What Works

For Circular Design in the Built Environment

June 2025

vic.gov.au/circular-economy

VICTORIA
State
Government

Acknowledgment

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices.

We are committed to genuinely partner, and meaningfully engage, with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond.

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Contents

Glossary

AEC	Architecture, engineering and construction industry.
B2B	Business-to-business, referring to interactions or transactions occurring between businesses, rather than between a business and consumers (B2C). This may involve the exchange of goods, services or information between businesses.
Built Environment	Human-made surroundings people use to live, work, and play. It encompasses buildings and parks, and their supporting infrastructure such as transport, water, and energy networks.[1] The specific emphasis of this report is buildings and construction-related developments.
Carbon footprint	The amount of carbon dioxide emissions associated with all the activities of a person, other entity (e.g., building, corporation, country, etc.) or the production and use of a product. It includes direct emissions, such as those that result from fossil-fuel combustion in manufacturing, heating, and transportation, as well as emissions required to produce the electricity associated with goods and services.
CEBIC	Circular Economy Business Innovation Centre, a Victorian Government virtual hub supporting businesses to innovate and collaborate to improve productivity and reduce waste. CEBIC supports Victorian businesses to transition to a circular economy through its research, provision of advice, hosted events and funding opportunities. CEBIC was established through Recycling Victoria – A new economy (2020), the government's 10-year action plan to transform Victoria's waste and recycling system.
Circular economy	An economic system aimed at eliminating waste and maximising the continual use of resources. It aims to keep products, components, and materials at their highest utility and value at all times and is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems. In a circular economy, products are designed for durability, repair, and recycling, and materials are managed so they may be reused or regenerated.
Circular Design	Circular design focuses on designing products and systems to minimise waste and maximise resource utilization by keeping materials in use for as long as possible, promoting reuse, repair, and recycling, and ultimately regenerating nature.
Circularity	In the context of this report circularity has been used to describe products, practices or systems that eliminate waste and maximise the value and reuse of resources.
Collaboration	Communicating and working together for mutual benefit, building on each other's ideas to solve problems, produce something new or do something differently.
DEECA	Department of Energy, Environment and Climate Action, bringing together Victoria's energy, environment, water, agriculture, forestry, resources, climate action, and emergency management functions into a single department to maximise connections between the environment, community, industry and economy.
Embodied carbon	Embodied carbon refers to the emissions associated with materials and construction processes throughout the whole lifecycle of a building or infrastructure.
ESG	Environmental, Social and Governance, referring to a set of criteria used to assess a company's performance and practices related to environmental sustainability, social responsibility, and corporate governance.
Linear economy	An economic system in which resources are extracted, transformed into products, consumed and discarded as waste, leading to a one-way flow of materials. It is characterised by a "take-make-waste" approach with a focus on continuous production and consumption, maximising economic growth without consideration of long-term impacts on resources and the environment.
Product as a service	A business model where instead of selling a product outright, companies offer it as a service.
Virgin materials	Raw materials extracted from the natural environment that have not previously been used, recycled or processed. These materials are the default inputs in a linear economy.

[1] Australian State of the Environment, 2016

Introduction

While the built environment benefits human wellbeing, it places considerable pressure on the natural environment. With one of the fastest growing populations in Australia, Victoria needs to accelerate construction, while also introducing circular practices to improve material efficiency, lower waste and reduce associated emissions. Given the inefficiencies relating to wasted valuable materials, and the cost of managing waste generated by the sector, there are significant opportunities for businesses in the building and construction sector to reduce negative impact and improve performance through embedding circular economy principles.

The construction sector is one of the largest sources of managed waste in Australia, contributing 17% of all waste produced in the country.[2] According to Victoria's waste projection model, 6.7 million tonnes of construction and demolition waste was generated in Victoria in 2022–23.[3] Despite recycling efforts, a significant portion still ends up in landfills, with about 16% of all waste generated by the construction sector having this fate.[4] The cost of managing this amount of waste is considerable. The construction industry spends around $2 billion on waste services[5] in Australia each year, highlighting the economic burden of waste. These costs are rising and are expected to rise further as landfill space becomes scarcer, and the cost of managing each tonne of waste increases accordingly.

