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Green Building Council Australia

A practical guide to circular procurement

For new buildings and major refurbishments

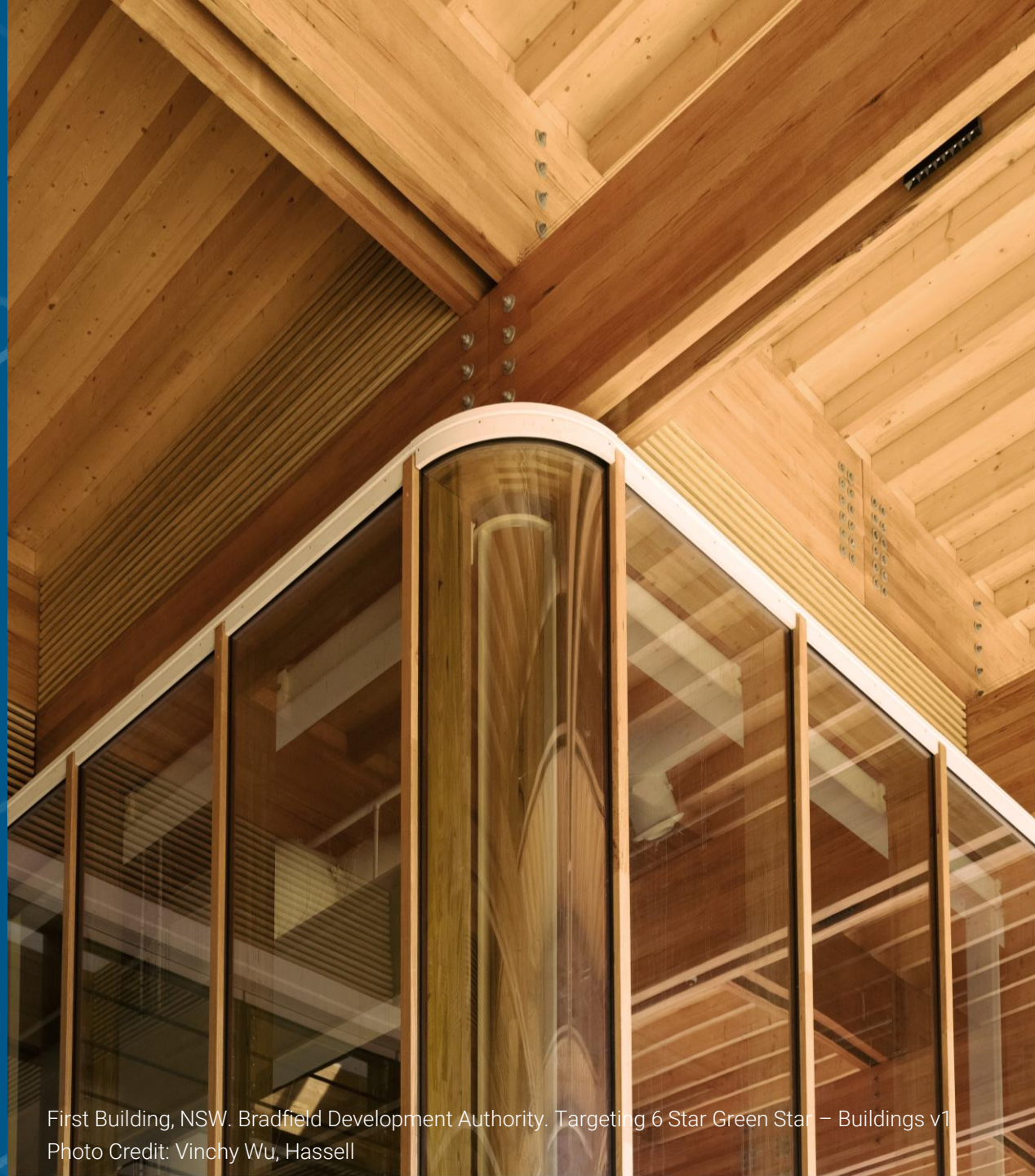
NSW GOVERNMENT

Queensland Government

Government of South Australia

Green Industries SA

cefc



First Building, NSW. Bradfield Development Authority. Targeting 6 Star Green Star – Buildings v1
Photo Credit: Vinchy Wu, Hassell

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Green Building Council Australia

Acknowledgment of Country

We at the Green Building Council of Australia recognise the Traditional Custodians of Country throughout Australia. We pay our respects to Elders past and present, and recognise their continuous connection to lands, skies and waters.

Australia's First People are the world's oldest continuous living culture, and Australia's first practitioners of sustainability. They have shaped the built environment for millennia with purpose-built architecture that responds to the unique character and challenges of the landscape. The Green Building Council of Australia recognises the power of the built environment to shape a future that cares for both people and planet. The choices we make today matter for the future of tomorrow.

Green Building Council Australia

Established in 2002, Green Building Council of Australia (GBCA) is the nation's authority on sustainable buildings, communities and cities. Our vision is for healthy, resilient and positive places for people. Our purpose is to lead the sustainable transformation of the built environment. GBCA represents more than 550 individual companies with a combined annual turnover of more than $46 billion.

TECHNICAL PARTNER

GHD

Founded in 1928, GHD is a global professional services company with over 11,000 employees in 160 offices across 5 continents. Together with our clients, we create lasting community benefit to make water, energy and communities sustainable for generations to come. This is the vision and purpose behind all our efforts."

FUNDING PARTNERS

NSW GOVERNMENT

The NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) has a vision of thriving ecosystems and communities. It leads the way on climate change, driving the sustainable transition to a net zero economy, powered by affordable, reliable, and clean energy.

Queensland Government

The Department of the Environment, Tourism, Science and Innovation recognises the enormous value a clean environment, innovative society and economy, and vibrant culture contributes to our lives. As a diverse organisation, the department brings together key areas of work to achieve our objectives for a better Queensland.

Government of South Australia
Green Industries SA

Green Industries SA (GISA) leads South Australia's transition to a circular economy by eliminating waste and maximising resource value. Collaborating with industries, businesses, and households, GISA promotes innovation, resource efficiency, and waste reduction. Guided by the state's Waste Strategy, GISA drives sustainable change for economic, social, and environmental benefits.

cefc

The CEFC is Australia's specialist climate investor, helping cut emissions in the race towards net zero. We work with co-investors, industry and government to drive economy-wide investment in renewable energy, energy efficiency and low emissions technologies. With access to more than $32 billion from the Australian Government, we invest to deliver a positive return for taxpayers.

Midtown Centre, QLD. InDeMa Properties. 5 Star Green Star – Design & As Built v1

Introduction

The built environment is responsible for nearly 50% of global resource use, and 37% of GHG emissions. Reducing the impacts of our sector can best be achieved through implementing a circular economy.[1,2] The circular transition represents an opportunity to tackle the shared global challenges of decarbonisation, climate change, biodiversity loss, and pollution.

Although there is improved awareness and adoption of high-level principles, there is a notable gap in project-level implementation. While adoption of the concept is emerging in industry, there remains a critical need for practical guidance to bridge the divide between theory and application. This is because many professionals and organisations struggle to translate high-level principles into tangible actions that can be effectively implemented throughout a project's lifecycle.

The Green Building Council of Australia (GBCA) has collaborated with GHD to develop "A practical guide to circular procurement – for new buildings and major refurbishments" (the Guide). This guide aims to provide professionals and decision makers across Government and the private sector the considerations and tools to enable circular procurement across each stage of a building project.

The guide is designed for project stakeholders focused on embedding circularity in each stage of a building and refurbishment* project. The guide outlines practical steps across a project's life-cycle to ensure circularity is embedded, procured, and delivered appropriately. This guide also clarifies the roles of all stakeholders involved in a project.

In doing so, the Guide serves as a crucial resource to empower industry professionals with the knowledge and tools needed to transform ambition into action, paving the way for a more sustainable and circular built environment.

*Major refurbishments aim to extend the building's lifespan, improve performance, or adapt it to new uses while retaining some of the original structure.

Background & audience

This guide was developed after a comprehensive literature review of existing resources for circular procurement for several sectors. This guide builds on these existing circular economy resources and aims to translate them to practical procurement steps for the built environment.

For more information on the opportunity of the circular economy, please refer GBCA's Driving Circular Conversations.

The practical guide:

1. Introduces circular economy fundamentals
2. Introduces circular procurement concepts
3. Outlines circular strategies to drive circular principles in the built environment
4. Details how each strategy can be implemented at each stage of the building lifecycle
5. Provides sample procurement clauses for briefs and contracts
6. Provides case studies of circularity in action
7. Highlights additional circular economy resources including enablers and tools to deliver circular strategies

Please note, text that contains an underline includes a link to either an external resource, or to further information within the guide.

Contents

Familiar with circular economy and circular procurement?

Start here

Circular economy fundamentals

What is a circular economy?

The circular economy is a system transformation that aims to deliver economic and environmental benefits by retaining resource value within the economy rather than losing it to landfill. This is achieved by designing out waste leakages, prioritising closing resource loops across the value chain and regenerating natural systems.

It is underpinned by three core principles[3]:

- Eliminate waste and pollution
- Circulate products and materials (at their highest value)
- Regenerate nature

Circularity has been practiced for millennia by Indigenous communities globally, including Aboriginal and Torres Strait Islander peoples. Indigenous cultures generally focus on sufficiency, enabling resources to regenerate and to consider the needs of future generations[4].

Why circularity in buildings?

Globally, the built environment is a major contributor to land use change and resource consumption, with construction and demolition processes responsible for nearly 100 million tonnes of raw materials annually[5].

The sector is also energy intensive, representing 36% of energy consumption and 39% of carbon dioxide emissions[6]. It also negatively impacts Earth's systems as key thresholds like biosphere integrity and land-use change are breached every year. Overconsumption means that humans are currently using resources around 1.75 times faster than earth's biocapacity can regenerate. By adopting circular practices, the built environment can help reduce the number of earths needed to sustain the population:

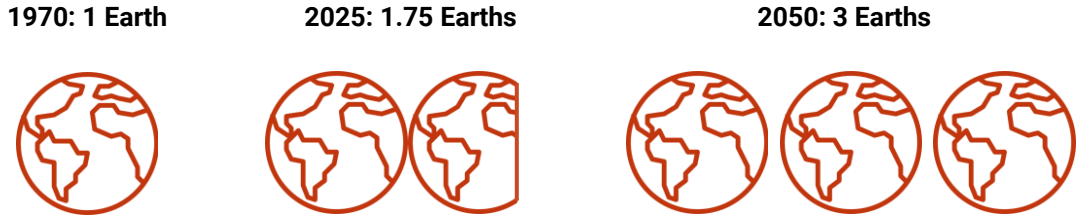


Figure 1. Overconsumption and scarcity of natural resources [7]

The construction industry is responsible for the consumption of 40-50% of raw materials globally, including housing, construction and infrastructure[8]. Of this, it's been estimated that only 30% of materials are currently recycled[9].

Circular economy fundamentals (continued)

Why circularity in buildings?

Building and demolition waste is the largest waste stream in Australia - accounting for 35% of all waste. In 2022–23, approximately 26.8 million tonnes, or 1,020 kilograms per person were generated[10].

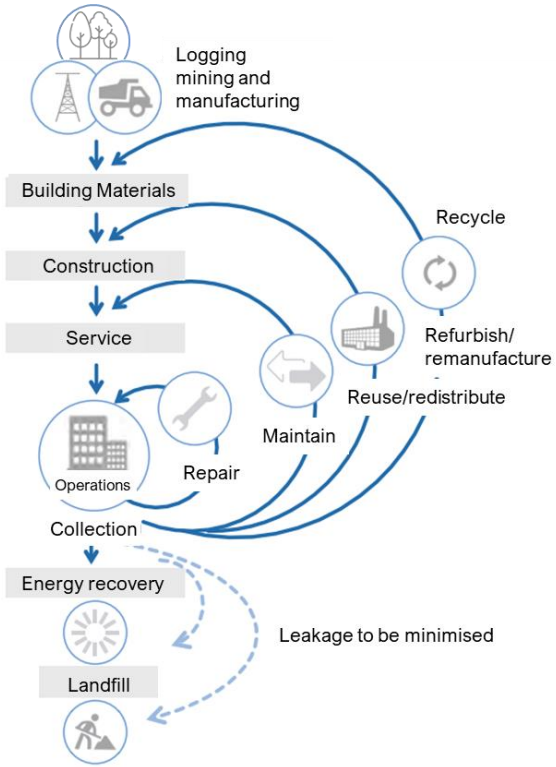


Figure 2. Can the circular economy transform the world's number one consumer of raw materials?[11]

The Australian government The Circular Advantage Report 2024 identified the built environment as one of five priority sectors.

Figure 2. is a reinterpretation of The butterfly diagram by the Ellen Macarthur Foundation. It describes how the built environment can achieve a circular economy by circulating products and services along the supply chain through repair, maintenance, reuse, refurbishment or recycling.

