Circular Economy for the built environment: a summary

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Definition

A Circular Economy (CE) is an alternative to a traditional linear economy (make, use and dispose) in which we:

1. Keep resources in use for as long as possible
2. Extract the maximum value from them while in use
3. Then recover and regenerate products and materials at the end of each service life.

Context

Circular economy within the built environment aims to address the global issue of resource scarcity and environmental degradation. Following circular economy principles will often lower the whole life carbon, thereby helping to address the climate emergency. LETI has undertaken further work to understand the tensions between circularity and low carbon products.

Primary actions to transition to a circular economy

Design new buildings for:

1. Easy maintenance and renovation E.g. designing in layers
2. Flexibility and adaptation whilst avoiding over-design
3. Longer life and facilitating deconstruction for future reuse
4. Recording accurate materials data for the future.

Optimise existing buildings by:

1. Understanding what resources are in existing buildings
2. Reusing buildings, systems, components and materials rather than recycling
3. Deconstructing not demolishing
4. Using low-carbon and biogenic materials.

Circularity hierarchy in the built environment

1 Maintain

Care and maintenance that retains the building, system, component or material as fit for purpose to maximise its useful life.

2 Refurbish

Redevelop through restoring, refinishing and future-proofing whilst avoiding unnecessary major replacement of any parts. This also encompasses retrofitting.

3 Repurpose (with adaptation)

Redevelop with significant major changes and replacement of shorter-life parts to accommodate different needs and uses (E.g. from industrial to mixed-use).

4 Deconstruct and reuse

Deconstruct a building and retain its constituent elements, systems and components as much as possible. Reuse each system, component or material again through checks, cleaning and repair, and with minimal reprocessing or remanufacture. Ideally, further processing or transporting would be avoided where possible.

5 Remanufacture and recycle

Recycling is when materials at end-of-life are reprocessed and remanufactured into products, materials or substances whether for the original or alternative purposes. This incurs additional energy in-puts and materials may devalue. The terms 'upcycling' and 'downcycling' describe when the recycling process shifts the value of the material or product higher or lower than the original.

Biogenic materials

Prioritise the use of biogenic, regenerative and renewable resources over the use of finite, virgin resources. Optimise designs to enable biogenic regeneration at the end of life stage. Biogenic materials have varying carbon implications in their manufacture and is therefore a field which requires further study. LETI will be undertaking work in this area.

CE strategies by layer

Infrastructure and buildings can be broken down into distinct layers, each with different lifespans and replacement cycles. Different CE strategies may be needed to maximise the value of each layer. Layers are to be easily separated from each other to accommodate different lifespans.

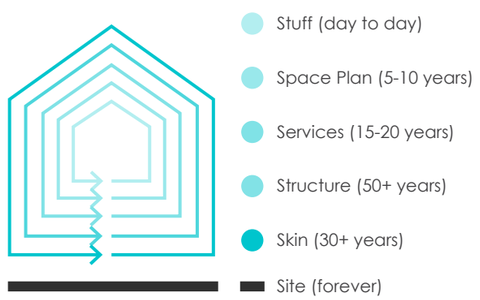

Figure 2: Building layers. Ref: Stewart Brand and Frank Duffy (1994)

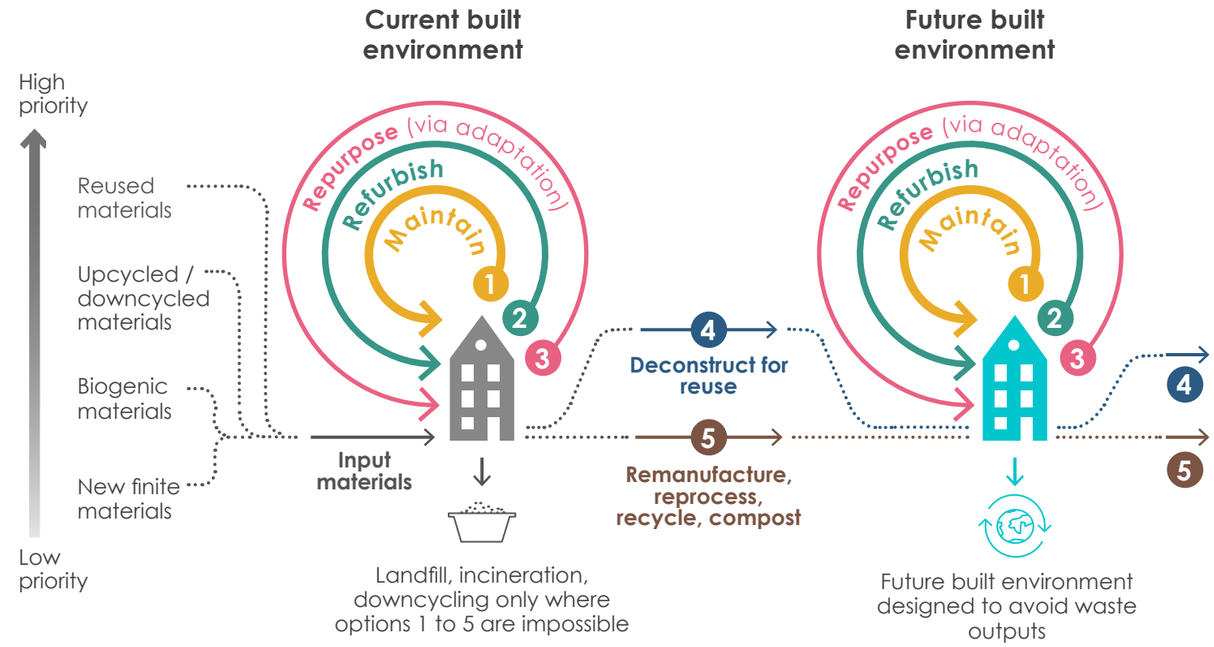

Figure 1: Material flows between the existing and future built environment

Metrics

There are multiple relevant metrics for circularity. LETI proposes the following:

A. Indicators of material use circularity:

- % of materials and elements reused (aim for 100%)
- % of materials and elements designed to be reusable at end-of-life (aim for 100%)

B. Indicators of embodied carbon:

- Changes in carbon values in Product, Construction and Use stages of the BS EN 15978 standard, due to incorporation of CE features
- Carbon value of BS EN 15978 Module D, which represents the benefits of passing material into the next use cycle.

Guidance: This summary document is intended to be a simple guide to CE concepts and issues. It should be read in conjunction with the Opinion Piece: CE and carbon in construction, LETI Climate Emergency Design Guide, LETI Embodied Carbon Primer, BS 8001, RICS Professional Statement. A LETI Circular Economy Primer is scheduled to be published.

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