It is not only about waste. Building and construction uses large amounts of materials including concrete timber, and steel among others. The consumption of these resources contributes to environmental and social harm. For example, the production of cement contributes to around 8% of global greenhouse gas emissions.[6]

With this in mind, the Victorian Government's Circular Economy Business Innovation Centre investigated the potential of circular design within the built environment, including strategies, benefits and successful applications. The *What Works for circular design in the built environment* report showcases insights and case studies and demonstrates how businesses stand to gain from effective circular design while delivering economic and environmental outcomes for Victoria. The purpose of this report is to equip businesses with the information they need to begin testing the circular design opportunities within their sphere of the built environment. This report also aims to equip policy makers operating within the built environment with an increased understanding of circular design and the potential benefits that could be realised through its widespread uptake.

The report focuses on five key circular design principles, with additional guidance on developing the investment case for circular design, including highlighting the triple bottom line (economic, social, and sustainable) advantages to business from embracing circular design. The report concludes with outlining key actions that can be taken across supply chains to mainstream circular design in the built environment.

The circular economy

In response to the high impact of the built environment sector, leading companies are increasingly adopting the circular economy as a model that dramatically improves materials efficiency, reduces waste and unlocks value.

The circular economy is a system where materials never become waste and nature is regenerated. In a circular economy, products and materials are kept in circulation through processes like maintenance, reuse, refurbishment, remanufacture, recycling, and composting. The circular economy tackles climate change and other global challenges, like biodiversity loss, waste, and pollution, by decoupling economic activity from the consumption of finite resources.[7]

A circular economy continually seeks to reduce environmental impacts of production and consumption while enabling economic growth through more productive use of natural resources. It allows us to:

[2] Waste Account, Australia, Experimental Estimates, 2018-19 financial year | Australian Bureau of Statistics (abs.gov.au)

[3] Victoria's waste projection model dashboard | vic.gov.au (www.vic.gov.au)

[4] Ibid.

[5] Waste Account, Australia, Experimental Estimates, 2018-19 financial year | Australian Bureau of Statistics (abs.gov.au)

[6] Making Concrete Change: Innovation in Low-carbon Cement and Concrete | Chatham House – International Affairs Think Tank

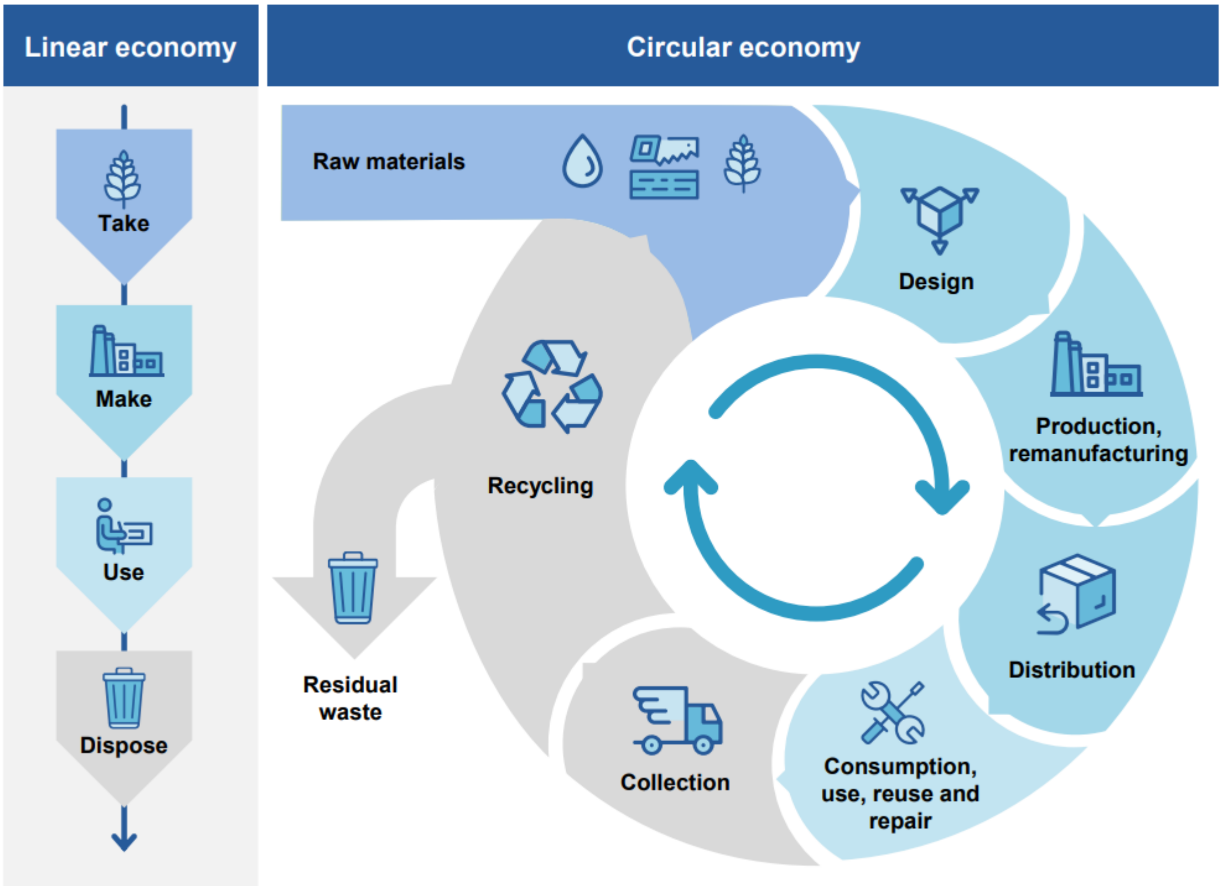
[7] https://www.ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview

