			

# 3 More than design

Luminaire design is the cornerstone of a circular lighting concept. But of course, the design alone cannot achieve circularity.

The product will eventually have to be returned to the manufacturer so that it can get a second life, the so-called reverse logistics (see the white paper on Reverse Logistics, available at [philips.nl/circularlighting](http://philips.nl/circularlighting)). In addition, a circular design will often result in a product that may not have the lowest purchase value, but that does achieve the lowest costs across its life span. This is a direct benefit for clients. But this also means that the business model will change, removing the barrier of the higher investment (see the white paper on business models, available at [philips.nl/circularlighting](http://philips.nl/circularlighting)).



## Sources

Products that last  
*Bakker, Hollander, van Hinte & Zijlstra (2014)*

Product Design for a Circular Economy: A case study towards a circular luminaire  
*M.R. van den Berg (2014)*

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[www.biobasedeconomy.nl](http://www.biobasedeconomy.nl)  
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## Philips Circular lighting

Philips Lighting takes sustainability very seriously. This is why we developed Philips Circular lighting. Philips Circular lighting is an approach that applies the “make, use, return” circular economy principles to the lighting industry. Lighting is designed to use resources in a smarter and more efficient way, building in traceability, serviceability, refurbishment and upgrade options, parts harvesting and recycling of used materials.

Philips Circular lighting contributes to your corporate sustainability ambitions. We provide guaranteed lighting performance with regard to energy, light level and uptime, while owning the reuse, refurbishing or recycling loop to ensure you get maximum value from the lighting system.

With a cradle-to-cradle mentality, we offer a sustainable service option allowing you to pay for the light you use, rather than an upfront investment in the materials. By minimizing materials waste and reducing the environmental impact, we create an ecosystem that extends the life of our lighting products and provides a better future for the next generation.

### Questions? Suggestions?

Feel free to contact us at anytime – we look forward to hearing from you.