Eight strategies for delivering circular buildings

- **Design for disassembly**
- **Design for lifespan**
- **Design for flexibility**
- **Design for modularity**
- **Dematerialisation**
- **Material Selection**
- **Reuse and adaptive reuse**
- **Product-as-a-service**

Eight strategies for delivering circular buildings (continued)

In the built environment, circularity can be practiced through the following strategies. Whilst most effective to implement during the planning and design phases, they can be applied throughout a building's lifecycle to reduce, slow down, or close the loop on resource use.

Design for disassembly	Creating buildings and components that can be easily recovered without damage, enabling reuse, repurposing, or recycling of materials.
Design for lifespan (durability and maintenance)	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.
Material selection	Prioritising products that contain recycled content and are recyclable, are healthy and low-impact, those that are mono-materials, or biobased, or products that are part of reputable product stewardship scheme.
Reuse and adaptive reuse	Repurposing existing assets, materials or components from existing built assets to minimise demand for new resources
Product-as-a-service	A business model where users pay to access the product, rather than purchasing the product outright. Service providers then provide long-term maintenance and support, minimising waste generation.

Progress of circularity in Australia

With a circularity rate of 4 per cent, Australia has considerable potential to build its circular economy. This will help foster new industries and technologies and boost Australia's role in the global economy[11].

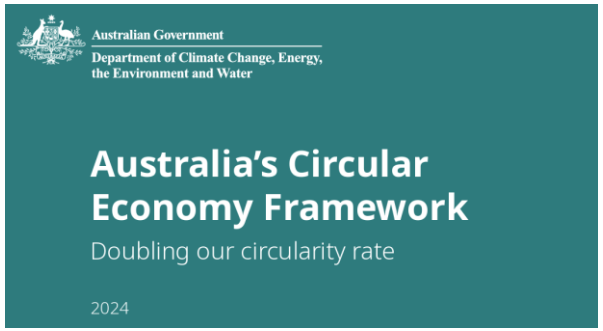
Upcoming guides

Circular Design Guide, City of Sydney Investigating the latest in circular design in the City

Circular Procurement Guidelines, Better Buildings Partnership and thinkstep_anz. A comprehensive introduction to the foundations of circular procurement that compliments this practical guide.

Australia's Circular Economy Framework, 2024

The Framework outlines priorities to optimise Australia's international trade and economy through a national strategy aligned with global supply chains. It emphasises product-based opportunities, including sustainable building materials, and highlights the circular economy as a progressive, secure market that supports sustainability goals. In the built environment, it prioritises refurbishing, adaptive reuse, and the use of circular, low-carbon, and climate-resilient materials. Enablers include circular strategies (see page 8), embedding circularity in new buildings, and developing markets for recycled content. This framework follows The Circular Advantage report, released by DCCEEW in December 2024.



Australia's circular economy: Unlocking the opportunities

Interim report

Australia's circular economy: Unlocking the opportunities, 2025

Though there has been a slight improvement in Australia's circularity over the past decade, progress is hampered by inconsistent regulation across 6 key areas, one being the built environment. The report recommends government harmonise regulations and facilitate and coordinate innovation diffusion to achieve greater outcomes. More information would enable consumers greater ability to make decisions on sustainable products, whilst monitoring outcomes of material use and circularity would help identify opportunities and provide better data.

The interim report can be found here, with a final report date to be advised.

CSIRO's Australia's Comparative and Competitive Advantages in Transitioning to a Circular Economy, 2024

This report highlights construction as a top industry for global competitiveness in a circular economy. It emphasises the environmental and economic benefits of reusing and recycling materials and has spurred Federal Government reports and initiatives outlining steps toward circularity.

Green Star & circular procurement

Green Star includes several credits that align well with circular procurement practices, and with broader circular economy principles.

Green Star Buildings v1

Green Star Buildings v1 rewards the reuse of buildings and building components, as well as the use of more circular products and practices. Green Star project teams can be rewarded for circular procurement through the following credits:

- Responsible Products: Structure, Envelope, Systems and Finishes
- Upfront Carbon Emissions
- Life Cycle Impacts
- Responsible Procurement
- Responsible Construction
- Leadership Challenge – Circular Economy

The rating tool rewards building reuse by rewarding significant refurbishments with a 4-star rating by targeting the following:

- Minimum Expectations
- Responsible Products credits
- Upfront Carbon Emissions credit

Green Star Buildings v1.1 will increase the focus on circularity with a new credit encouraging developing and emerging circularity metrics. The rating tool update should be available in 2025. Updates to the rating tool can be found here.

Green Star Communities v2

Similar to Buildings v1, Communities projects can achieve recognition for implementing circularity through the following credits:

- Responsible Products: Services Infrastructure, Public Realm Hardware, and Civil Works
- Responsible Construction Practices
- Responsible Procurement
- Sustainable Buildings
- Upfront Carbon Reduction
- Upfront Carbon Compensation
- Life Cycle Impacts
- Leadership Challenge – Circular Economy

Green Star Fitouts v1 (in development)

The proposed Circular category promotes the procurement, design and construction practices that enable reuse and recovery of products and materials. To understand more about the Fitouts tool, please see the draft credits here.

For more information of circularity related credits in Green Star, see appendix A.

ISO 59020

This standard aims to support companies in transitioning to circular practices. It provides a measurement and assessment methodology that includes boundary setting, choice of indicator, processing, and interpreting data.

Responsible Products Program

Across the mentioned rating tools sits the Responsible Products credits. These credits were created to recognise project teams for the selection of products with lower environmental impacts, are transparent, respect human rights, and reduce carbon content.

Products are deemed 'Responsible' through recognition by a product certification initiative, who verify the claims made by a manufacturer.

The Responsible Products Guidelines are the credits that have been developed with industry to recognise these product certification initiatives. The criteria span across five focus areas; responsible, positive, healthy, and circular. For further information, please see the Responsible Products Guidelines here.

GBCA are working with industry to update the Responsible Products Guidelines, which will include a greater focus on circularity.

Circular procurement in buildings

What is circular procurement?

Circular procurement is the process in which a product, a service or a project is purchased according to the principles of a circular economy. In this process the technical aspects of the product are as circular as possible, taking maintenance and return policies at the end of the use period into account, as well as including financial incentives to guarantee circular use.

The benefits of circular procurement in buildings

Circular procurement promotes a range of positive economic, social, and environmental outcomes outlined below and detailed on the following pages that may provide value to developers and investors:

Procuring in line with policy

Procuring offers the opportunity for organisations to support the social and environmental policies of the organisation. Procurement policies may specify targets for environmental sustainability, local employment, or align with Reconciliation Action Plans to support First Nations people, communities and organisations. It's a good idea to review the procurement policies prior to tendering for products and services.

1

Reduced cost of materials

Utilising circular strategies can reduce dependency on virgin materials and rare minerals, leading to significant monetary savings.

2

Extended asset value

The management, maintenance and repair of products within the building's lifecycle result in higher value of components at end of use. By utilising the building as a material bank (see BAMB case study), building owners can realise higher values in building materials and components.

3

Economic growth and job creation

Transitioning to a circular economy in the Australian built environment is expected to vastly add to the country's GDP and employment market, demonstrating the broad economic potential of circular practices.

4

Environmental benefits

Practicing circular procurement in buildings can lower carbon and water usage, limit biodiversity loss, and reduce waste and pollution.

5

Access to green financing and investment

Circular projects can attract green loans, lower interest rates, and favourable financing, enabling cost-effective development.

1

Reduced cost of materials

Using circular principles can help reduce project costs by:

- **Refusing:** Question whether all materials or construction are necessary, exploring opportunities to use existing products, services, or buildings to maximise site value.
- **Reducing**: Use materials efficiently during manufacturing and construction to minimise costs.
- **Reusing:** Incorporate existing elements and materials to save time and reduce project costs.
- **Repurposing:** Reimagine materials or assets for new uses with minimal effort, extending their life and retaining or increasing their value.
- **Recycling:** Integrate materials with recycled content and/or recyclable materials like steel, or concrete to reduce environmental impacts and costs. Recycling should be a last resort, ensuring materials stay in use longer and at their highest value.

The value of sustainable construction materials in Australia

Construction materials that incorporate timber, recycled content, or are lower in embodied emissions have been projected to grow at a compound annual growth rate of 12.1% for the 5 years to 2026. From 2024, the market for "green steel" is expecting to grow from US$3.75bn to US$129.08bn in 2032.[12]

2

Extended asset value

Managing and maintaining assets retains and extends their value, enabling multiple uses. Unlike traditional models where buildings and materials are discarded after use, this approach allows developers and owners to preserve much of the initial financial and construction value for new projects.

Success depends on creating and retaining data on attributes and maintenance cycles, enabling new owners to confirm the product's suitability and re-certify it as needed. For example, periodic testing of HVAC systems ensures they are well-maintained and perform efficiently. This data helps new owners understand operational parameters and make informed decisions when purchasing or leasing systems.

Figure 3. Midtown Centre – Brisbane.

3 Economic growth and job creation

The building and construction sector has the capacity to harness the circular economy to create a stronger and more resilient economy. The sector currently accounts for 10% of Australia's GDP and provides employment to approximately 1.35 million people[13].

Scope of opportunity

- The commercial real estate sector boasts over 859 million square metres of floor space. This number is projected to double by 2050 to accommodate the growing demand for offices, retail spaces, and other facilities[14].
- Circular economy practices could create AU$773 billion to the economy over 20 years and reduce by 3.6 million tonnes of carbon dioxide equivalent by 2040[15].

Government investment to drive the circular economy:

- The $15 billion National Reconstruction Fund aims to drive a circular economy in key sectors by supporting new and emerging recycling and clean energy industries
- The $250 million Recycling Modernisation Fund aims to support the processing of previously exported waste. With support from states, territories and industry, it is estimated that the fund will represent $1bn in projects, increasing the country's processing capacity by over one million tonnes per year.
- The CEFC committed $75 million in debt financing towards a large construction & demolition recycling facility and an addition $60 million towards repurposing an existing office park into a retirement living community.

Environmentally sustainable procurement policy

Released in 2024, the Federal Government's Environmentally Sustainable Procurement policy mandates that construction contracts exceeding $7.5 million prioritise products that minimise greenhouse gas emissions, are environmentally safer, and retain their value for longer.[16]

4 Environmental Benefits

In addition to the social and economic benefits of a circular economy, circular principles fundamentally result in the following environmental benefits:

1. Lower carbon and water usage

Extending the lifespan of products and materials through circular strategies reduces the need for energy- and water- intensive extraction and production processes. Additionally, circular practices such as closed-loop systems reduces freshwater consumption and can enable manufacturers to operate at a lower cost and off the water grid.

2. Limits biodiversity loss

Reducing reliance on virgin materials reduces the need for raw materials and rare minerals, minimising landscape and habitat disruption. Just as indigenous knowledge teaches us, our resources are limited and must be taken care of.

Figure 4. Landscape design of the bio-solar PV roof of First Building – Bradfield City Centre.

3. Reduces waste and pollution

When products and materials are designed for durability, reuse, and recyclability, they can be recirculated through the system, minimising the need for product to go to landfill. Additionally, by keeping materials in use longer and reducing the need for new raw materials, the circular economy decreases industrial pollution and water contamination.

5

Access to green financing and investment

Circular buildings use fewer resources, minimise waste, and comply with emerging sustainability standards. This is appealing to the financial sector searching for stable, low-risk investments. Alignment with recognised frameworks (like the EU Taxonomy or TCFD) and established lending practices (e.g., sustainability-linked bonds) makes circular projects more likely to secure favourable interest rates, longer loan tenures, and greater investor interest compared to conventional developments.

Why are lenders and investors interested in circular buildings?

- Circular buildings inherently address climate-related concerns such as carbon emissions, resource depletion, and end-of-life waste. This makes it easier for lenders and investors to meet their own sustainability targets and demonstrate adherence to stricter reporting standards (e.g., TCFD, SASB, ISSB) which are increasingly viewed by shareholders as corporate governance practice, required for investment to occur.
- Whole-life costing methods provide better detail to investors on the design, durability of materials and components, and extended building lifespans which can create more stable revenue streams and lower operational costs over time.
- By retaining residual or salvage values for materials, circular buildings ensure assets can be repurposed or resold at a higher value than traditional buildings.

The finance sector has begun codifying metrics and requirements for circularity in the built environment. The sector is also subject to disclosure requirements in this space. For example:

- **EU taxonomy on sustainable finance:** Provides guidance on what a sustainable investment is, with metrics targeting waste, global warming potential, circular design, material extraction, and transparency. Beyond the EU, there are 32 other global taxonomies (including in the ASEAN region), though Europe's remains the most comprehensive regarding circularity.
- **International capital markets alliance and loan market association:** These two bodies publish several guidelines for the issuance of green bonds, green loans, and sustainability linked-loans. Amongst the criteria, there is guidance for circular economy targets.
- **EU's sustainable finance disclosure regulation (SFDR)**: Requires financial market participants to disclose ESG risks and impacts, including circular economy considerations.
- **Mandatory climate-related financial disclosures (Australia):** Requires eligible entities to report climate emissions (including scope 3 from their supply chain). Although not strictly about circularity, it addresses climate risks and opportunities that frequently overlap with circular economy principles.
- **Measuring What Matters (Australia):** The framework considers sustainability metrics, ensuring resource efficiency and ecological health, amongst other criteria, are considered in national policy and investment decisions.