- Avoid waste with good design and effective recovery of material that can be reused.
- Promote more efficient business models that encourage intense and efficient product use, such as sharing products between multiple users, or supplying a product as a service that includes maintenance, repair and disposal.
- Increase the value people obtain from the resource needed to create goods and services.

The circular economy transforms our linear economy mindset (take, use and throw away) and fosters innovation and productivity that invigorates existing business and creates new ones, delivering more jobs and more growth for local regional and state and global economies.

An explanation of how resources flow in a circular economy compared to a linear one is shown in Figure 1.

Figure 1: Resource flows in a circular economy compared to a linear one[8]



Source: **Productivity Commission**

The 'Built Environment' refers to the human-made surroundings people use to live, work, and play. It encompasses buildings and parks, and their supporting infrastructure such as transport, water, and energy networks.[9] While opportunities for embedding circularity exist across all of these aspects, the specific emphasis of this report is buildings and construction-related developments.

The Victorian built environment services sector, including architecture, engineering, and construction firms, has a critical role to play if Victoria is to achieve a circular economy as envisaged within Victoria's circular economy plan, *Recycling Victoria: A new economy*.[10] Critical to the success of this transition will be mainstream application of circular design principles across the built environment sector.

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[8] Productivity commission report

[9] Australian State of the Environment, 2016.

[10] Victoria's plan for a circular economy | vic.gov.au (www.vic.gov.au)

During the building design process, whole of life decisions are made regarding how the building is to be constructed, used, maintained, repaired, and ultimately decommissioned. More than 70% of a building's lifecycle environmental impact is determined during the design phase.[11] It is therefore critical to consider circular design opportunities during the design phase to minimise environmental impacts and avoid waste in the built environment over the entire building lifecycle.

What is Circular Design in the Built Environment?

Circular Design in the Built Environment is a specific design approach that seeks to incorporate circular economy principles throughout the design and total asset lifecycle of buildings and/or structures. It focuses on designing products and systems to minimise waste and maximise resource utilisation by keeping materials in use for as long as possible, promoting reuse, repair, and recycling, and ultimately regenerating nature.

The Ellen MacArthur Foundation, a leader in circular economy thinking, states that for buildings and construction, applying circular economy principles can reduce the embedded carbon emissions from construction materials by 38% by 2050.[12] For example, ensuring that steel is recycled (through avoiding contamination) and that more value is generated through the design and application of steel, would avoid 500 Mt of additional primary steel production by 2050 and in doing so, reduce CO2e emissions by more than 1 billion tonnes of CO2e per year.[13]

The Ellen MacArthur Foundation outlines three principles of a circular economy (see **Error! Reference source not found.**) that can be applied directly to the design and construction phase of a built structure.[14]

These principles (and the focus of this report) include:

1. **Design out waste and pollution** – being efficient with materials use through good design (for example specific of sizing that reduces offcuts) and using low toxic materials (low VOC components) during the construction, operation, and end of life phase of a building or structure.
2. **Keep products and materials in use, at their highest value –** design to enable and facilitate the circulation of building products and materials, at their highest value, for as long as possible.
3. **Regenerate natural systems –** for example by specifying certified sustainable materials (e.g. timber from sustainable forests) as an alternative to extraction of finite materials.

