TECHNICAL STATEMENT

# The Circular Economy: an Interim Guide

## CONTENTS



A circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems.

LIA recognises the need for a Circular Economy within our lighting industry.

The purpose of this LIA interim guide is to set out a common understanding of the circular economy and predict its opportunities and challenges.

## 1. THE NEED FOR A CIRCULAR ECONOMY

The UK Government is committed to moving towards a more circular economy which will see us keeping resources in use as long as possible, extracting maximum value from them, minimizing waste and promoting resource efficiency. The Circular Economy Package[1] (CEP) introduces a revised legislative framework, identifying steps for the reduction of waste and establishing an ambitious and credible long-term path for waste management and recycling. In this respect the aims of the UK Government and EU Commission remain highly aligned at this time with the UK Governments July 2020 UK Policy Paper linking direct to that of the EU Circular Economy Package.

The need for a circular economy is also set out in The European Commission's 'Circular Economy Action Plan', 2020[2], which is part of the European Green Deal. It begins with:

> 'There is only one planet Earth, yet by 2050, the world will be consuming as if there were three. Global consumption of materials such as biomass, fossil fuels, metals and minerals is expected to double in the next forty years, while annual waste generation is projected to increase by 70% by 2050.
>
> As half of total greenhouse gas emissions and more than 90% of biodiversity loss and water stress come from resource extraction and processing, the European Green Deal launched a concerted strategy for a climate-neutral, resource-efficient and competitive economy. Scaling up the circular economy from front-runners to the mainstream economic players will make a decisive contribution to achieving climate neutrality by 2050 and decoupling economic growth from resource use, while ensuring the long-term competitiveness of the EU and leaving no one behind.'

# TECHNICAL STATEMENT

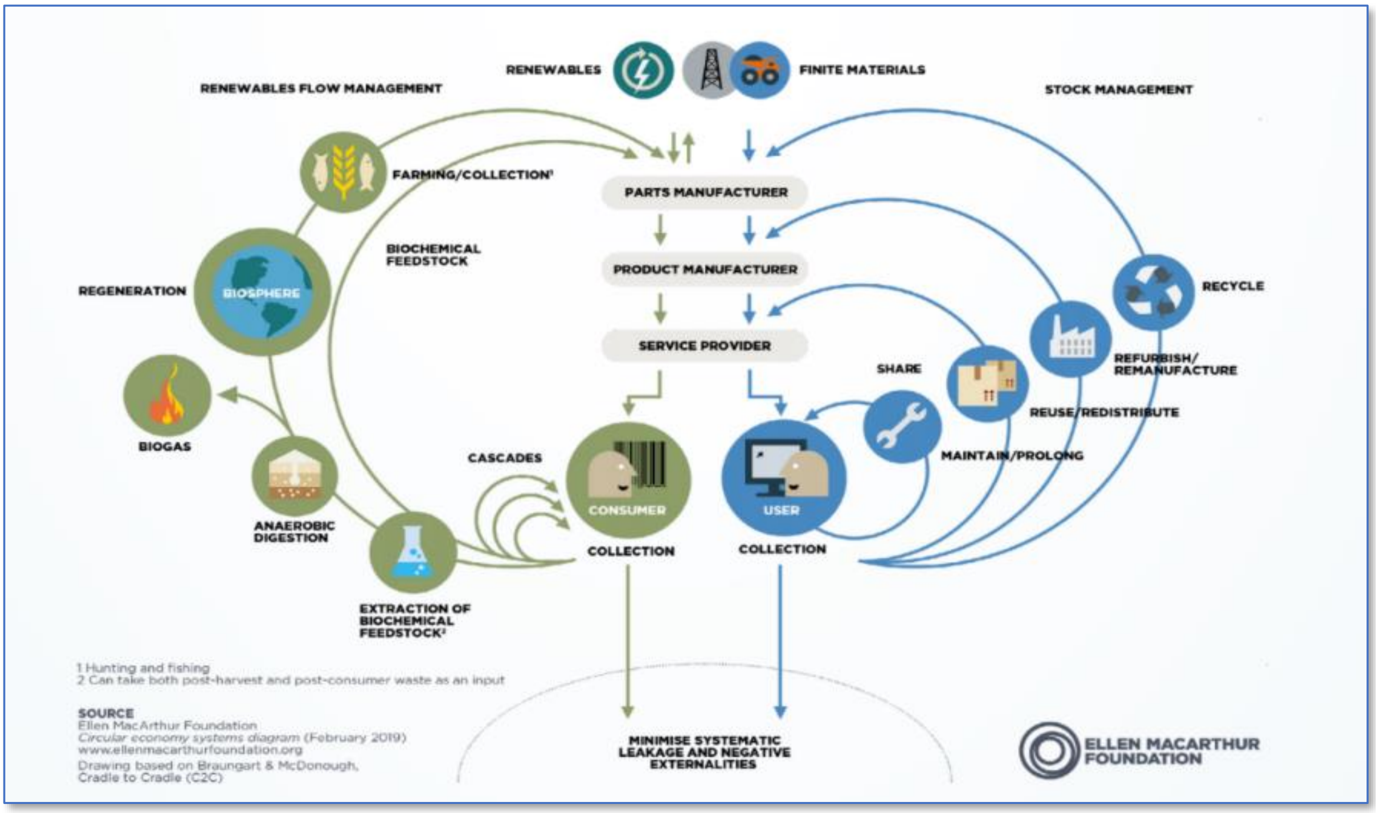
## 2. WHAT IS A CIRCULAR ECONOMY?