More information on accessing sustainable finance can be found in GBCA's Unlocking the value: A practical guide for sustainable finance in the Australian real estate sector.

Metrics for financing the transition to a circular real estate sector

Please note: 'Impact reduction' is not a circular strategy but has been included as the metrics are important. Metrics are quickly evolving and GBCA expects to see change in the near future.

The metrics below for each circular strategy and impact reduction category have been extracted from multiple finance-sector frameworks and real estate guidance documents (see Appendix E). They can be used to help transition the real estate sector towards a circular economy and develop better benchmarks over time. They can also by used by the sector to access "green" finance or loans.

The *established* benchmarks are commonly used in the sector, with clear guidance available. However, despite advancements in benchmarking for the real estate sector, most truly circular metrics are still *developing* or *emerging*. For *developing* metrics, interim internal benchmarks can be developed using historical project data (e.g., material usage, waste diversion, water recycling), but at this time there is no agreed industry method for these yet. These should be regularly reviewed against advancements by industry associations, voluntary schemes, and regulations to ensure alignment. *Emerging* metrics shown on the left are not used or tested in the built environment or finance sectors yet. It is recommended that these metrics not be included as clauses at this time but instead monitored as they evolve.

Strategy	Reuse and adaptive reuse	Dematerialisation	Design for modularity and flexibility	Design for lifespan	Design for disassembly	Material selection	Product-as-a-service	Impact reduction
Established	Construction and demolition waste diversion rate (%)					Products that are certified (%)		Upfront carbon
Developing		Amount of waste generated (kg/m^2)				Recycled or reused content (%)		Upfront water
	Material Circularity Indicator (MCI) and Circularity Transition Indicator (CTI) can be used as an emerging metric across all circular strategies.							
Emerging	Reuse index (out of 1) Residual (salvage) value assessment	Material Intensity	Products that can be disassembled (%)	Circular lifecycle cost (CLC)	Building that can be disassembled (%)	Products with material passports (%)	Products with service agreements (%)	Upfront nature

Sample clauses for common and developing metrics

Institutions are encouraged to adopt the established and developing metrics as outlined on the right.

Information on *established* metrics is readily available and can be provided by most major projects in Australia. For all projects, the financial institution should also seek disclosure on the items highlighted on the right. Having this information will assist in creating industry wide metrics.

For the *developing* metrics,

- Consider incentivising disclosure, until benchmarks are agreed more broadly.
- Coordinate with relevant guidance for most *established* and *developing* metrics from industry associations
- Align with industry by certifying with established tools such as Green Star or NABERS

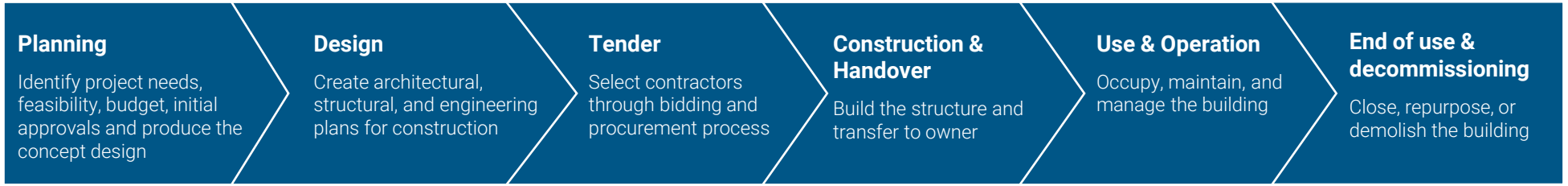
GBCA is already working on developing appropriate benchmarks for Australia for the developing metrics, and even some developing metrics based on the release of ISO 59020:2024 *Circular economy — Measuring and assessing circularity performance* (for Material Circularity Indicator (MCI) and Circularity Transition Indicator (CTI)). These will begin appearing in Green Star Buildings v1.1.

Established metrics	Construction and demolition waste diversion rate • At least 80% of C&D waste must be diverted from landfill, or • The building has a 4 Star Green Star Buildings rating or higher (see here for credits to target circular outcomes)	Certified products (%) • __% of all responsible products* must meet a Responsible Product Value of __ as defined by the Green Building Council of Australia, or • The building has a 4 Star Green Star Buildings rating or higher and achieves at least 1 point in the *Responsible Credits (not Procurement)*	Upfront carbon • The total upfront carbon from the building must not exceed __ $kg/CO_2/m^2$ calculated as per the NABERS Embodied Carbon methodology, or • The building achieves a __ Star NABERS Embodied Carbon rating, or • The building achieves a 4 Star Green Star Buildings rating or higher	**In addition, the following must be disclosed:** • Waste generated from construction and demolition activities • Any additional upfront carbon or life-cycle impacts
Developing metrics**	**Waste generated** • The total waste generated at the site from construction and demolition activities is less than __ kg/m^2, or • The building has a 4 Star Green Star Buildings rating or higher and achieves the Reduced Waste Generation Leadership Challenge	**Recycled or reused content** • The percentage of total material inputs from post-consumer recycled or reused sources is reported • At least __% of total material inputs come from post-consumer recycled or reused sources	**Upfront water use** • The total upfront water from the building must not exceed __ l/m^2	

* Green Star Buildings Responsible Products credits include structure, envelope, systems and finished.
** To be included as stretch targets where appropriate

Circular procurement during a building's life-cycle stages

This section aims to assist project teams define, engage and deliver a circular project. This section is meant to complement existing activities at each stage, with key tasks like stakeholder engagement planning expected to take place outside its scope. The life-cycle stages of a building have been defined as follows:



The following pages are intended to be picked up by project teams and served as a guide for each life-cycle stage of a building. They detail:

1. Stakeholders: The key decision makers per stage, as per the stakeholders here.
2. Circular strategies: Opportunities to be explored, detailed further here.
3. Objective: The overarching goal for each life-cycle stage of a building.
4. Core tasks: Key actions required at each life-cycle stage to achieve circular strategies.
5. Deliverables: Outputs produced at each life-cycle stage, to be completed before progressing to the next stage.

Addition definitions

See further information for core tasks and deliverables in Appendix H

Additionally, enablers and tools have been included as appendices and can be used between stages.

Key stakeholders across the building life-cycle stages

Investors

Fund circular projects and incorporate circular economy targets into investment strategies.

Developers

Advance the circular economy by commissioning adaptable, durable structures, using recycled materials, and planning for lifecycle management to minimise waste. They can prioritise asset reuse and design buildings for disassembly and material recovery.

Authorities

Implement policies to incentivise circular outcomes. They also implement circular obligations into reporting and development approval processes.

Supply chain

Provide products that reduce waste, extends longevity, and regenerates nature. Suppliers can enhance circularity by offering products as services, managing end-of-life processes, and supply chain transparency.

First Nations peoples

Share cultural, spiritual, and environmental knowledge, enriching projects with deep connections to land, water, and community. Their practices can inform, contribute to, and benefit from circular economy outcomes.

Procurement specialists

Select suppliers, securing circular procurement agreements, awarding contracts based on circular value, and overseeing product lifecycles to ensure circular economy principles are met.

Builders & trades

Promote circular outcomes in partnership with developers, ensure performance and environmental specifications of products and materials are maintained through construction, ensuring that materials are procured as specified or communicate variances.

Professional services

Integrate circularity into business cases, project briefs, and design documentation. They assess environmental impact, optimise circular outcomes across a building's lifecycle, and specify materials and services that best support circular principles.

Owners

Embed circular procurement principles into purchasing decisions, ensuring products and materials align with circularity. They oversee asset lifecycle management to meet sustainability goals.

Leasing agents

Promote and negotiate the use of products and materials designed for circularity in rental agreements and tenancy design guidelines.

Tenants & occupants

Agree to the circular principles specified within the lease, following the tenant guidelines provided by landlords. Where possible, tenants should retain existing fitouts and seek to regenerate nature where possible.

Asset managers

Implement circular procurement by selecting and managing assets that align with circular principles. They oversee asset lifecycles to minimise waste and maximise resource efficiency.

Demolition & recycling businesses

Ensure materials are properly de-fitted and disassembled for reuse or recycling, diverting waste from landfill in line with circular procurement principles. They must meet project targets and provide reporting.

Planning (feasibility and project brief)

Stakeholders
- Investors
- Developers
- Authorities

Strategies
- Reuse and adaptive reuse
- Dematerialisation
- Design for modularity and flexibility
- Design for lifespan
- Design for disassembly
- Material selection
- Product-as-a-service

Objective

This stage sets the project's circularity vision and goals. It requires balancing circular and strategic objectives with financial feasibility, resources and constraints. Circular principles have the greatest impact when delivered through the early stages of a project.

Core tasks

- ❑ **Define the circular vision:** Set circular economy goals and align with sustainability objectives and Green Star targets.
- ❑ **Complete a circularity audit**: Identify ways to reduce waste, reuse materials, and integrate circular strategies.
- ❑ **Embed circularity**: Include circular targets in briefs, business cases, and budgets.
- ❑ **Assess team capability:** Ensure the team can deliver circular outcomes or be provided training.
- ❑ **Plan for material recovery:** Develop a circular deconstruction strategy if demolition is unavoidable.
- ❑ **Design for end-of-use:** Ensure adaptability, reuse, and disassembly to extend material lifespans.
- ❑ **Engage the market:** Work with suppliers and contractors to source circular materials and solutions.

Circular practices for existing buildings

Existing buildings can practice circularity. In fact, trialling and testing strategies in our existing building stock is essential to deal with future circular buildings. See the Building as Material Banks case study.

Deliverables

- ❑ **Project brief** with clear circularity vision and targets
- ❑ **Business case** and **feasibility report** including vision and metrics and long-term benefits not typically referenced in Cap-Ex/Op-Ex modelling.
- ❑ **Technical and functional specification** with circularity criteria and clauses included
- ❑ **Circularity Audit**
- ❑ **Deconstruction and resource recovery plan***
- ❑ **Circularity training plan**

*For projects with existing assets on site

Key Considerations

Compliance and Regulation - It is essential that project teams apply due diligence and ensure all inclusions and clauses comply with applicable building codes and standards, regulation and/or legislation.

Re-thinking project budgets - Circular strategies such as Product as a Service often necessitate reviewing traditional Cap-Ex/Op-Ex models. Budgets need to adjust to the option for lower initial costs whilst allowing for potentially higher servicing and maintenance costs through the lifespan of the building.

Design (concept and detailed design)

Stakeholders
- Developers
- Professional Services
- Procurement Specialists

Strategies
- Reuse and adaptive reuse
- Dematerialisation
- Design for modularity and flexibility
- Design for lifespan
- Design for disassembly
- Material selection
- Product-as-a-service

Objective

To investigate circular economy strategies and agree on feasible approaches. This includes translating the circular vision to the design and technical specifications, as well as preparing contract documents.

Core tasks
- ❑ **Define circular requirements:** Confirm with team and set targets
- ❑ **Coordinate:** Ensure proper engagement, detail strategies in drawings and specifications
- ❑ **Refine specifications**: Outline methods and techniques to implement circularity through construction
- ❑ **Engage with potential suppliers and contractors:** ensure circular strategies can be delivered
- ❑ **Understand service life** and circularity level for each building layer
- ❑ **Complete a Disassembly Plan**

Deliverables
- ❑ **Disassembly Plan**
- ❑ Document circularity initiatives in **project design and sustainability reporting**
- ❑ **Impact indicator analysis** (e.g. upfront carbon) and **circularity assessment reports**
- ❑ **BIM model** to include circularity and environmental information
- ❑ **Procurement/contract documents** with circularity requirements (see Circular Procurement Clauses)

Tender

Stakeholders
- Developers
- Professional Services
- Procurement Specialists

Strategies
- Reuse and adaptive reuse
- Dematerialisation
- Designing in layers
- Design for modularity and flexibility
- Design for lifespan
- Design for disassembly
- Material selection
- Product-as-a-service

*For projects with existing assets on site

Objective

To finalise design and invite contractor proposals for the project. At this stage, the team should use *Select and Award Criteria* (see Enablers and Tools) to assist prioritising the circular goals set in planning.

Core tasks
- ❑ **Communicate with the contractor:** Ensure the circular methods, techniques and Green Star targets in the tender documentation is clear
- ❑ **Clearly mark elements to be reused or adapted:** Ensure documentation outlines what elements are existing and how they are to be integrated*
- ❑ **Create a Select and Award framework**: Include metrics to evaluate bids on circularity and consult procurement policy to ensure organisational circularity and ESG targets are incorporated.
- ❑ **Include circularity vision and requirements in project documents and procurement clauses**
- ❑ **Establish data tracking methods:** Ensure circularity metrics can be tracked and reported on.