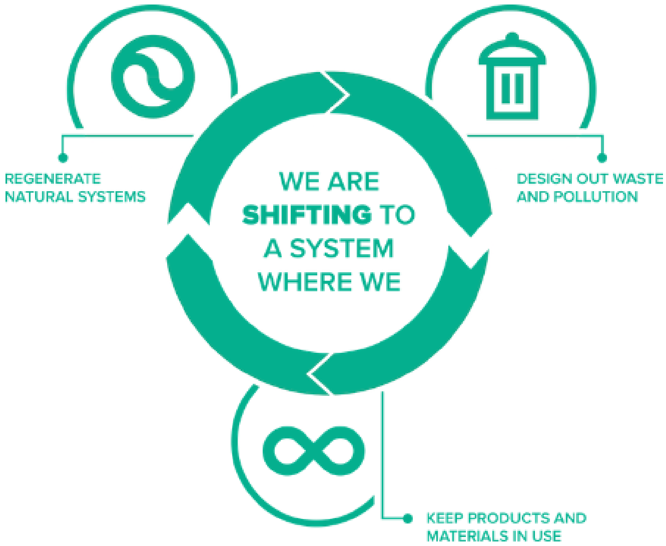
[11] Zhou, Y et al (2020) Design variables affecting the environmental impacts of buildings: A critical review, *Journal of Cleaner Production*, Volume 387.

[12] Ellen Macarthur Foundation. www.ellenmacarthurfoundation.org/topics/climate/overview

[13] Ellen Macarthur Foundation. Completing-the-picture-How-the-circular-economy-tackles-climate-change.pdf

[14] Ellen MacArthur Foundation. What is a circular economy?

Figure 2: The three circular economy principles



Source: Ellen MacArthur Foundation

Circular economy principles can guide the design of Victoria's built environment to eliminate waste, use more sustainable products, and reuse materials and components beyond the building's lifespan.

No Net Zero without a circular economy

Global targets on reducing greenhouse gas emissions have been set by countries in an effort to avert catastrophic climate change.

The Paris Accord[15] is an agreement that commits countries, including Australia, to the global goal of holding the increase in global average temperatures to well below 2°C of warming and pursuing efforts to keep warming to less than 1.5°C.

The Paris Accord compels global economies to accelerate the transition to net zero emissions by 2050. Much of the progress being made is through the energy transition shift from fossil fuel sourced energy to renewable energy generation and storage.

The Ellen MacArthur Foundation's *Completing the Picture*[16] report illustrates that moving to renewable sources of energy production will help meet approximately 55% of the greenhouse gas reduction required to meet net zero (or the Paris Accord). However, approximately 45% of global emissions remain to be addressed.

These emissions predominantly arise from the extraction and production of materials, products and food. Compared to the energy transition, reducing emissions from these sources involves changes to more systems and is therefore more complex. The *Completing the Picture* report proposes that transforming from a linear economy model to a circular economy is essential if achievement of net zero emissions by 2050 is to be attained.

The built environment is a large consumer of materials and products and therefore embedding circularity within the built environment lifecycle becomes a key contribution to global efforts to achieve net zero emissions by 2050 or earlier.

How the Victorian Government is supporting Circular Design in the Built Environment

Victoria can be a global leader in Circular Design in the Built Environment. The Victorian Government is supporting several initiatives to further this vision.

[15] The Paris Agreement | UNFCCC

[16] Completing the picture: How the circular economy tackles climate change (ellenmacarthurfoundation.org

Recycled First

The Recycled First Policy supports the Victorian Government's circular economy strategy, *Recycling Victoria: a new economy* – a 10-year plan to overhaul the state's recycling sector, grow domestic recycling capabilities, and fuel innovation.

Since March 2020, all tenderers on Victorian major transport projects have been required to demonstrate in their bids how they will optimize the use of recycled and reused materials at levels permitted under current standards and specifications. Tenderers are also encouraged to identify opportunities to trial new innovative products or increase the use of recycled and reused materials within existing standards.