We live in a linear manufacturing model currently, with a take-make-waste extractive industrial model. We have become accustomed to hearing about reducing the consumption of single use plastics, such as coffee stirrers, banning plastic bags from supermarkets and carrying reusable cups into our favourite coffee retailer. However, a circular economy is about far more than this. 'A circular economy aims to redefine growth, focusing on positive society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles:

- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems'[3]

The Design stage of a product is critical to all of the above. 'Waste and pollution are not accidents, but the consequence of decisions made at the design stage, where around 80% of environmental impacts are determined.'[4]

This infographic[5] provides a circular economy overview.



TECHNICAL STATEMENT

## 3. THE CIRCULAR ECONOMY & LIGHTING

The Circular Economy applied to lighting and other segments is discussed in the BEIS report prepared by ICF Consulting Services Ltd: 'UK Energy-related Products Policy Study, Final report, July 2021' (give a reference) and specifically on lighting in Lighting Europe's October 2017 white paper: 'Serviceable Luminaires in a Circular Economy'[6]. Taking outcomes from these reports, and adding comments, particularly on controls, LIA suggests the following benefits that the serviceability of lighting products brings 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. This can involve remanufacturing old lighting stock like TL5 luminaires as well as newer LED luminaires. Replaced parts can be recycled or sometimes reused in line with Circular Economy principles.
- 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.
- It could take time to realise, but serviceable luminaires could enable new business models and create new jobs. E.g.: new opportunities arising 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.
- Repairs and upgrades to lighting control systems can often be made by replacing or adding component devices to return the system to proper functionality or even to enhance and add to their functionality.
- Lighting control systems can have software and/or firmware upgrades automatically applied to various component devices that can effectively update, protect and even increase the functionality of the components and the systems they reside in. Preventative update patches are already commonplace with connected lighting controls systems. The use of the "Cloud" as a method of monitoring and upgrading software can be imagined. Lighting controls systems, and particularly wireless versions, can support the circularity of the buildings in which they are installed by allowing greater flexibility in how the space is re-configured through it's life as the needs or the users of the space change, without the need to rip out and replace cabling and switches, etc that are still functioning properly. As buildings evolve so features can be turned on and off to suit the use of the space.
- Large reductions in use-stage energy consumption of the lighting installation are achievable through the use of efficient lighting technologies, for example LED luminaires and lamps and lighting controls systems. Reduced energy consumption results and result in lower demand for raw material extraction for fuel, energy generation equipment and distribution infrastructure and so also support the principles of the material efficiency and circular economy.

TECHNICAL STATEMENT

- Circular practices such as repair, re-use, product as a service can all be supported by the data provided by analytics from lighting controls systems. For example, it's easier to anticipate the remaining life of a component if it's known for how long and to what extreme the component has been operated previously.

## 4. CIRCULAR ECONOMY & LEGISLATION

The Ecodesign for Energy-Related Products and Energy Information (Lighting Products) Regulations 2021 was laid in Parliament on 1st July. The next stage is a vote (no changes allowed) in the House of Commons & House of Lords which is expected mid Sept. When approved it then becomes law and a SI is published. An application date of 1st October is set.