Deliverables
- ❑ **Select and Award Framework**
- ❑ **Project design and sustainability reporting** with document circularity initiatives included
- ❑ **Bill of quantities** with performance specifications
- ❑ **BIM model** containing environmental and circularity information
- ❑ **Procurement/contract documents** with requirements as outlined in this Guide

Construction and handover

Stakeholders
- Developers
- Owners
- Professional Services

Strategies
- Dematerialisation
- Design for modularity and flexibility
- Design for lifespan
- Design for disassembly
- Material selection
- Product-as-a-service

Objective

Ensure circularity is integrated and implemented in the construction phase, with documentation to support strategies. Upon completion, ensure documentation is in place for the use and decommissioning phases of the project.

Core tasks
- ❑ **Procure and install:** Refer to specifications for materials and components and ensure substitutions are approved.
- ❑ **Collect and verify:** Ensure technical specifications and certifications from suppliers and service providers are received and filed.
- ❑ **Inspect:** Ensure regular inspections to monitor progress and ensure circular specifications are being delivered
- ❑ **Track and report:** Work with project team to collect and report on circularity metrics
- ❑ **As-built documentation:** Include bills of quantities, disassembly plans, operation and maintenance manuals, warranties, etc. Provide digital access for stakeholders
- ❑ **Test all elements:** Ensure performance aligned to circularity specifications prior to handover

Deliverables
- ❑ **Sustainability Construction Report**
- ❑ **Digital database of materials and components** (e.g., materials passport). Store with As-Built documentation
- ❑ **As-built documentation** with circularity information
- ❑ **Updated impacts and circularity assessment reports**
- ❑ **Building operation & maintenance guidelines** with **Asset Management Plan**

Use & operation

Stakeholders
- Asset Managers
- Tenants and Occupants
- Leasing Agents

Strategies
- Design for modularity and flexibility
- Design for lifespan
- Product-as-a-service

Objective

Ensure ongoing optimisation of resource efficiency throughout the building's operation by monitoring performance, maintenance and repair, extending asset lifespan.

Core tasks
- ❑ **Integrate circularity:** Include in the Asset Management Plan and other maintenance scheduling
- ❑ **Educate building occupants:** Provide information about the circular features of the building
- ❑ **Provide detailed information:** Ensure maintenance staff can repair materials, and log them in maintenance schedules
- ❑ **Update As-Built documentation:** Ensure any changes to the building (e.g., repairs, maintenance, upgrades) are documented
- ❑ **Track, monitor, record and report:** Provide information on the building's circularity performance and operational ratings to relevant stakeholders.

Deliverables
- ❑ Current As-builts and materials database
- ❑ **Building circularity performance reports** (water, energy, and waste)
- ❑ **NABERS Upfront Carbon ratings** or **Green Star Performance** ratings

End-of-use & decommissioning

Stakeholders
- Investors
- Asset Managers
- Authorities
- Demolition & recycling business

Strategies
- Design for disassembly
- Product-as-a-service

Objective

Ensure disassembly and material recovery are executed to the disassembly plan.

Core tasks

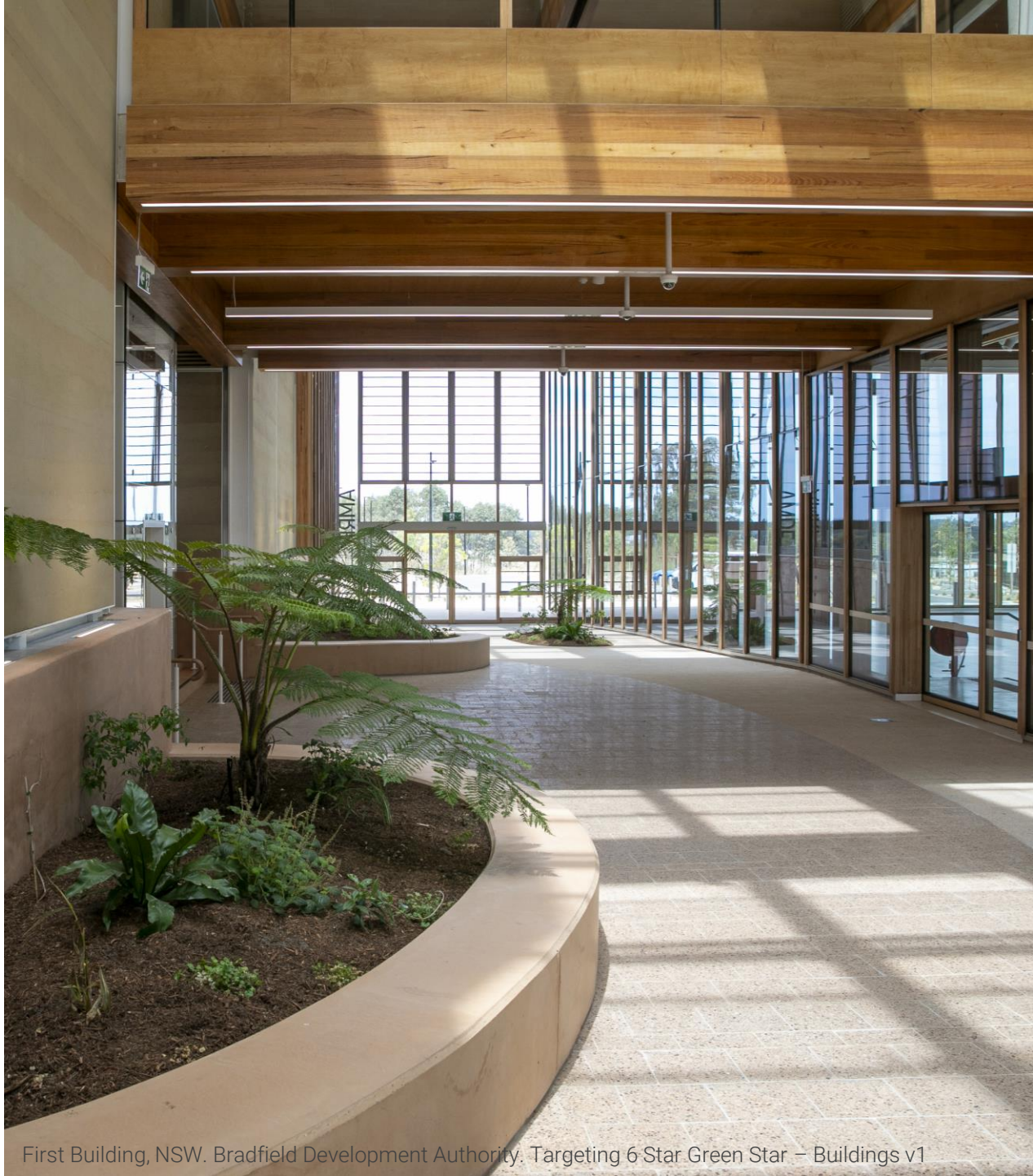
- ❑ **Conduct a pre-decommissioning audit:** Identify materials pre-deconstruction and demolition.
- ❑ **Develop a logistics plan:** Identify how materials could be used post-deconstruction and demolition
- ❑ **Update materials database**: Complete as part of pre-decommissioning audit
- ❑ **Engage with take-back schemes and product-as-a-service providers:** Organise product and material recovery
- ❑ **Disassemble**: Follow the disassembly plan for the building and its elements
- ❑ **Report:** Track the destination of materials

Deliverables

- ❑ **Procurement documentation** with circularity requirements
- ❑ **Report** with destination of materials

End of use considerations

Upon deciding the building is no longer of use to the current set of users, seek to understand options to ensure it is retained at highest best value. Options may include adapting for new use, renting or selling. See the Midtown Centre case study.



First Building, NSW. Bradfield Development Authority. Targeting 6 Star Green Star – Buildings v1

Circular Procurement clauses

This section provides key inclusions for briefs from feasibility to operation as well as procurement clauses to support circularity. Whilst not exhaustive, these items offer the greatest impact on circular outcomes. Project teams should align selections with strategic objectives and collaborate with procurement and legal teams to ensure alignment with organisational policies and practices.

Please note: As documentation will vary from project to project, so too will how circularity and sustainability are addressed. While briefs often include a separate "Sustainability" section, integrating circularity throughout the document improves visibility and execution. This is crucial, as circularity may be unfamiliar to some stakeholders and is inherently linked to other strategies like structural design and embodied carbon.

Brief language

Circular Activity	Wording to assist with planning and procurement
Conduct circularity audit	Evaluate existing structure/s and elements on site for reuse or adaptive reuse. Including but not be limited to: • Structural components (steel beams, timber joists, beams etc., concrete slabs) • Façade / envelope (windows, doors, roofs, cladding) • Systems including mechanical, electrical, and plumbing components (pipes, wiring, ducting, air handling, air conditioning units) • Finishes (tiles, flooring, partitions, ceiling linings, fixtures, joinery)
Assess material salvage and storage options	• Develop strategy for safely removing, storing, and transporting reusable materials • Collaborate with stakeholders for testing and recertification of items where necessary (ie structural, electrical elements)
Consider product-as-a-service in project budgets	• Consider the feasibility of utilising product-as-a-service within the project • Collaborate with suppliers to enable ease of design integration • Ensure project planning and budget documentation allows for this across the building's life cycle
Documentation and reporting	• Produce an audit report from the site assessment • Complete an inventory of all salvaged materials, including their source, condition, and intended use in the new project • Collect specifications of all product-as-a-service items to provide to design team • Provide progress updates and final reports on opportunities for reused materials (both on and off site) in the project

The brief outlines the project's goals, budget, and deliverables and aligns the client, consultant and project team.

Contract language

The supplier/contractor shall...	
Circular strategies	"...ensure elements are procured and delivered to provide the desired circular outcomes in line with the brief."
Circularity audit	"...conduct an audit to evaluate and prioritise the reuse of existing assets, materials, or components. A final report must be delivered to the developer as part of the execution of the contract."
Assess for reuse	"...inspect and assess existing assets and materials to determine their suitability for reuse in accordance with project requirements and technical specifications." "...refer to material banks and marketplaces for secondary products and materials to be incorporated in the project." "...submit a detailed plan outlining the intended use of reused and reusable assets or materials, expected benefits (cost, avoided carbon emissions), and compliance with technical, safety, and operational considerations of the project."

Procurement clauses ensure outcomes are procured to the brief and help to mitigate legal and reputational risks.

Compliance and Regulation

It is essential that project teams apply due diligence and ensure all inclusions and clauses comply with applicable building codes and standards, regulation and/or legislation.

Planning - Procurement clauses

Brief language

Conduct circularity audit	Evaluate existing structure/s and elements on site for reuse or adaptive reuse. Including but not be limited to: • Structural components (steel beams, timber joists, beams etc., concrete slabs) • Façade / envelope (windows, doors, roofs, cladding) • Systems including mechanical, electrical, and plumbing components (pipes, wiring, ducting, air handling, air conditioning units) • Finishes (tiles, flooring, partitions, ceiling linings, fixtures, joinery)
Assess material salvage and storage options	• Develop strategy for safely removing, storing, and transporting reusable materials • Collaborate with stakeholders for testing and recertification of items where necessary (ie structural, electrical elements)
Consider product-as-a-service in project budgets	• Consider the feasibility of utilising product-as-a-service within the project • Collaborate with suppliers to enable ease of design integration • Ensure project planning and budget documentation allows for this across the building's life cycle
Documentation and reporting	• Produce an audit report from the site assessment • Complete an inventory of all salvaged materials, including their source, condition, and intended use in the new project • Collect specifications of all product-as-a-service items to provide to design team • Provide progress updates and final reports on opportunities for reused materials (both on and off site) in the project

Contract language

The supplier/contractor shall…

Circular strategies	"…ensure elements are procured and delivered to provide the desired circular outcomes in line with the brief."
Circularity audit	"…conduct an audit to evaluate and prioritise the reuse of existing assets, materials, or components. A final report must be delivered to the developer as part of the execution of the contract."
Assess for reuse	"…inspect and assess existing assets and materials to determine their suitability for reuse in accordance with project requirements and technical specifications." "…refer to material banks and marketplaces for secondary products and materials to be incorporated in the project." "…submit a detailed plan outlining the intended use of reused and reusable assets or materials, expected benefits (cost, avoided carbon emissions), and compliance with technical, safety, and operational considerations of the project."

First Nations practices

Where possible, engage First Nations Peoples early. Their insights can inform planning, material selection, and long-term stewardship.

Refer to Designing with Country by Government Architect NSW.