Successful tenderers must report against their Recycled First commitments during delivery, ensuring that recycled and reused materials are prioritized over virgin materials, resulting in diversion of valuable resources from landfill.

The Recycled First Policy also facilitates continuous improvements to transport standards, specifications, and research and development. It aims to develop new markets and create greener, more sustainable transport infrastructure outcomes, contributing significantly to Victoria's circular economy goals.

Since its inception, the Recycled First Policy has driven behaviour change across industry, diverting approximately 5 million tonnes of recycled and reused materials from landfill and establishing new Victorian businesses to support the circular economy.

More information can be found here: https://bigbuild.vic.gov.au/about/ecologiq

Recycled Markets Acceleration Package (RMAP):

This package of work increased demand for recycled materials across the economy, creating new and expanded markets for their use.

Since 2020, Sustainability Victoria has provided over $16 million in funding supporting over 90 projects to accelerate markets for recycled materials by developing, validating and commercialising products and processes containing recycled materials.

Through this program the Victorian Environment Protection Authority was also able to progressively reduce or remove the permission requirements for the use of recycled aggregates in construction, reducing costs for industry.

In addition, the RMAP program investigated the benefits, barriers and opportunities for government procurement to drive the transition towards a circular economy including the uptake of recycled materials. This work is informing cross-government approaches to policy design for procurement and will foster demand for Circular Design within the Built Environment.

More information can be found here: https://www.sustainability.vic.gov.au/our-work/markets-acceleration

Circular Economy Business Innovation Centre (CEBIC):

The Victorian Government's Circular Economy Business Innovation Centre (CEBIC) empowers businesses to rethink and redesign business models and products to adopt circular practices that design out waste and keep resources at the highest value.

With a focus on Circular Design principles, the Centre:

- Provides education opportunities through training, programs and thought-leadership events to increase industry circular economy capabilities.
- Addresses systemic challenges through providing space for collaboration across industry, academia and government to work together to identify barriers and solutions.
- Incentivises industry collaboration to ideate, experiment and build the evidence base for circular solutions through the Circular Economy Innovation Fund.
- Provides investment for organisations to scale and increase the access to Victorian circular economy solutions through the Circular Economy Business Support Fund.
- Creates a community of best practices through the digital hub that share best practice insights, case studies and research with industry. Learn more at www.cebic.vic.gov.au

The built environment has been a key focus area for the Centre, having funded a waste reducing prefabrication project, and a project on circular modular housing system. In addition to this the Centre has produced a range of support material which can be found here https://www.cebic.vic.gov.au/learn/explore-by-industry/circular-design-in-the-built-environment.

The Circular Economy Market Report:

This annual report produced by Recycling Victoria provides Victorian specific construction and demolition sector performance and material stream data and insights.

The latest Circular Economy Market Report from Recycling Victoria, shows Victoria's circular economy performance is strong compared with national rates. Victoria is the first state or territory to report against new circular economy measures under Australia's Circular Economy Framework.

The full report can be found here https://www.vic.gov.au/circular-economy-market-report

Section 1: Circular Design Strategies for the Built Environment

This section outlines five core strategies for Circular Design in the Built Environment. It provides high-level guidance on the aims, strategies, and benefits of key Circular Design strategies. For each strategy, a guide to further reading and resources are provided.

The Circular Design in the Built Environment strategies are:

1. Avoid building new – retrofit and reuse.
2. Design for material efficiency.
3. Design for long-term use.
4. Design with sustainable materials and components.
5. Design to maximise material recovery, at the highest value, at end of life.

Table 1 illustrates how each of these five design strategies relate to the circular economy principles The table also illustrates how each of these strategies are relevant to different phases within the life of a built asset (in most cases more than one) and together enable circularity across the Built Environment.

Table 1: Circular Design Strategies and Phases of the Built Asset Lifecycle

Circular Design Strategy	Circular Principle/s	Design Phase	Construction Phase	Operational Phase	Renovate	End of Life
Avoid building new – retrofit and reuse	Keep products and materials in use					
Design for material efficiency	Design out waste and pollution					
Design for long-term use	Design out waste and pollution					
Design with sustainable materials and components	Keep products and materials in use & regenerate nature					
Design to maximise resource recovery, at the highest value, at end of life	Keep products and materials in use					

These strategies are not mutually exclusive. Indeed, a truly circular Built Environment will involve consideration and widespread implementation of all these design strategies across the life of built structures.