Link to draft SI - https://www.legislation.gov.uk/ukdsi/2021/9780348225488/contents

The Circular Economy is touched upon in chapter 2, part 6:

*6. Manufacturers, authorised representatives and importers of containing products must ensure that light sources and separate control gears can be replaced with the use of commonly available tools and without permanent damage to the containing product.*

*Paragraph (1) does not apply where a technical justification related to the functionality of the containing product is provided in the technical documentation explaining why the replacement of light sources and separate control gear is not appropriate.*

Note that the same requirements are applicable in Europe from 1st Sept 2021 as set out in Article 4 of EU 2019/2020 (Single Lighting Regulation). See https://eur-lex.europa.eu/eli/reg/2019/2020/oj

## 5. CHALLENGES AHEAD

Circular business models present opportunities for business as set out above. However, as with any other traditional manufacturing industry, the transition to a circular model for the lighting industry is unlikely to come without challenges. These will include:

- Re. Article 4 from the Ecodesign Directive quoted above – is it possible to treat an industry as diverse as lighting in one measure? The domestic market is huge and includes a lot of imported, often low cost lamp solutions that are not designed for the circular economy. Industrial and street lighting provide better opportunities to target both design and application. For example Zhaga has made some inroads into the standardised approach to LEDs and in street lighting this has been quite successful as the DALI Alliance is now working with Zhaga to create the D4i / Zhaga scheme. Commercial lighting is a mixed picture. As an industry we have the opportunity to define not only the design of the scheme and luminaries but also minimum quality standards for performance and interoperability between devices.
- Does it make sense to focus on light source replacement at the same pace as shorter-lived control gear, especially considering all that this entails (at an extreme, standardisation of interfaces.)
- Should compliance be via self-declaration or independent assessment? Think of the costs involved – especially if mandatory for all derivatives and specials. But also think about the non-compliance of unscrupulous importers. Compliance also refers to the correctness of green claims (avoiding

TECHNICAL STATEMENT

‘Greenwash’). Maybe self-declaration for luminaires designed to use lamps and control gear which have been independently certified?

- Interoperability of software and interchangeability of hardware both support circularity for example by allowing components from multiple suppliers to be used in products or systems initially produced by a different manufacturer, so removing the reliance on a single supplier for repair and upgrade. This can be especially critical where that original manufacturer has gone out of business, potentially rendering a product or system unable to have its life extended through repair or upgrade. However, there are significant concerns around mandating interoperability and interchangeability, including risks around disincentivising a producer’s efforts to innovate, so potentially resulting in net-negative effects for sustainability as well as a sacrifice of user experience.
- The lighting industry moving more towards being a service industry could make sense, but it will take time: think of setting up local repair networks and extended duties of care with commitments to provide spares at reasonable cost.
- Let us not stifle innovation and creativity by travelling too far down the road of commoditised modularity and less regular component upgrades.
- How to responsibly gauge the extent of upgrade possibilities for a luminaire? These upgrade possibilities can add expense and environmental impact. How to balance this with the likelihood that these upgrades will be put into practice. This will vary segment by segment. Not every circular activity necessarily has a positive outcome in every situation and so it’s important to keep the ultimate goal of improved environmental sustainability in mind rather than being overly fixated on the routes used to get there. An example of thinking on this topic is given in the references.[7]
- How to responsibly gauge when a good time is to upgrade. Lumen depreciation levels? Availability of more efficient light sources? New controls options? Substances involved in the first build have subsequently been banned. This will involve new ways of doing business with maybe extended relationships between specifiers and their clients.
- What is considered to be the smallest unit of reasonable repair beyond which there are no practically repairable parts? Repairing a circuit board is seldom practical. However, repairing a product by replacing a circuit board could certainly be practical where the circuit board is designed for replacement. It seems like luminaires give us a great opportunity to support the principles of circular economy as they can certainly have serviceable parts such as the light source, the LED Driver/ballast, optics, decorative elements, control system devices, etc. Deep repairs, like repairing a circuit board, raise much greater concern about whether such repairs are done properly and that the product remains in compliance with safety, performance and other legal requirements.
- Who carries out repairs or upgrades? Potentially, mirroring the car industry, not the original manufacturer. The repairer in this instance would provide UKCA/CE compliance and warranty.
- To be successful our industry must embrace Circular Economy principles throughout the entire manufacturing process. Developing circular principles means a full 360° approach to Procurement, Assembly, Supply Chain, Material Selection, Go To Market strategies and ‘end of first life’ approach. Added to these manufacturer considerations, there will need to be process changes from designers, contractors, end-users, sustainability managers and facilities managers. This will take time and fresh

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TECHNICAL STATEMENT

thinking on how to encourage change in a Circular Economy direction given the current practices and prevalence of short-term cost considerations in the construction industry.

