# Design for Circularity

## Leadership Challenge

**Points: 3**

**Developed in partnership with the GBCA**

## Outcome

The building's circularity is improved through its design and material choices.

## Rating tool applicability

- Green Star Buildings
- Green Star – Design & As Built
- Green Star – Interiors
- Green Star – Performance
- Green Star – Communities

## Criteria

| | | |
|---|---|---|
| **Credit Achievement** | **2 points** | • **Circular Design Strategies:** The project implements circular design strategies<br>or<br>• **Circularity Measurement:** The project measures the circularity of key materials in the building |
| **Exceptional Performance** | **1 point** | In addition to *Credit Achievement,* the project meets the following:<br>• **Circularity Improvement:** When compared against a reference building, the project shows an improvement in circularity. |

## Additional information

### Stage implementation

| Strategy | Brief | Concept | Design | Tender | Construction | Handover | Use |
|---|---|---|---|---|---|---|---|

### Synergies with other Credits

- Responsible Construction
- Responsible Procurement
- Responsible Products
- Upfront Carbon Emissions
- Life Cycle Impacts

### Sustainable Development Goals

Goal 11 (Sustainable Cities and Communities)

### Relevant reporting initiatives

None

# Why is this Leadership Challenge Important?

In today's linear economy natural and social capital is extracted and exchanged for financial capital to facilitate economic growth. This profit at all costs model is no longer economically, socially, or environmentally viable.

Australia generates only $1.28 USD of output for every kilogram of material consumed – less than half the OECD benchmark. New Zealand is only slightly higher at $1.4.

Globally, 91% of all raw materials are wasted after their first use, as value is often only placed on the function of a product or material for the time it provides the function and not on the material value, which is often discarded as waste[1].

The built environment is a major contributor to the linearity of the economy as:

- Buildings account for ~40% of energy-related global carbon emissions
- Buildings are responsible for 50% of global material use
- 42.4bn tonnes of materials consumed annually

As a result of this linearity the built environment is facing increasing risks, including:

- Volatile resource prices which are also expected to rise over the long term[2]
- Dwindling supply of easy-to-access, high-grade stocks of key commodities
- Governments' restrictions on pollution and waste that apply along entire product life cycles
- Increased focus on emissions happening today, particularly as energy systems decarbonise

This Leadership Challenge presents an opportunity for stakeholders of the built environment to transition from the extractive, wasteful and increasingly risky linear economy to a viable and value-generating alternative – the circular economy.

A circular economy aims to redefine growth, focusing on values and value creation. It is an economic model that is designed to be restorative and regenerative, underpinned by gradually decoupling economic activity from the consumption of finite resources, designing waste and pollution out of supply chains, and transitioning our energy to renewable energy sources.

**The circular economy is underpinned by three key principles:**

- Design out waste and pollution
- Keep products and materials at their highest value for as long as possible
- Regenerate natural systems

2024 MBIE research into circular impacts found that, based on eight key circularity interventions, Aotearoa New Zealand could save an estimated 1.5-1.9Mt CO2e per annum, with the majority of these savings relating to resource efficient buildings and infrastructure interventions.[3]

As an economic model that is designed to be restorative and regenerative, the circular economy can support stakeholders of the built environment to achieve industry priorities, including climate action and resilience, health and wellbeing, biodiversity, social impact, and resource efficiency through a systems-based approach.

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[1] https://www.circularity-gap.world/2021

[2] https://www.ellenmacarthurfoundation.org/assets/downloads/publications/TCE_Report-2013.pdf

[3] https://www.mbie.govt.nz/dmsdocument/28471-impacts-of-circular-approaches-on-emissions-jobs-and-other-factors

Transitioning to a circular economy does not only amount to adjustments aimed at reducing the negative impacts of the linear economy, such as improving waste diversion rates. Rather, it represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits.

No one entity can achieve circularity in isolation from the systems and supply chain they operate within, and as such this Leadership Challenge presents a systemic opportunity for stakeholders of the built environment to work within their supply chains to create circular outcomes.