By adopting these core strategies, businesses can play a pivotal role in shaping a future where the Built Environment thrives within the principles of circularity, sustainability, and resilience.

Strategy 1: Avoid building new – retrofit and reuse

Before deciding to build a new structure, consider whether existing assets and materials can be reused, renovated, or repurposed to meet project requirements. A new build may be more carbon and resource intensive than strategies that involve creatively re-using existing structures, products and materials.

Relevant Circular Economy Principle: keep products and materials in use, at their highest value.

Design Actions

- Incorporate existing materials or components into a retrofit, renovation, or repair project, to achieve either the same, or a new function.
- Separate and/or remove potential sources of contamination.
- Transfer intact materials or components for reuse off-site, if they cannot be used on site.

Benefits:

- **Prolong the life of existing materials and products**

  Retrofitting and reusing materials helps optimise their lifespan, reducing the demand for new resources. This is crucial in conserving natural resources and minimising the environmental impacts associated with resource extraction and manufacturing.

- **Reduce use of virgin materials compared to new builds**

  Reusing existing materials significantly diminishes the need for new production, reducing the associated environmental impacts such as deforestation, mining, and energy-intensive manufacturing processes.

  By minimising the reliance on virgin materials, the overall waste generated from construction activities can be reduced, promoting a more sustainable and circular approach to resource use.

- **Reduce upfront building costs**

  While projects need to be assessed on a case-by-case basis, retrofitting and reusing existing structures can result in cost savings compared to constructing new buildings. Depending on the extent of work required, retrofitting can decrease the need for new materials, and the cost of demolition and waste management.

  Lower upfront costs enhance the feasibility of projects, making sustainable practices more accessible to a broader range of clients and communities.

- **Reduced embodied carbon**

  Retrofitting and reusing structures generally have a lower carbon footprint compared to new construction, as they involve fewer energy-intensive processes and reduce the need for transporting and manufacturing new materials.

  Embodied carbon refers to the total greenhouse gas emissions generated during the entire lifecycle of building materials, from extraction and manufacturing to transportation and installation. By choosing to retrofit and reuse, projects contribute to mitigating climate change by minimising the embodied carbon associated with the construction process, aligning with Victoria’s efforts to reduce emissions.

What works example - Wilam Ngarrang Apartments – Retrofit and Reuse

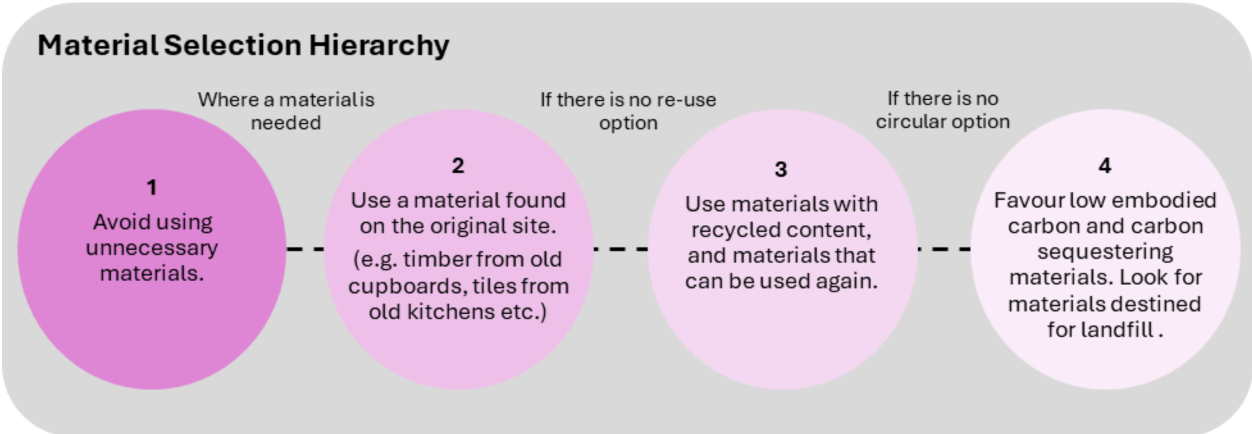
The Wilam Ngarrang Apartments,[17] located in Fitzroy, Melbourne, are an example of how retrofit and reuse projects can deliver sustainable outcomes that are financially viable for all stakeholders. These 15 studio, three-story apartment blocks underwent a sustainable retrofit, involving upgrades to apartments, communal spaces and outside spaces.