- Standards and guides on Circular Economy principles are essential to aid with design and discipline green claims. Without a comprehensive and harmonised approach there will be confusion ahead between clients, specifiers, engineers and manufacturers.
- Customer requirements for the product choices they make to fit with their own ESG/CSR aspirations around materials, manufacturing location, social impact of production etc may differ from industry guidance.

## 6. LIA AND THE CIRCULAR ECONOMY

LIA are well placed to track and contribute to Circular Economy developments for the UK lighting industry. At a standards level LIA are active in the national committees of BSI, this participation escalating with LIA staff/members also working directly at the levels of CENELEC and IEC; the close links LIA has with government reach out in the UK to BEIS (Department for Business, Energy & Industrial Strategy) and via Lighting Europe into the European Parliament and Commission. The LIA have set up a technical committee concerned with the Circular Economy and Life Cycle Analyses. It feeds into Lighting Europe Task Forces covering these two issues (mandated from WG Sustainability).

The LIA supports measures toward the Circular Economy, agreeing with the business benefits as set out by Lighting Europe above. It is already involved with studies and initiatives, some previously detailed, and discussing the various challenges we see before our industry.

The LIA track record of engagement with environmentalism has in the past embraced REACH, RoHS, WEEE and conflict mineral compliance, as well obviously as efficacy initiatives.

LIA will continue to advise its members on all aspects of the Circular Economy in our lighting industry. This holding paper is a first step communication to be developed.

## 7. REFERENCES

[1] https://www.gov.uk/government/publications/circular-economy-package-policy-statement/circular-economy-package-policy-statement

[2] https://ec.europa.eu/environment/strategy/circular-economy-action-plan_en

[3] https://www.ellenmacarthurfoundation.org/circular-economy/concept

[4] https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy

[5] https://www.ellenmacarthurfoundation.org/circular-economy/concept/infographic (simplified)

[6] https://www.lightingeurope.org/images/publications/position-papers/LightingEurope_-_White_paper_-_Serviceable_luminaires_in_a_Circular_Economy_-_October_2017.pdf

[7] https://www.repro-light.eu/download/569/

TECHNICAL STATEMENT

## 8. GLOSSARY

The below sources are used in the glossary:

| Source | |
|---|---|
| 1 | https://www.ceguide.org/Glossary |
| 2 | https://www.ellenmacarthurfoundation.org/ |
| 3 | https://www.investopedia.com/terms/e/environmental-social-and-governance-esg-criteria.asp<br>https://www.investopedia.com/terms/c/corp-social-responsibility.asp |
| 4 | https://spot.ul.com/blog/embodied-vs-operational-carbon/#:~:text=Operational%20Carbon%3A%20The%20amount%20of,for%2028%25%20of%20global%20GHG. |
| 5 | https://www.oneclicklca.com/simple-epd-guide/ |
| 6 | https://en.wikipedia.org/wiki/Lighting_as_a_service |
| 7 | https://kenniskaarten.hetgroenebrein.nl/en/knowledge-map-circular-economy/how-is-a-circular-economy-different-from-a-linear-economy/ |
| 8 | https://ec.europa.eu/environment/archives/eussd/pdf/footprint/PEF%20methodology%20final%20draft.pdf |
| 9 | https://sciencebasedtargets.org/ |
| 10 | https://ghgprotocol.org/sites/default/files/standards_supporting/FAQ.pdf |
| 11 | https://www.epa.gov/sustainability/learn-about-sustainability |

| A | Source |
|---|---|
| **Additive manufacturing**<br>Manufacturing objects by adding material (instead of removing material) | 1 |
| **B** | **Source** |
| **Biodegradable materials**<br>A material which microorganisms can break down into natural elements (i.e. water, biomass, etc.). | 1 |
| **C** | **Source** |
| **Circular Economy**<br>A circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems. | 2 |
| **Closed-loop recycling**<br>Recycling a product and manufacturing it into the same product again and again. | 1 |
| **Corporate Social Responsibility (CSR)**<br>A self-regulating business model that helps a company be socially accountable—to itself, its stakeholders, and the public. | 3 |
| **Cradle-to-Gate**<br>An LCA that evaluates the environmental impacts of a product or process from raw material extraction through manufacturing. | 1 |
| **Cradle-to-Grave**<br>An LCA that evaluates the environmental impacts of a product or process from raw material extraction up through disposal. | 1 |
| **Cradle-to-Cradle**<br>An LCA that evaluates the environmental impacts of a product or process from raw material extraction beyond end of life to remanufacturing using end of life material as secondary raw materials. | - |