**This Leadership Challenge aims to:**

- Broaden and deepen the understanding and implementation of circular economy initiatives
- Catalyse the development of circularity in materials and supply chains
- Develop circular economy measurement practices that will support the establishment of industry benchmarks
- Share circular economy leadership and case studies to further educate and empower action
- Promote partnerships in supply chains

# Requirements

In a circular economy, products and materials are valued for both their functionality and their materiality, as well as the value that they contribute to the system. This Circular Economy Leadership Challenge requires the project team to identify, select and implement circular economy initiatives to increase the circularity of material/s and product/s within the supply chain/s of the project.

## Credit Achievement

The project must comply with **one** of the following criteria:

- Circular Design Strategies

or

- Circularity Measurement

## Circular Design Strategies

### Circularity Assessment

Prior to construction, a feasibility study of circular design strategies is completed. The feasibility study:

- Assesses the feasibility of implementing the following strategies for the building's structure and at least one other building layer (ie. envelope, finishes or systems):
  - Resource efficiency strategies (designing out waste): dematerialisation, reuse and adaptive reuse and product-as-a-service.
  - End-of-use strategies (how can the product/material remain at its highest purpose): design for disassembly, design for lifespan, design for flexibility and design for modularity.
- Identifies at least one end-of-use strategy and at least one resource efficiency strategy that is not business as usual practice that can be integrated into the design.
- Sets measurable targets for the identified strategies.

### Implementation

The building incorporates the circular design strategies identified in the circularity assessment and develops relevant manuals to support the end-of-use strategies.

Upon practical completion, the project assesses how the project performed against the targets set initially. Where targets are not met, the project team reviews the design of the project, identifying lessons learned, areas of improvement and key achievements.

Handover documents are provided to the building owner and the facilities management in a digital format. Information on where the manuals can be located is included in the operations and maintenance information.

## Circularity Measurement

The circularity of the top three materials (by mass, cost or volume) in at least three of following layers of the building are calculated:

- Structure
- Envelope
- Finishes
- Systems

### Calculating circularity

Calculations use a methodology that complies with *ISO 59020:2024 Circular economy – Measuring and assessing circularity performance* such as the Material Circularity Indicator (MCI) or Circular Transition Indicator (CTI).

The circularity of each material is reported as a single percentage value incorporating the core and optional indicators from *ISO 59020:2024.*

## Exceptional Performance

The project must comply with the following criterion:

- Circularity Improvement

## Circularity Improvement

Project teams must demonstrate a 10% improvement in total circularity, weighted by cost.

# Submission content

Submissions for this credit must contain:

- **Submission form**
- **Evidence** to support claims made in the submission

### Recommended evidence

The following list of evidence serves as a guide for the Certified submission and is not exhaustive. Project teams are not required to provide all of the listed items and alternate forms of documentation can be used to demonstrate compliance. The key requirement is that evidence is provided to support each claim.

**Circular Design Strategies**

- Extracts from the circularity feasibility study assessment.
- As built drawings annotated to highlight circular design strategies.
- Manuals to support end-of-use strategies (e.g. a disassembly plan if the building includes design for disassembly or a manual to highlight modularity options).
- Summary of performance against targets.
- Summary of lessons learned, areas of improvement and key achievements.

- Extracts from the relevant handover documents.
- Contracts specifying circularity / circular design outcomes.

**Circularity Measurement**

- Circularity calculations.
- Product data sheets or similar supporting the relevant circularity claims.
- Bill of quantities or bill of materials (where relevant for offsite assembly).

**Circularity Improvement**

- Circularity calculations for building.
- Product data sheets or similar supporting the relevant circularity claims.

Refer to the *Guidance for Submitting for Designed Assessment* available on the Green Star resources portal for further information on submitting evidence for the Designed assessment.

# Guidance

Guidance is supporting information for the credit requirements and is not mandatory to apply. However, where project teams deviate from guidance, they should provide a narrative as to why. The Certified Assessor(s) may use their discretion to determine if the approach is compliant. Project teams may submit a Technical Question to the GBCA prior to submission to seek clarification on an alternate approach.

**Circularity assessment**

The assessment may include reviewing existing assets, building documents, conducting site surveys, creating a digital twin or evaluating the potential for reuse. Findings should be summarised in a report format. Refer to GBCA's *A practical guide to circular procurement* for further guidance.