Circular Design Features

The project initially incorporated several Circular Design elements, including:

- Reduced use of virgin materials and resources. The project illustrates how retrofit and reuse strategies can dramatically reduce virgin material and product requirements typically associated with new builds. For example, the existing double brick structure, the hallway handrails, door frames, joinery handles, stair balustrades, and fuse box were all retained.
- Reuse and recycling materials on site was a top priority. During the initial demolition process, all materials were catalogued and stored for reuse. These strategies were estimated to reduce construction waste by up to 80%. For example, the existing roof sheeting was repurposed as fencing on around the site, and the former kitchen tiles were reused in the new communal laundry area.
- Consideration was given to best practice operational waste management. For example, a communal compost system was installed in an accessible location for all apartments. If used regularly, it has the potential to reduce operational waste to landfill by 60%.
- Commitment to recycle all materials that could not be reused or repurposed. All aluminium, glass, metal, plaster, timber, and concrete waste that could not be retained was separated and recycled.

Figure 3: The material selection hierarchy used by building stakeholders on the project



What Worked

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Making Circular Design a priority from the start	All project stakeholders were committed to circular material selection principles from the start of the project and incorporated this into initial project feasibility assessment. It helped in this case that an environmental consultant (Finding Infinity) was a project lead, but there was also strong alignment with the asset owner, architects, and construction clients.
A pragmatic approach, firmly rooted in financial viability	The Finding Infinity design team rooted their design decision making by strictly adhering to an environmental financial threshold. This meant that only those retrofit options assessed to be cost-effective, in terms of a 10-year payback time, were actioned. This ensured the initiative increased the lifespan and amenity of the building while reducing operational costs, without a dramatic increase in rents for tenants.

[17] Kennedy Nolan - Wilam Ngarrang Retrofit

Strategy 2: Design for material efficiency

Material efficiency is about meeting project requirements, through reduced resource and material consumption and waste. It also involves getting the most out of materials used. Material efficiencies can be achieved through efficient construction techniques and design choices that, for example, maximise the use of the entire space, or eliminate unnecessary materials.

Circular Economy Principles: Design out waste and pollution.

Design actions:

- Increase the functional use of the entire asset, through designing for multi-use or increasing the use of often empty spaces – e.g. meeting rooms or break-out spaces in office.
- Avoid unnecessary structures or finishes.
- Use efficient construction techniques such as prefabrication and modular methods.
- Use efficient and innovative engineering techniques (for example computer aided design and material planning).
- Avoid, if possible, material intensive designs such as high-rise or building underground in favour or low or medium rise.
- Minimise wastage during construction through design and efficient ordering/stock management.

Benefits:

- **Reduce embodied carbon emissions**

  Designing for material efficiency involves careful consideration of the materials used in construction, resulting in reduced embodied carbon emissions. By minimising unnecessary material consumption and waste, the overall carbon footprint associated with the manufacturing and transportation of materials is decreased.

  Using efficient construction techniques, such as prefabrication and modular methods, further reduces energy-intensive processes and contributes to a more sustainable Built Environment.

- **Minimise extraction of new resources**

  Designing for material efficiency reduces the demand for natural resources such as water, energy and wood. This in turn helps to reduce the ecological impacts of resource extraction such as habitat loss, greenhouse gas emissions and pollution.

- **Reduce upfront material costs**

  Material efficiency in design not only benefits the environment, but also leads to economic advantages. By reducing the overall material requirements, projects can experience lower upfront material costs, making sustainable construction practices more economically viable and accessible.

  Minimising material costs enhances the financial viability of projects, making them more appealing to a wider range of clients and stakeholders. This economic benefit supports the mainstream adoption of sustainable design practices.

What Works example - ISPT – 500 Burke Street Retrofit

The retrofit of the 500 Burke Street, Melbourne office tower, by Property company ISPT, is widely recognised as a leading example of a circular retrofit.[18] ISPT successfully transformed the ageing skyscraper into an A-grade commercial property, while also successfully recovering many of the resources from the existing office fit-out.