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| D | Source |
|---|---|
| **Dematerialization**<br>Delivering a product using a percentage or none of the mass compared to the conventional product. | 1 |
| **Design for disassembly**<br>Design principle that calls for the end-of-life options of how the product, components and materials can be deconstructed. | 1 |
| **Design for flexibility**<br>Design principle (most commonly applied in building design and construction) that calls for use of interstitial space, programmed soft space, shell space, expansion capacity, demountable partitions and mobile or modular furnishings. | 1 |
| **Design for recyclability**<br>Design principle that calls for the end-of-life accounting of how the product will be collected and recycled. | 1 |
| **Design for repairability**<br>Design principle that calls for products to be manufactured using fasteners, materials and processes that allow them to be easily be fixed. | 1 |
| **Design for sustainability**<br>Design principle that calls for the optimization of environmental and social benefits across a product or service's life cycle. | 1 |
| **Downcycling**<br>Use of secondary materials that results in a lower economic value of that material that cannot be recovered. | 1 |
| **Durability**<br>Product characteristic that determines the length of time over which it maintains its value or functionality | 1 |
| **E** | **Source** |
| **Eco-design**<br>Design principle that calls for the minimization of negative environmental and health impacts across a product or service's life cycle. | 1 |
| **Electronic waste (E-waste)**<br>Disposed electronic and electrical products. These products typically contain hazardous materials and require certified handling and recycling. | 1 |
| **Embedded impacts**<br>The environmental and social impacts of a product, from material extraction through the use phase. | 1 |
| **Embodied Carbon:**<br>The amount of carbon emitted during the making of a building. This includes extraction of raw materials, manufacture and refinement of materials, transport, the building phase of the product or structure, and the deconstruction and disposal of materials at the end of life. | 4 |
| **End-of-life**<br>The life cycle stage during which a product no longer has value to its original owner and is then disposed of. | 1 |
| **Environmental Product Declaration (EPD)**<br>A document which transparently communicates the environmental performance or impact of any product or material over its lifetime. Construction EPDs are based on the ISO 14040/14044, ISO 14025, EN 15804 or ISO 21930 standards. | 5 |
| **Environmental Social Governance (ESG)**<br>Environmental, social, and governance (ESG) criteria are a set of standards for a company's operations that socially conscious investors use to screen potential investments. | 3 |
| **F** | **Source** |
| **Footprint**<br>The impact of a product or service across its life cycle. One can calculate a product's carbon, water, energy and material footprints, for example. This is similar to an LCA except that footprints typically only evaluate one environmental issue. | 1 |
| **G** | **Source** |
| **Green public procurement**<br>A policy in which governments commit to buying products and services with environmentally-preferable characteristics. | 1 |

TECHNICAL STATEMENT

| H | Source |
|---|---|
| **Hazardous materials**<br>A material or substance that has the potential to harm humans, animals or the environment. | 1 |
| **I** | **Source** |
| **Impact analysis**<br>The second phase of an LCA in which environmental impacts are determined. | 1 |
| **Inventory analysis**<br>The first stage of an LCA in which the inputs and outputs (materials, energy, water, economic value, etc.) of the system are identified. | 1 |
| **Improvement analysis**<br>The third stage of an LCA in which solutions are evaluated for mitigating environmental impacts. | 1 |
| **J** | **Source** |
| **Just-in-time manufacturing**<br>Manufacturing strategy to reduce wasted time and resources by providing products or services as they are needed by the next step in the production process. | 1 |
| **L** | **Source** |
| **Landfilling**<br>The disposal and burying of solid waste. The degradation of the waste results in the creation of local air and water pollution. | 1 |
| **Leasing**<br>A service model in which the customer pays for continuous access to a product over an agreed period of time. | 1 |
| **Life cycle**<br>All of the stages that a product goes through in its lifetime: raw material extraction, processing, manufacturing, use, end-of-life and transportation. | 1 |
| **Life cycle assessment**<br>A method to evaluate the environmental impacts of a product or system over its life cycle. An LCA is typically done in three parts: (1) Inventory Analysis, (2) Impact Assessment, (3) Improvement Analysis. | 1 |
| **Life cycle cost**<br>A method to evaluate the financial impacts of a product or system over its life cycle. | 1 |
| **Lighting as a Service (LaaS)**<br>A service-based business model in which light service is charged on a subscription basis rather than via a one-time payment. | 6 |
| **Linear Economy**<br>A linear economy traditionally follows the “take-make-dispose” step-by-step plan. This means that raw materials are collected, then transformed into products that are used until they are finally discarded as waste. | 7 |
| **Linear risk**<br>The risk a company faces when depending on the conventional "take-make-dispose" economic model. | 1 |
| **Local materials**<br>Materials that are extracted and processed within the same region they are being purchased. Specific distances depend on the material, process and objectives. | 1 |
| **M** | **Source** |
| **Modular design**<br>Design principle that calls for products to be manufactured using a set of components that can be individually replaced, preventing entire products from becoming useless. | 1 |
| **O** | **Source** |
| **Open loop recycling**<br>Recycling product A and manufacturing it into product B. | 1 |