Design - Procurement clauses

Brief language

Dematerialisation	• Collaborate with stakeholders to reduce material use and specify lighter, space-efficient materials. • Design layouts that use less material without sacrificing space or functionality • Explore alternative materials with higher strength-to-weight ratios to reduce overall material volume

Design for disassembly	• Ensure system accessibility for easy removal of wiring, plumbing, and components at end-of-life or during maintenance.
	• Prioritise mechanical fasteners like screws and bolts to enable disassembly and reconfiguration.
	• Develop a disassembly plan, including:
	  • Detailed diagrams showing how major components and systems can be disassembled.
	  • Specifications for reversible connections and assembly methods.
	  • Recommendations for handling, storing, and transporting disassembled components for reuse or recycling potential.
	  • Integrate Building Information Modelling (BIM) or similar to document the building's disassembly strategy, including the location and specifications of all major components, connection methods, and material compositions. The BIM model shall be updated throughout the project lifecycle and issued to the Principal upon completion."

Design for lifespan	• Design for disassembly to enable efficient reuse, recycling, or repurposing of components at end-of-life. • Select adaptable systems (e.g., MEP, electrical, plumbing) that allow upgrades or expansions without major disruptions to other layers of the building. • Ensure climate resilience by aligning the design with the project's climate resilience plan. • Avoid over-engineering to balance durability, material efficiency, and embodied carbon.
Design for flexibility	• Plan key locations (e.g., plumbed areas, lifts, stairs) to support future floor plan changes. • Ensure internal spaces (e.g., meeting rooms, common areas, workstations) can be adapted to suit future needs. • Design building systems (electrical wiring, data networks, plumbing) that are accessible and adaptable for future needs. • Design for the potential addition of new technologies, such as smart building systems or renewable energy solutions. • Prioritise mechanical fasteners, joints, and connections designed for disassembly and reconfiguration. This includes using screws, bolts, and other removable fasteners rather than permanent fixtures.

Writing a Building Disassembly Plan

A guide was developed by Built and Coreo, to assist building projects of all sizes to write a disassembly plan, including a template and questionnaire. See the guide here.

Design - Procurement clauses (continued)

Brief language

Design for modularity	• Establish a modular design strategy by dividing the building into standardised, interchangeable modules (e.g., structural, mechanical, spatial) designed for easy assembly and disassembly with minimal disruption. • Use modular components like partitions, HVAC systems, and ceilings to enable upgrades, repairs, or removal without affecting other building layers. • Standardise components such as wall panels, structural supports, windows, and doors for easier installation and adaptation during the building's use phase.
Low impact materials	Prioritise the selection of materials that: • Disclose their impacts through Environmental Product Declarations (EPDs) or similar. • Are third party certified for lower social and environmental impacts. Refer to the GBCA's responsible products program for guidance. • Require fewer resources to produce and are durable. • Do not contribute to environmental harm, such as those that are toxic, non-biodegradable, or difficult to reuse or recycle. • Are from renewable sources and can regenerate naturally within a reasonable time frame. • Are from secondary or recycled sources to minimise resource extraction and waste. • Are materially efficient through precise manufacturing, prefabrication, and modular systems.
Material reuse integration	• Collaborate with design and construction teams to ensure the compatibility and integration of reused materials. • Identify alternative uses for materials that cannot be used within the project including listing on marketplaces.
Material selection	Investigate and select materials that: • Offer enhanced performance and durability. • Support selected circular strategies in the project ie lifespan, modularity, disassembly, reuse. • Require minimal finishes ie products that make use of the raw designed surface over those that require regular re-finishing. • Can be easily sourced and/or replicated to ensure cost efficiency and consistency in the building's construction. • Are third party certified and disclose their impacts. Refer to the GBCA's responsible products program for guidance. • Ensure material selection considers unwanted consequences.

Tradeoffs and unintended consequences

When considering the design and procurement for the project, it's important to manage unintended consequences through strategies such as digital twins and careful collaboration with the project team.

Design - Procurement clauses (continued)

Brief language

Product-as-a-service (PaaS)	• Identify components or systems suitable for as-a-Service models, such as lighting, HVAC, vertical transportation, furniture, or flooring, considering maintenance complexity, on-site team skills, and lifespan. • Collaborate with PaaS suppliers to ensure the building is designed for maintenance and upgrades throughout its lifecycle.
Documentation and reporting	• Maintain detailed records of design changes, material selections, and construction methods • Report on the implementation and success of circular strategies, including outcomes and lessons learnt • Provide clear and detailed documentation for the disassembly process • Provide solution for capturing information on the origin and reuse potential of materials (e.g material passports, labelling etc) • Include guidance for managing the deconstruction and recovery of materials, including product stewardship schemes

Contract language

The supplier/contractor shall…

Circular strategies	"…ensure elements are procured and delivered to achieve the desired circular outcomes outlined in the brief." "…seek approval for deviations from circular performance outcomes if materials or products are impractical, unavailable, or cost-prohibitive." "…maintain detailed records of changes, material selections, and construction methods." "…record variances in the materials specified in the design stage of the project." "…report on the implementation and success of circular strategies, including outcomes and lessons learnt." "…provide information on the sourcing, operation and disassembly of all products and materials in line with the brief." "…prepare and submit reports on key deliverables included in the brief such as % reused materials utilised in the project."
Product-as-a-service (Paas)	"… design and enable components or systems within the building that are suited for as-a-Service models considering factors like complexity and schedules of maintenance, skills required by on-site maintenance teams, and lifespan." "…collaborate with PaaS suppliers to ensure the building is designed for the products or systems to be maintained or upgraded over the lifecycle of the building."

Tender - Procurement clauses

BriefILanguage

Dematerialisation	• Provide materials in line with dematerialisation strategies. Materials should be light and space/transport efficient • Seek Principal's approval for proposed substitutions should specified materials be unavailable or unsuitable
Design for disassembly	• Allow for mechanical fasteners, joints, and connections that are designed to facilitate disassembly, reconfiguration etc, including using screws, bolts, and other removable fasteners rather than permanent fixtures. • Allow for ease of access to systems to enable the straightforward removal of wiring, plumbing, and other components at the end of the building's life.
Design for lifespan	• Ensure infrastructure and systems are installed (e.g., MEP systems, electrical and plumbing) to be upgraded or expanded without requiring major works to other building layers • Build to be resilient to changing climate conditions. Align with climate resilience plan • Resist over-engineering of building elements to ensure balance of lifespan with material efficiency and embodied carbon
Design for flexibility	• Detail and construct plumbed areas and access points (e.g., lifts, stairs, circulation) to support future floor plan changes. • Design internal spaces (e.g., meeting rooms, common areas, workstations) to allow adaptability for changing needs. • Ensure building systems (e.g., wiring, data networks, plumbing) are accessible and adaptable for future upgrades or advanced technologies. • Use mechanical fasteners like screws and bolts to enable easy disassembly and reconfiguration, avoiding permanent fixtures.
Design for modularity	• Implement a modular design strategy, dividing the building into standardised, interchangeable modules (e.g., structural, mechanical, spatial) designed for easy assembly and disassembly with minimal disruption. • Incorporate modular components and systems (e.g., partitions, HVAC, ceilings) that enable easy upgrades, repairs, or removal without impacting other building layers. • Use standardised components (e.g., wall panels, structural supports, windows, doors) to simplify installation and adaptation during the building's use phase.

Tender - Procurement clauses (continued)

Brief language

Low impact materials	Select materials that: • Disclose their impacts through Environmental Product Declarations (EPDs) or similar. • Are third party certified for lower social and environmental impacts. Refer to the GBCA's responsible products program for guidance. • Require fewer resources to produce and are durable. • Do not contribute to environmental harm, such as those that are toxic, non-biodegradable, or difficult to reuse or recycle. • Are from renewable sources and can regenerate naturally within a reasonable time frame. • Are from secondary or recycled sources to minimise resource extraction and waste. • Are materially efficient through precise manufacturing, prefabrication, and modular systems.
Material reuse integration	• Integrate reused materials into the new construction • Collaborate with design and construction teams to ensure the compatibility and integration of reused materials with new materials
Material selection	Specify materials that: • Offer enhanced performance and durability • Support selected circular strategies in the project ie lifespan, modularity, disassembly, reuse • Require minimal finishes ie products that make use of the raw designed surface over those that require regular re-finishing • Can be easily sourced and/or replicated to ensure cost efficiency and consistency in the building's construction • Are third party certified or disclose their impacts. Refer to the GBCA's responsible products program for guidance • Ensure material selection considers unwanted consequences
Product-as-a-service (Paas)	• Co-ordinate with PaaS suppliers to ensure the building is delivered for products or systems to be installed, maintained, and upgraded over the lifecycle of the building

Tender - Procurement clauses (continued)

Brief language

Documentation and reporting	• Maintain detailed records of design changes, material selections, and construction methods • Report on the implementation and success of circular strategies, including outcomes and lessons learnt • Provide clear and detailed documentation for the disassembly process • Provide solution for capturing information on the origin and reuse potential of materials (e.g material passports, labelling etc) • Include guidance for managing the deconstruction and recovery of materials, including product stewardship schemes

Contract language

The supplier/contractor shall…

Circular strategies	"…ensure elements are procured and delivered to provide the desired circular outcomes in line with the brief." "…seek approval for deviations from circular performance outcomes if materials or products are impractical, unavailable, or cost-prohibitive." "…maintain detailed records of changes, material selections, and construction methods." "…record variances in the materials specified in the design stage of the project." "…report on the implementation and success of circular strategies, including outcomes and lessons learnt." "…provide information on the sourcing, operation and disassembly of all products and materials in line with the brief." "…prepare and submit reports on key deliverables included in the brief such as % reused materials utilised in the project."
Product-as-a-service (Paas)	"…implement the "Product-as-a-Service" (PaaS) model for [selected building components and systems]" "…enter into/facilitate establishment of service agreements with qualified providers to supply, maintain, monitor and upgrade these components or systems as part of the PaaS model. These agreements must specify: • Performance standards and key performance indicators (KPIs) • Maintenance schedules and responsibilities • Terms for review, repair, replacement, and end-of-life recovery • Service duration and renewal options." "…ensure that products provided under the PaaS model are designed for durability, repairability, and reuse. Providers shall retain ownership of the products, enabling full recovery, refurbishment, or recycling at the end of the service term." "…provide a comprehensive PaaS implementation plan for approval by the Procuring Entity, including: • A list of components or systems provided under PaaS • Details of service agreements, including providers and contractual terms." "…document sustainability and circularity metrics associated with the PaaS model."

Construction - Procurement clauses

Enabling reuse

Permanent fixtures such as adhesives and welds limit the potential for reuse.

Brief language

Dematerialisation	• Collaborate with stakeholders to reduce material use and specify lighter, space-efficient materials.
Construction techniques	• Develop plan to ensure the building's components are built and assembled for flexibility, modularity or reuse, as designed • Adopt construction methods that reduce material waste, such as prefabrication, advanced assembly, and optimised cutting • Use construction methods that ensure structural integrity, durability and weather-resistance • Select fixings that are mechanical rather than chemical where possible to enable replacement
Develop plan for material reuse integration	• Integrate reused materials and ensure compatibility with new components
Material selection	• Confirm selected materials offer enhanced performance and durability whilst maintaining repairability, disassembly and reuse. • Ensure material selection considers unwanted consequences
Documentation and reporting	• Provide detailed documentation of materials, and construction methodology and integrate with disassembly plan • Develop an on-site resource management plan to ensure materials are reused/recycled as possible • Include detailed operation and maintenance manuals on building layers so that that building operators can easily modify the space during maintenance or works associated with future upgrades or changes

Contract language

The supplier/contractor shall…

Circular strategies	"…ensure elements are installed or constructed to provide the desired circular outcomes in line with the brief." "…seek approval for deviations from circular performance outcomes if materials or products are impractical, unavailable, or cost-prohibitive." "…work with Product as a Service providers to ensure products and systems are installed and perform correctly." "…maintain detailed records of changes, material selections, and construction methods." "…report on the implementation and success of circular strategies, including outcomes and lessons learnt." "…provide information on the sourcing, operation and disassembly of all products and materials in line with the brief." "…prepare and submit reports on key deliverables included in the brief such as % reused materials utilised in the project."