Business as usual

A practice is considered business as usual if it is a practice that is typically used in the local industry by the building owner or developer or by buildings of a similar typology. For example, if a warehouse-type project used structural steel, this would be considered business as usual and therefore would not be considered a design for disassembly strategy however if a disassembly plan was also provided by the project team to the building owner and a strategy was in place to be able to disassemble the column base connections, this could be considered design for disassembly. Extracts of as built drawings from at least 3 past projects can be used to demonstrate what is considered as business as usual.

Measurable targets

The following metrics are recommended for each circular strategy. Refer to GBCA's *A practical guide to circular procurement* for further information and guidance on the metrics.

| Circular strategy | Recommended metrics | Metric |
|---|---|---|
| Design for disassembly | • Percentage of building that can be disassembled<br>• Products that can be disassembled | • % by contract value or mass<br>• % of cost |
| Design for lifespan | • Circular lifecycle cost (CLC) | • Cost savings |
| Design for flexibility | • Percentage of building that can be adapted for a different function | • % by area |
| Design for modularity | • Percentage of building that is modular | • % by mass |

| Circular strategy | Recommended metrics | Metric |
|---|---|---|
| Dematerialisation | • Amount of waste generated<br>• Material Intensity | • kg/m$^2$<br>• kg/m$^2$ |
| Reuse and adaptive reuse | • Reuse index<br>• Residual salvage value assessment | • Out of 1<br>• % of construction costs |
| Product-as-a-service | • Products with service agreements | • % of cost |

**ISO 59020:2024 Circular economy – Measuring and assessing circularity performance**

The following are the core circularity indicators from the standard:

- Average reused content
- Average recycled content
- Average renewable content
- Percent actual reused products and materials
- Percent actual recycled material
- Percent actual recirculated material in the biological cycle

The following optional circularity indicator outlined may also be used:

- Average lifetime of product or material relative to industry average

**Circular Improvement**

Common circularity calculation methodologies typically provide a score for the building's circularity where a low score indicates low circularity or a linear material flow. Examples of the required scores in these common calculation methodologies to meet the credit requirements are included below:

- MCI: a fully circular building would have a score of 1 and a fully linear building would have a score of 0.1. To demonstrate a building is 10% circular, a score of 0.19 is required.
- CTI: a fully circular building would have a material circularity percentage of 100% and a fully linear building would be 0%. To demonstrate a building is 10% circular, a material circularity percentage of 10% is required.

Other calculation methodologies may be used. Projects are to indicate the scale that is used including the scores of a fully linear building and a fully circular building.

# Definitions

Definitions provided here must be applied to *Requirements* unless agreed with GBCA via a Technical Question.

**Design for disassembly**

Creating buildings and components that can be easily recovered without damage, enabling reuse, recycling, or repurposing of materials.

**Design for lifespan**

Creating buildings and components that are durable, easy to maintain, and repairable to extend their useful life.

**Design for flexibility**

Creating buildings and spaces that can adapt to changing needs or functions over time, reducing the need for major alterations or demolition.

**Design for modularity**

Creating buildings and components in standardised, prefabricated modules, that can be adjusted or reassembled to changing needs and functions over time without significant structural alterations.

**Dematerialisation**

Reducing the quantity of materials used in a building while maintaining functionality and performance. This includes the quantity of waste produced during construction.

**Reuse and adaptive reuse**

Repurposing existing assets, materials or components from existing built assets to minimise demand for new resources.

**Product-as-a-service**

Procurement of services rather than products. As the focus shifts from ownership to usage, users pay for the service of a product provides rather than ownership.

# Additional resources

The following resources support this Leadership Challenge:

- Arup – Circular Buildings toolkit
- Built & Coreo – How to write a Building Disassembly Plan
- GBCA – A practical guide to circular procurement
- UKGBC – Circular Economy How-to Guide: Reusing products and materials in built assets
- World Business Council for Sustainable Development (WBCSD) – Circular Transition Indicators (CTI) for buildings – Sector guidance
- https://www.ellenmacarthurfoundation.org/