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| **Operational Carbon**<br>The amount of carbon emitted during the operational or in-use phase of a building. | 4 |
| **P** | **Source** |
| **Packaging (Primary)**<br>Packaging in contact with the product (plastic sack holding cereal). | 1 |
| **Packaging (Secondary)**<br>Packaging that contains one or more primary packages (cereal boxes). | 1 |
| **Packaging (Tertiary)**<br>Packaging that contains one or more secondary packages (plastic wrap for a palette of cereal boxes). | 1 |
| **Product Environmental Footprint (PEF)**<br>A multi-criteria measure of the environmental performance of a good or service throughout its life cycle. | 8 |
| **R** | **Source** |
| **Recovery**<br>Process of extracting material, energy or water from the waste stream for reuse or recycling. | 1 |
| **Recyclable materials**<br>Materials that can be recycled. | 1 |
| **Recycled content**<br>The portion of a product that is made from recovered and recycled materials. | 1 |
| **Recycling**<br>The collection, sorting and processing of disposed materials for use in another manufacturing process. | 1 |
| **Refurbished materials**<br>Discarded materials or products that are topically repaired, refinished and sanitized to serve their original function. | 1 |
| **Regenerative design**<br>A design principle that calls for products or services to contribute to ecosystem health. | 1 |
| **Regenerative economy**<br>A scenario in which products and services replenish their own sources of energy, water and materials in a closed-loop system. | 1 |
| **Remanufacturing**<br>Process of recovery, disassembly, repair and sanitizing components or parts for resale and reuse. | 1 |
| **S** | **Source** |
| **Science Based Targets**<br>Science-based targets show companies how much and how quickly they need to reduce their greenhouse gas (GHG) emissions to prevent the worst effects of climate change. | 9 |
| **Scope 1 Emissions**<br>Direct emissions from owned or controlled sources. | 10 |
| **Scope 2 Emissions**<br>Indirect emissions from the generation of purchased energy | 10 |
| **Scope 3 Emissions**<br>Indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions. | 10 |
| **Social life cycle assessment**<br>A method to assess the social and sociological impacts of a product or service across its entire life cycle. | 1 |
| **Sustainability**<br>Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations. | 11 |

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TECHNICAL STATEMENT

| T | Source |
|---|---|
| **Take-back program**<br>An initiative to collect used products or materials from consumers and reintroduce them to the original processing and manufacturing cycle. | 1 |
| **Technical nutrients**<br>Man-made materials designed to be long-lasting and reused. | 1 |
| **U** | **Source** |
| **Upcycle**<br>Use of secondary products, components or materials that results a higher economic value of that material. | 1 |
| **W** | **Source** |
| **Waste Electrical and Electronic Equipment (WEEE)**<br>See "Electronic waste" | 1 |
| **Waste hierarchy**<br>The priority order available for managing wastes, ranked in descending order of preference, based on the best environmental outcome across the lifecycle of the material. (1) Prevention, (2) Reduce, (3) Reuse, (4) Recycle, (5) Incineration, (6) Landfill. | 1 |
| **Z** | **Source** |
| **Zero waste**<br>Program to divert all (at least 95%) waste from landfill. The scope of zero waste may or may not include incineration depending on reference. | 1 |

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