Use & operation - Procurement clauses

Brief language

Product-as-a-service (PaaS)	• Implement monitoring systems to track the performance of PaaS components, ensuring they meet performance standards and can be easily serviced or replaced when necessary
Repair and maintenance	• Ensure any repair, maintenance and renovation work is carried out in line with operations and maintenance manuals to ensure the best outcomes of the systems • Ensure the building and its component modules are disassembled and reconfigured, with minimal disruption to overall structure • Modify any building systems (electrical wiring, data networks, plumbing) to be accessible and adaptable for future needs such as integration of automated systems or advanced building technologies • Consider reusing standardised elements (e.g., wall panels, structural supports, windows, doors) as part of a renovation or reconfiguration of the building or its components
Documenting and reporting	• Maintain comprehensive records of all products, systems, and service agreements involved in the PaaS model, ensuring transparency and tracking of performance. • Attend periodic meetings with PaaS providers to ensure the performance and data management of the system. • Update As Built drawings or BIM models following reconfiguration or renovation of the building

ContractlLanguage

The supplier/contractor shall…

Circular strategies	"…ensure elements are installed or constructed to provide the desired circular outcomes in line with the brief." "…ensure all work is carried out in line with the requirements of building's design and its operations and maintenance manual." "…seek approval regarding circular performance outcomes prior to procurement should products and materials require not be practical, available or cost effective." "…maintain detailed records of changes, material selections, and construction methods." "…report on the implementation and success of circular strategies, including outcomes and lessons learnt." "…provide information on the sourcing, operation and disassembly of all products and materials in line with the brief." "…prepare and submit reports on key deliverables included in the brief such as % reused materials utilised in the project." (refer to Appendix D)

End of use - Procurement clauses

Brief language

Disassembly and deconstruction	• Ensure any final repair and maintenance work is carried out in line with operations and maintenance manuals to ensure the best outcomes of the systems for future reuse. Ensure disassembly considers planned next strategy ie reuse, adaptation, recycling • Contact marketplaces to understand opportunities for elements to be purchased. Understand how value can be maximised – refer to budget as necessary to confirm where this may have been assigned • Ensure the building and its components, modules and systems are disassembled with careful attention to manuals and plans for reuse, in line with disassembly plans and up to date as-built documentation • Ensure all material passports and other documentation is transferred to new owners or users

The supplier/contractor shall…

Contract Language

Disassembly and deconstruction	"…ensure elements are disassembled or demolished to provide the desired circular outcomes in line with the brief." "…ensure all deconstruction work to systems is carried out in line with operations and maintenance manuals." "…handover detailed records and material passports where available for all salvaged components and systems." "…report on the implementation and success of circular strategies, including outcomes and lessons learnt."

CASE STUDY: Uniting on Second – Bowden

Targeting 5 Star Green Star Buildings v1

Location: Bowden, Kaurna Country, South Australia

Context

Building typology
Multi-level residential affordable housing

Developer
Uniting SA

Builder
Kennett Builders

Architect
City Collective

Circular Strategies
Design for disassembly and reuse.

Buildings as material banks (BAMB)

Kennett Builders have partnered with the University of Adelaide and dsquared Consulting to trial a material bank on three residential developments including Uniting on Second – Bowden.

Most of a building's environmental impacts are generated prior to operation. Then, often at the end of a building's life, high value building materials are down-cycled or sent to landfill. Kennett seeks to change this with their material bank initiative, the first of its kind in Australia. The process involves tagging existing building materials with QR codes, incorporating them into BIM modeling, and then making the products available for use on future projects through material banks.

The Uniting on Second project has focused on tagging and tracking materials that are large, high value, and that are designed for disassembly including steel frames, solar panels and precast panels; these panels alone were valued at $3.7m - 10% of the project's value - showcasing the cost and carbon savings that can be made on future projects.

> "With resource constraints in industry over the next 5, 10, 15 years, Material Banks will help alleviate productivity issues, so we can build more with less because we've already manufactured the material.
>
> ANTHONY CARBONE | General Manager, Kennett Builders

Challenges

Kennett shared several challenges they faced at the Uniting on Second project, with suggestions on how to overcome them:

1. Risk that reused structural products fail on future projects - Test the strength and load levels of materials at end of use to ensure the product complies on the next project.
2. 30 - 40 year wait time for new buildings entering the program to be ready for reuse - For this initiative to reach critical mass, existing buildings need to be carefully deconstructed, tagged, and added to the material bank.
3. Logistics between disassembled buildings and new projects – Set up and train disassembly teams, removalists, storage sheds and logistic facilities to manage reused materials. These need to be set up today, to deal with future demand.
4. Custodians of material bank data – Uniting SA are currently the custodians of the data however Kennett is advocating for the federal government to hold the digital bank, whilst they maintain the physical bank.

Next steps

The potential of a new industry around material banks is high and Kennett expects both employment and the economy are set to benefit, along with new partnerships between government and industry.

Next, Kennett hope to continue innovating the material bank by moving from physical tagging to RFID technology (Radio Frequency Identification). A shift to RFID will require significant investment and Kennett is seeking funding to understand the longitudinal economic impact of the material bank.

GBCA are proud to acknowledge that the Material Bank initiative is being used to target the Leadership Challenge under Green Star - Buildings v1.

CASE STUDY: Midtown Centre

6 Star Green Star – Design & As Built v1.1

Location: Brisbane, Yuggera and Turrbal Country, Queensland

Context

Building typology
Commercial office

Developer
InDeMa Properties

Builder
Hutchinson Builders

Architect
Fender Katsalidis

Circular Strategies
Adaptive reuse

Reimagining redevelopment

Demonstrating that re-development doesn't always require extensive demolition work, Midtown Centre utilised the existing site by reusing and enhancing the two 20-level government buildings, known fondly as the 'Ugly Sisters' by Brisbane's property community.

Challenges

This project set out to achieve a PCA 'A Grade' building plan, targeting its sustainability credentials. However, the two existing 1980's designed buildings posed many challenges.

The site necessitated intensive investigatory works. Additional testing, surveying and design were required to determine if the building could:

- achieve the new standard for 2.7m high ceilings
- connect the two buildings at every level and add more floors
- satisfy Council that the heritage listed façade be preserved

Finally, the building needed to be respected and credible in the market; using the legacy of the original asset and adding amenity to the local area that . This was achieved by providing a compelling on-floor amenity and public realm offering, with a highly curated 100m long pedestrian cross-block link through the buildings from Charlotte Street to Mary Street.

Midtown Centre retained more than 50,000 tonnes of concrete and 3,600 tonnes of steel, reducing its carbon footprint by the equivalent of 11,000 tonnes of carbon dioxide.

Benefits

Despite the upfront costs to clarify the viability and condition of the existing buildings, there were numerous benefits to this adaptive reuse project:

1. Speed to market – approx. 35% faster project delivery. A major point of difference was the reduced build time, by avoiding significant demolition.
2. Cost efficiency – approx. 30% saving compared to a new build.
3. Embodied energy – 49% saving in upfront carbon.

Next steps

Acknowledging that every new project comes with its own challenges, InDeMa Properties are taking their learnings from Midtown Centre and are now applying the same principles of adaptive reuse to 450 Queen Street, Brisbane.

CASE STUDY: First Building - Bradfield City Centre

Targeting 6 Star Green Star Buildings – v1

Location: Bradfield, Dharug Country, New South Wales

Context

Building typology
Government and manufacturing facility

Developer
Bradfield Development Authority, NSW Government

Builder
Taylor Construction

Architect
Hassell

Circular Strategies
Design for disassembly, material selection.

Circularity for a resilient future

The First Building in Bradfield City Centre is an industry innovation hub housing Stage 1 of the Advanced Manufacturing Readiness Facility. With an advanced manufacturing hall, workspaces and public atrium, First Building provides world-class manufacturing support in the heart of Western Sydney

Designed by Hassell, and informed by Indigenous narratives of Country from Djinjama, First Building was designed as a modular kit-of-parts. It can be disassembled, expanded, or relocated, ensuring its resilience to the evolving needs of the city.

The building also utilises a combination of materials that that low-impact and/or enable disassembly:

- **Timber** Australian hardwood from renewable sources was selected for its strength properties that meet long spans over the manufacturing hall within strict deflection criteria. The innovative timber roof and structure was efficiently installed on site with mechanical fixings to enable future disassembly.
- **Bamboo** –FSC-certified bamboo from was used for the façade louvres. The bamboo sourced from House of Bamboo is part of product stewardship program, the company taking the product back for repurposing.
- **Steel** - The steel components, including the core, utilise mechanical fastenings to allow the core and full superstructure to be disassembled. The steel structure was installed in 2 weeks, delivering program efficiency.
- **Green Ceramics –** Bespoke ceramic tiles in collaboration with UNSW SMaRT Centre MICROfactorie™ composed of recycled fabric and glass.
- **Carpet** – Selected carpet tiles by Interface, designed in collaboration with Marrwari and Euahlayi artist Danielle Mate. As a part of Interface's ReEntry program, the 100% recycled carpet can be reused at the end of its lifecycle.

Challenges

- **Realisation of concept to reality** – Designing the building's superstructure to be disassembled was the project's greatest challenge. Aligning the building's concept to the sustainability ambitions for the new city of Bradfield allowed the team to realise the structural concept, managing the desire on site to revert to more conventional, welded connections.
- **Understanding capacity and capability of the timber industry** - Designing mass timber buildings requires a number of considerations including available species, size of timbers and other technical considerations can vary widely depending on the material source and factory location. Working at an early stage with the contractor helped align the design intent with the ideal material, source and detail.

Next steps

First Building officially opened in March 2025 . The development of Bradfield, Australia's newest city in 100 years, will continue with the Second Building and a 2-hectare Central Park, all connected within five minutes Metro ride to the new Western Sydney International Airport. Sustainability and climate resilience will be embedded into all aspects of Bradfield's design and development, continuing the high benchmark set by the First Building.

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Appendix A - Progress of circularity in Australia

In addition to national circularity initiatives, the government bodies that funded this paper provided key procurement documents to set the scene for the progress of circularity in Australia.

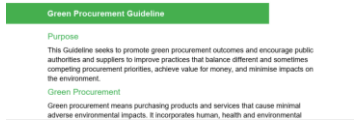
NSW Government Procurement Policy Framework

Sets out the policy and operating framework for the NSW public sector procurement system. The framework includes procurement goals, and the policies that support them. The objectives are as follows:

1. Value for money: Balancing financial and non-financial factors such as quality and cost
2. Fair and open competition: Ensuring opportunities for suppliers through transparent, competitive processes.
3. Easy to do business: Making procurement simpler, easier and more efficient.
4. Innovation: To assist government to work smarter and deliver better services.
5. Economic development, social outcomes: Support economic participation, social outcomes, develop skills and local create jobs.

Supporting the circular economy - South Australia's Waste Strategy 2020-2025

Outlines actions that can contribute to the development of a circular economy through advancing waste management and resource recovery. Its goals include driving innovation in the green industry sector, supporting local businesses to become more resource-efficient and competitive, and enhancing environmental sustainability.



Green Procurement Guideline – Procurement SA

This guide acknowledges that public authorities have influence through their purchasing power, and with that can encourage suppliers to adopt practices to achieve value for money and minimise impacts on the environment. Public authorities are encouraged to continuously improve green procurement goals, policies, and outcomes, ensure staff are equipped to implement these throughout the procurement process, and process are set up to reduce, repair, reuse or recycle goods.

Queensland Procurement Strategy 2023

This strategy builds upon the Buy Queensland initiative, aiming to use government procurement as a tool to drive economic, social, ethical, and environmental outcomes. The strategy sets a framework to create:

- Quality local jobs
- Thriving, resilient and decarbonised economy
- Responsible intergenerational value
- Trust in procurement

Appendix B - Circularity in Green Star

Direct

Indirect

Green Star Buildings v1

Credit	Outcome	Direct / Indirect Circularity Relationship
Responsible Construction	The builder's construction practices reduce impacts and promote opportunities for improved environmental and social outcomes.	Direct
Responsible Procurement	The procurement process for key products, materials, and services for the building's design and construction follows best practice environmental and social principles.	Direct
Responsible Structure	The building's structure is comprised of responsibly manufactured products.	Direct
Responsible Envelope	The building's envelope is comprised of responsibly manufactured products.	Direct
Responsible Systems	The building's mechanical, hydraulic, transportation and electrical systems are comprised of responsibly manufactured products.	Direct
Responsible Finishes	The building's internal finishes are comprised of responsibly manufactured products.	Direct
Exposure to Toxins	The building's occupants are not directly exposed to toxins in the spaces they spend time in.	Indirect
Upfront Carbon Emissions	The building's upfront carbon emissions from materials and products have been reduced and offset.	Direct
Life Cycle Impacts	The building has lower environmental impacts from resource use over its lifespan than a typical building.	Direct
Indigenous Inclusion	The building celebrates Aboriginal and Torres Strait Islander people, culture, and heritage .	Indirect
Impacts to Nature	Ecological value is conserved and protected.	Indirect
Biodiversity Enhancement	The building's landscape enhances the biodiversity of the site.	Indirect
Nature Stewardship	Biodiversity is restored beyond the building site.	Indirect
Leadership Challenge – Circular Economy	Celebrates initiatives or outcomes that are deemed new and break barriers, and in turn inspire others to follow.	Direct

Appendix B - Circularity in Green Star

Direct

Indirect

Green Star Communities v2

Credit	Outcome	Direct / Indirect Circularity Relationship
Responsible Construction Practices	Consistent environmental best practice is embedded throughout clearing and site preparation, excavation, demolition and construction activities.	
Responsible Procurement	The procurement process for key products, materials, and services for the planning, design and construction of the precinct follows best practice environmental, social and circular principles.	
Responsible Services Infrastructure	The precinct's services infrastructure is built with responsibly manufactured products and materials.	
Responsible Public Realm Hardware	The precinct's public realm hardware is comprised of responsibly manufactured products and materials.	
Responsible Civil Works	The precinct's civil works are built with responsibly manufactured products and materials.	
Sustainable Buildings	The precinct has sustainable buildings.	
Healthy Buildings	The precinct has buildings that promote the health of occupants.	
Upfront Carbon Reduction	The precinct's upfront carbon emissions from materials and products and construction practices have been reduced and offset.	
Upfront Carbon Compensation	Remaining upfront carbon emissions are measured and compensated for with nature-based solutions.	
Life Cycle Impacts	The precinct has lower environmental impacts from resource use and construction than a typical precinct.	
Positive Buildings	The precinct has water and energy efficient buildings built with lower upfront carbon emissions.	
Design with Country	Culture and connection to Country is integrated into the precinct's planning, design and ongoing management, ensuring that First Nations Peoples lead and benefit from the development of the precinct.	
First Nations Inclusion	Cultural leadership by Aboriginal and Torres Strait Islander Peoples' is embedded in the project.	
Sensitive Site Protection	The precinct does not significantly impact sensitive sites or sensitive species.	
Impacts to Nature	Impacts to biodiversity and ecosystems are minimised during construction and operation of the precinct.	
Biodiversity Enhancement	Biodiversity in the precinct is maintained and enhanced.	
Nature Stewardship	The project contributes to the long-term protection, management, improvement and restoration of ecosystems in Australia.	
Leadership Challenge – Circular Economy	Promotes achievements that are considered leading practice in Australia	

Appendix C – Guidance & Tools

Guidance/Tool	Description
Green Star Buildings	A holistic tool that extends beyond the environment to address the issues that will define the next decade of the built environment. The tool's 8 categories enable owners and developers to act on the areas of sustainability that matter most. These categories include Responsible, Healthy, Resilient, Positive, Places, People, Nature and Leadership. See appendix B for the relevant circularity credit.
NABERS Embodied Carbon	Enables eligible new buildings and partial rebuilds to measure, verify, and compare their upfront embodied carbon with similar buildings. The tool provides a certified measure of carbon intensity, incorporating material, transport and construction emissions. Where enough benchmarking data is available the rating will include a star rating result
National Framework for Recycled Content Traceability	Aims to boost confidence in recycled materials, by guiding the collection and sharing of information. It enables Australian governments to set consistent expectations and supports industry to meet these.
EN 15804	The most widely used global reporting standard for Environmental Product Declarations (EPDs) in the construction industry. An EPD is an independently verified and registered document that communicates transparent and comparable data. In 2019, a significant update (EN 15804+A2) was released that is now mandatory.
EU Level(s)	A common language for assessing and reporting on the sustainability performance of buildings. It is a simple entry point for applying circular economy principles in our built environment.
EN 15978	Specifies the calculation method, based on Life Cycle Assessment (LCA) and other quantified environmental information, to assess the environmental performance of a building and its site, and gives the means for the reporting and communication of the outcome of the assessment. The standard is applicable to new and existing buildings and refurbishment projects.
Madaster	Manages construction materials flows throughout their lifecycle. The system also tracks and documents materials, turning them into valuable assets for reuse. This approach helps meet financial, regulatory, and environmental goals while conserving non-renewable resources and transforming each project into a sustainable resource hub.
ISO 59020	Sets forth requirements and guidance for organizations to measure and assess their circularity performance within defined economic systems. This document aims to standardise the process by which organisations collect and calculate data using mandatory and optional circularity indicators, ensuring consistent and verifiable results.
ISO 20887	An overview of design for disassembly and adaptability (DfD/A) principles and potential strategies for integrating these principles into the design process. This document provides information for owners, architects, engineers, and product designers and manufacturers to assist in their understanding of potential DfD/A options and considerations
ISO 15686-5	Requirements and guidelines for performing life-cycle cost (LCC) analyses of buildings and constructed assets and their parts, whether new or existing.
BSI Flex 279	Requirements for biodiversity outcomes suitable for inset and offset projects, including in terrestrial and marine habitats. It covers processes, characteristics of biodiversity outcomes, additionality, and change measures.
World Business Council for Sustainable Development (WBCSD)	Tools include: • Global Circularity Protocol (GCP) for Business is a framework to guide companies in target-setting, measuring, reporting and disclosing progress on resource efficiency and circularity, combined with comprehensive and targeted policy guidance to accelerate the shift toward circular business models and a regenerative economy. • Measuring circular buildings - Building on the existing CTI framework, this white paper proposes an approach for measuring circularity of buildings
GRI	GRI 306 Waste - A series of standards for organisations to report their socio-environmental practices. The standard for waste data disclosure is the closest one on circular economy aspects.

Appendix D - Circular metrics and descriptions

Common metrics	Metric	Description	Guidance/Tool
Construction and demolition waste diversion rate	% of waste	Percentage (by weight) of construction/demolition waste diverted from landfill (e.g., through reuse or recycling).	Green Star Responsible Construction and Responsible Construction Practices Credits
Percentage of certified products	% of value	Share of total building materials (by cost) that are third party certified	Green Star Responsible Products Credits
Upfront carbon	kg/CO2/m2	Carbon emissions from module A (as per EN15804) excluding biogenic carbon on a per square meter basis	NABERS Embodied Carbon tool
In development			
Waste generated	kg/m2	Amount of waste from construction and demolition per square meter of Gross Floor Area	Green Star Leadership Challenge or Global Reporting Initiative
Recycled or reused content	% of value	Share of total building materials (by cost) that contain post consumer recycled/reused content.	National Framework for Recycled Content Traceability or ISO59020
Upfront water use	Kg/L/m2	Water consumption metrics for materials and construction with module A (as per EN15804) as a boundary	EN15804 or Green Star Life Cycle Impacts
Emerging			
Reuse index	(out of 1)	Proportion of building elements (e.g., façade panels, structural steel) that are refurbished or repurposed from another site.	Circularity Calculator
Material intensity	Kg/m2	Total mass of materials used per unit of floor area (GFA). Lower intensity is a better result.	EN 15978 or ISO 59020
Material passport coverage	% of cost	Proportion of building components catalogued in a digital passport (tracking composition, origin, and potential for reuse).	Madaster
Products that can be disassembled	% of cost	Proportion of materials (against total value) that are designed for disassembly, recovery, and reuse	ISO 20887
Circular lifecycle cost (CLC)	Cost savings	An expanded whole-life costing approach factoring in salvage income, extended warranties, and material reuse revenues.	ISO 15686-5
Percentage of the building that can be disassembled	% of building value	Proportion of the building that can be disassembled at end of life as a proportion of total value	ISO 20887
Residual (Salvage) value assessment	% of construction costs	Estimate of recoverable material value at the end of the building's life, factoring in dismantling costs and market demand.	ISO 15686-5
Upfront nature	Land use	Amount of land degraded due to resource extraction or production	EN 15978 or Green Star Life Cycle Impacts
Material circularity indicator (MCI)	(out of 1)	Developed by the Ellen Macarthur foundation, MCI measures of how circular a product is. The closer to 1, the more circular.	Ellen MacArthur Foundation or ISO 59020
Circular transition indicator (CTI)	% material circularity	The weighted average of the % circular inflow and % circular outflow for a given building	WBCSD or ISO 59020

Appendix E – EU's Sustainable Finance Taxonomy Circular Economy Significant Criteria and Australia's real estate sector

In June 2023, the European Union introduced new Significant Criteria for Circular Economy for new buildings and existing building renovation. What this means is that for a financial instrument to be classified as 'sustainable' where the proceeds are directed to activities that assist the circular economy, these must comply with the criteria outlined in the taxonomy.

The EU's Taxonomy compass outlines the criteria in detail. In summary,

1. Construction and demolition waste landfill diversion rates of 90%
2. Whole life-cycle carbon emissions are calculated and disclosed to investors
3. The building is adaptable (e.g., flexible layouts, modular systems, accessible services, and clear documentation) and able to be disassembled (e.g., reversible connections, documented assemblies, and material labeling) as per the European Level(s) system
4. The three heaviest material categories (by kg) comply with strict raw material limits. For example, up to,
   - 70% of the concrete in the building comes from primary raw materials,
   - 30% of metals in the building comes for primary raw materials, and
   - 80% of timber is a primary raw material.

   The remainder proportion for each comes from re-use or recycled sources.
5. They must digitally record the as-built building (materials and components), for future maintenance and reuse (e.g., using EN ISO 22057:2022), share this information on demand, and preserve it).

Meeting the criteria outlined in the taxonomy in Australia presents genuine challenges, similar to those seen in Europe [17, 18].

Out of the five criteria in Australia, only the first two are applied in a meaningfully in Green Star rated buildings. The high construction and demolition waste diversion targets can be achieved in large metropolitan areas, and whole life carbon calculations have commonly been used in Green Star since 2012. However:

- Recent work from GBCA indicates that there are issues with how recycling rates are calculated in Australia, with impending changes planned in Green Star to shift to total waste generated calculations [19]
- After a review of whole life cycle analysis received since 2012, GBCA moved to upfront carbon reductions in the most recent tools, providing a more accurate picture of emissions, which relies on fewer assumptions.

Other requirements in the taxonomy are also challenging, even in Europe. It is not typical for the supply chain to report the amount of primary and secondary materials at a product level in a consistent manner. Because of this, the data received may not result in a change in the amount of recycled material in the supply chain, rather just a change in the way its accounted for. Material passports are still a novel concept, with no agreed standard as yet.

At this point, it is recommended that Australian financiers discuss green bonds intended to classify against this criteria with their intended recipient of proceeds to ensure that these issues are understood as there is a high risk of these not being easily achieved.

Appendix F – Guidance on circularity for the finance sector

To determine the metrics that could be used for financing circularity in the real estate sector, we conducted a scan of suggested circularity metrics and looked for commonalities. We then ranked them based on the maturity of their use in the Australian real estate sector. To determine the metrics used, we considered information in these documents:

- European Commission Categorisation System, European Commission
- Corporate Sustainability Reporting Directive (CSRD), European Commission
- EU Sustainable Finance Taxonomy Technical Screening Criteria (developed at sectoral level, *for certain sectors only),* European Commission
- Circular Economy Finance Guidelines, Dutch Banks ABN Amro, ING, Rabobank
- Financiamiento de Inversiones de Economía Circular (Methodology developed for Colombia), IADB, IDB Invest and BASE with Colombian banks Bancoldex, Bancolombia and Banco de Bogota
- Financing the Circular Economy: A Guidance Document for Canadian Financial Institutions, Circular Economy Leadership Canada in collaboration with UNEP FI
- Circulytics Mapping Circular Economy Indicators to EU reporting requirements, Ellen MacArthur Foundation
- Circular Transition Indicators, World Business Council for Sustainable Development (WBCSD)
- Harmonised Framework for Impact Reporting, International Capital Market Association (ICMA) Green Bond Principles Impact Reporting Working Group
- Financing circularity: Demystifying finance for circular economy, UNEP FI
- Circular Economy as an Enabler for Responsible Banking, UNEP FI
- Guidance on Resource Efficiency and Circular Economy Target Setting, UNEP FI
- Finance & Investment Rapid Review: Identification a measurement of circular assets and risks for the finance and investment sector in the transition to a circular economy, NSW Circular
- Towards a circular economy in the built environment, Circular Buildings Coalition
- ESG SDDS (Standard Data Delivery Sheet), INREV
- Making sustainable finance taxonomies work for the circular economy, Chatham House
- Circular Buildings Toolkit, Arup

Appendix G - Enablers and tools (planning)

Circularity audit

Auditing existing assets is a key first step in circular building projects. It involves reviewing the building's physical assets, assessing their condition, determining whether assets can be reused, adapted, or repurposed, and then adding them to a material inventory. The audit also evaluates the potential for reuse and adaptive reuse for a current project or whether the assets need to be sold on marketplaces for use on others.

A circularity audit may include reviewing building documents, conducting site surveys, creating a digital twin, estimating material residual values, and providing recommendations for reuse.

For more information:

- GlobalABC: Pre-demolition audit – overall guidance document
- FCRBE: Reuse Toolkit
- UKGBC: Circular Economy How to Guide
- GBCA: Green Star construction & demolition waste reporting criteria

Material exchange markets

Material exchange markets are digital platforms designed to facilitate the trade of surplus construction and demolition materials. These platforms provide a solution for managing excess materials, connecting recyclers with potential buyers, and supplying manufacturers with resources for innovation and recycling projects. They are particularly useful during the feasibility phase of a project to establish and target circularity goals. Throughout the design, construction, and decommissioning stages, these markets enable the project team to both acquire and dispose of materials and components, promoting reuse and extending the lifecycle of resources in the building industry.

Life Cycle Assessment

Life Cycle Assessment (LCA) is essential for evaluating circularity in building projects by measuring the environmental impact of materials and processes across their entire life cycle. In circular buildings, LCA focuses on aspects like resource efficiency, material reuse, and the potential for future disassembly or repurposing. Metrics such as embodied carbon, global warming potential (GWP), and resource depletion are used to assess circular performance, ensuring the building meeting sustainability and circularity goals.

Performing LCA during the concept design or existing building stage helps establish benchmarks for embodied carbon and identify material hotspots, guiding teams to select low-impact materials and design modifications. This integration ensures circular buildings align with long-term sustainability and circular economy principles.

Appendix G - Enablers and tools (design)

Digital Twins

Digital twins are a virtual model of a building that integrates real-time and historical data. They enable proactive issue detection, optimisation, and extend the lifespan of materials and systems, contributing to resource efficiency and waste reduction. In the design phase, digital twins, created using Building Information Modelling (BIM), optimise designs and track construction progress. During operation, they predict maintenance needs, optimise energy use, monitor building usage patterns, and support lifecycle analyses, helping improve building efficiency and align with long-term circularity and sustainability goals.

Examples include NSW Spatial Digital Twin, Digital Twin Victoria

End-of-use scenarios for a circular vision

End-of-use (EOU) scenarios are integral to the design of circular buildings by bringing reuse, repurpose and repair considerations early in the design phase, optimising for disassembly and waste minimisation.

Circularity audits and EOU scenarios are closely linked, with audits identifying materials suitable for EOU strategies. At the end of a building's current use , these scenarios guide the audit process and help determine which materials can be recovered, reused, or recycled, maximising value and minimising waste.

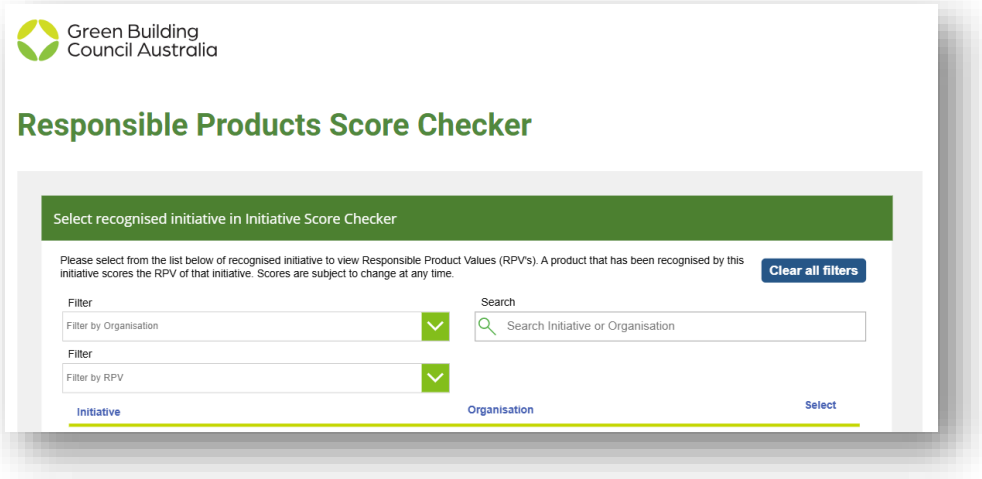
Backcasting supports EOU scenarios by establishing a vision for the building's lifecycle and desired circular outcomes like zero waste or maximal material recovery. Starting with this vision, the process works backwards to pinpoint necessary actions to realise these goals, especially during initial project phases such as design and planning. This ensures all decisions regarding materials, systems, and construction methods are aligned with long-term sustainability objectives, embedding circular principles from the outset and guiding the project towards its circular economy goals.

EPDs and Ecolabels

Environmental Product Declarations (EPDs) provide insights into a product's environmental impact and potential for reuse, recycling, or disassembly. They help project teams select materials that align with circular economy goals by detailing aspects like embodied carbon, resource use, and emissions. While EPDs do not directly compare products, they offer valuable data on material recovery, and support decision making.

Ecolabels, as independently verified certifications, help identify products that meet stringent environmental standards. Type III Ecolabels, based on independently verified data, often through an EPD, provide critical information for selecting low-impact, circular materials.

It is important to ensure that both Ecolabels and EPDs comply with relevant International standards. Refer to Green Star's Responsible Products Score Checker for a list of initiatives currently recognised by GBCA.



Appendix G - Enablers and tools (tender)

Select and award framework

A select and award for circularity involves evaluating, selecting, and contracting suppliers, contractor, and service providers based on circular economy practices such as resource efficiency, reuse, and circular design and innovation.

A weighting should be applied to all criteria, including those that recognise Aboriginal and Torres Strait Islander owned organisations, local businesses or those with the ability to provide life cycle costing/total cost of ownership.

Award criteria and scoring can be structured as follows:

Criteria	Evaluation Method	Priority	Score	Weighted Score
Dematerialisation	Tender documents and strategy	30%	80	(0.3x80)
Design for Disassembly	Disassembly Plan	20%	60	(0.2x60)
Develop plan for material reuse integration	Design for Disassembly Plan	15%	20	(0.15x20)
Material Selection	Specifications and brief	20%	50	(0.2x50)
Innovation	Innovative solutions for circular outcomes	15%	95	(0.15x95)

Excellent (100-85): Detailed, innovative circular solutions.
Very Good (84-75): Strong circular strategies.
Good (74-65): Circular value added to project.
Satisfactory (64-50): Meets minimum requirements.
Unsatisfactory (49-0): Does not meet requirements.

Drafting Clauses

When embedding circularity, procurement teams need to allow time and opportunity for innovation and collaboration. This section sets out questions to assist with project planning, market engagement, and specifications.

Minimise Purchases

- Do we need the product?
- Can we avoid owning the product? Or if we own, will the vendor support repair?
- If we can pay to access the product, rather than own, who will pay for upkeep/repair?

Minimise Total Materials

- Can materials be minimised, or reused?
- Can the product or asset be shared internally or externally?
- Can the asset be reused, refurbished, or remanufactured?
- How much waste is generated as by-product of asset? Can it be reduced or reused?

Maximise Recovered/Recoverable Materials

- Can the product be made with recycled content? And is it recyclable?
- Can you buy a previously used product?
- Can the vendor take back the product to be reused?
- Can the product be disassembled easily to facilitate re-use?

Maximise Product Use

- Can you share the product or asset internally or externally?
- Can you rent or lease the product or asset for a specified time?
- Can the asset be reused, upgraded, refurbished, or remanufactured?
- Can you include repair and a maintenance clause with the contract?

Maximise use of Low Impact of Materials

- Are there products third-party verified to be less impactful?
- Are the materials biobased, from renewable sources?
- Can the materials regenerate naturally within a reasonable time frame?
- Can you select materials that contribute to the local economy?
- Can you select materials from organisations that engage in nature regeneration and/or remediation?

Appendix G - Enablers and tools (use & operation)

Material Passports

Material passports combined with tracking software can provide a transparent, standardised system to inform decisions on materials, finishes and resource recovery and reuse driving a circular supply chain. They track and catalogue essential information about building materials and components, such as origins, history, current use, potential for future reuse, physical properties, chemical composition and maintenance and recycling possibilities. By enabling buildings to function as material banks, material passports ensure materials can be repurposed in future projects. They are maintained throughout the entire lifecycle, from design to decommissioning, ensuring accurate data for future reuse.

Examples include Product Circularity Datasheet, DGNB Building Resource Passport

Total Cost of Circularity

Factoring circularity into the economic analysis of buildings during procurement helps reveal whole of life financial impacts. Life Cycle Costing (LCC) calculates expenses throughout a building's lifecycle, however, it typically focuses on direct costs like maintenance and energy. Total Cost of Ownership (TCO) offers a more comprehensive view by incorporating indirect costs, such as disruptions or future liabilities. This shift moves beyond initial cost concerns, highlights potential long-term savings through resource reuse, reduced waste, and efficient material management.

By evaluating the residual cost of materials that can be reused or recycled, procurement teams can make more informed decisions about the materials and technologies to invest in, ensuring that financial returns from future reuse are considered.

Tools like Madaster's materials passport assist in tracking material conditions and their potential for reuse. Additionally, the Circular Value Index (CVI) offers insights into the financial viability of circular strategies. Combining LCC, TCO, and residual value assessments ensures that both financial and circular objectives are embedded in building projects.

Digital asset management platforms

Digital asset management platforms play a crucial role during the use and operation phase of a building by enabling efficient tracking, maintenance, and optimisation of building systems and assets. These platforms provide real-time data, facilitating proactive maintenance, reducing downtime, and extending the lifespan of assets. By centralising this information, digital tools enhance decision-making, streamline workflows, and ensure assets operate at peak performance. Effective asset management also helps align operations with sustainability goals, promoting resource efficiency, and minimising waste.

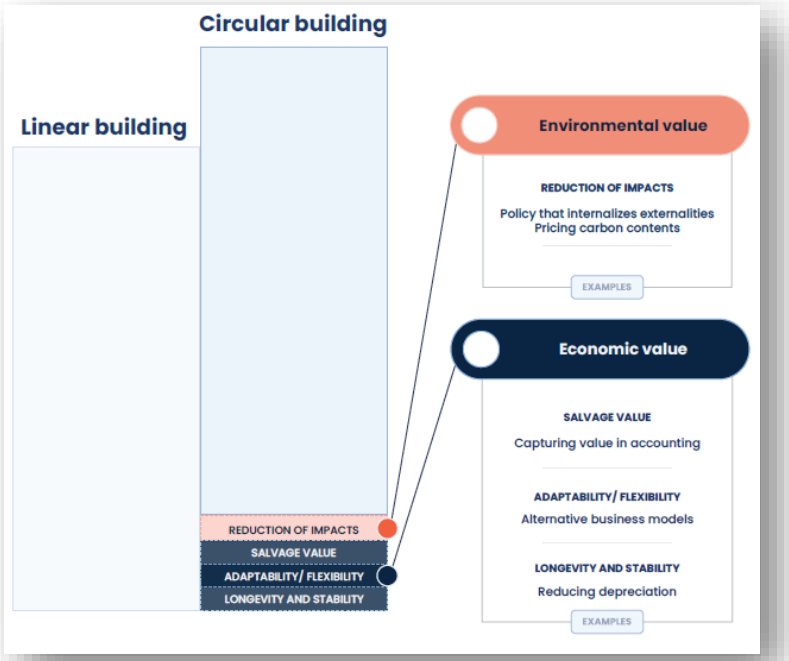


Figure 4. Capturing Circular Value – Towards a circular economy in the built environment[20]

Appendix H – Core Tasks & Deliverables: Definitions

Stage	Core Tasks or Deliverables	Definition
Planning	Assess team capability	Evaluate the knowledge, skills, and experience of project stakeholders to deliver circular procurement and construction. Identify training needs for the circularity training plan.
	Circularity training plan	Establish a training program for the project delivery team based on specific needs outlined in the team capability assessment, to build expertise in circular construction methods and procurement strategies. The plan may include an introduction to the circular economy in construction, to circular design strategies, digital tools and tracking, and finance considerations considering the experience that exists within the team.
	Plan for material recovery (for sites with existing assets)	Develop a circular deconstruction strategy for identifying, sourcing, and recovering materials from the existing site. Materials can be identified through the circular audit and should be used in alignment with the 10 R's. The plan should include logistics such as the collection, storage and prioritised redistribution of materials.
Design	Understand service life and circularity level for each building layer	Specify criteria for different building layers (structure, envelope, systems and finishes), ensuring access, adaptability, longevity, and reuse opportunities.
	Impact indicator analysis	To assess the environmental and circularity impacts of different design decisions. Projects can used metrics such as upfront carbon, material efficiency, and waste reduction potential to guide decision-making.
	Establish data tracking methods	Implement systems to collect, manage and report on circularity metrics throughout the building's life. Align metrics with Appendix D.
	Disassembly Plan	Ensures the building and its components can be recovered and reused at end-of-use. Please see Built/Coreo guide here.
Construction & handover	Sustainability construction plan	Define and communicate sustainable and circular construction processes in alignment with agreed design strategies. Communicate this plan with the project team and external stakeholders as necessary.
	Digital database of materials and components	Create a digital inventory of the building's materials. Information may form digital material passports, or a database including materials, composition, origin, construction method and maintenance cycles (for example).
	Educate building occupants	Provide information for building users regarding material use and maintenance to drive circular outcomes.
	Track, monitor, record and report	Continuously measure circularity performance, document key metrics, and share insights with stakeholders. Develop periodic reports assessing the effectiveness of circular strategies on operational water, energy and waste
End of use & decommissioning	Conduct a pre-decommissioning audit	Perform an assessment of building products and materials to optimise recovery, reuse, and recycling potential.
	Update materials database	As part of de-commissioning audit, revise and expand the digital materials inventory based on deconstruction findings, ensuring future reuse opportunities and knowledge transfer.

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TECHNICAL PARTNER

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SUPPORTING PARTNERS

GBCA would like to thank our Circular Economy Partners for their ongoing support

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