What Worked

What Worked	
Reduced costs	By focusing on retrofitting and existing structure and either re-using, refurbishing or recycling over 85% (15,000 pieces) of office equipment, the project enjoyed reduced project costs compared to a new build. Existing floors in the lobby space were rejuvenated.
Increased functionality of building	While the building was constructed in 1977, through this project its function was enhanced and updated to meet the needs of current and future tenants. This included providing greater flexibility such as agile spaces including a restaurant, café, coworking spaces and a courtyard.
Extending the life of an existing structure	The floorplate of the existing 1977 building was retained and with careful re-design the life of the asset has been extended for a further 40 years.
Improved environmental credentials	The leasing potential of the building has been improved by the retrofit. The building is now a PCA A Grade building, with premium grade tenant services, a six-star rating for Green Star Design and As Built and NABERS rating. The building retrofit project itself was carbon neutral.

[18] Cara Waters, The Age, 500 Bourke St: Old NAB building retrofitted in Melbourne CBD (theage.com.au)

Strategy 3: Design for long-term use

This involves designing to maximise the lifespan of an asset or its components. This can involve intelligent product choice and construction techniques, but also designing to ensure the asset is adaptable to meet changing needs or conditions over time. Building for durability, in some cases, may involve a trade-off in terms of upfront material efficiencies and embodied carbon, but generally results in favourable outcomes over the entire lifecycle.

Circular Economy Principle: Design out waste and pollution.

Design actions:

- Design with durable materials and components with guaranteed longevity, preferably beyond the life of the planned asset, so they can be adapted and reused. This needs to be supported by appropriate construction practices.
- Investigate product as a service[19] option for components. Product as a service provides an incentive for the product to have a longer life as ownership is retained by the producer.
- Design for easy repair and maintenance.
- Design to ensure asset can be easily adapted to meet evolving needs over time.
- Design for future climate conditions, considerations should include adapting designs to account for anticipated climate changes, ensuring that structures remain resilient and functional in changing environmental conditions. For more details, refer to the Built Environment Adaptation Action Plan. [20]

Benefits

- **Reduced embodied carbon (over life of asset)**

  Designing for long-term use involves selecting durable materials and components that can withstand the test of time. While there might be an initial trade-off in terms of upfront material efficiencies, the overall embodied carbon emissions can be reduced over the life of the asset. This is because a longer-lasting structure requires fewer replacements and renovations, leading to lower carbon-intensive activities throughout its lifecycle.

- **Reduce material footprint (over life of asset)**

  The use of durable materials and components, along with a focus on adaptability, can reduce the material footprint over the life of the asset. This approach minimises the need for frequent replacements or major renovations, thereby conserving resources and reducing the environmental impact associated with ongoing material extraction and production.

- **Reduced costs (over life of the asset)**

  While there might be an initial investment in durable materials, designing for long-term use often results in significant cost savings over the life of the asset. Reduced maintenance and replacement costs, coupled with enhanced resilience to changing needs or conditions, contribute to a financially efficient and sustainable approach to building design.

  The longevity and adaptability of a structure designed for long-term use contributes to an increased return on investment, as the asset remains functional and valuable for an extended period. This economic benefit aligns with the broader goals of sustainable and financially viable construction.

- **Higher sale and/or rental income**

  The factors that make a building have a longer expected life, such as the quality of materials and construction can be reflected in a higher asking price on the market (where market conditions allow).

[19] Product as a service refers to a business model where instead of selling a product outright, companies offer it as a service. Customers pay for the use of the product rather than owning it, while the company retains ownership and responsibility for maintenance, upgrades, and eventual recycling or disposal. This model encourages sustainability by extending the product's lifecycle and reducing waste.

[20] Built Environment Adaptation Action Plan

What works example – D5 Building Group & Villette – Modular Design System

Background

D5 Building Group's core business focuses on boutique and bespoke residential multi-development projects. D5 Building Group is collaborating with Villette, with the support of CEBIC, to deliver an innovative modular housing system. Modular building systems offer breakthrough advances in circularity reducing waste at all stages of the building life cycle and facilitating a longer life expectancy for materials and components. D5's modular system is designed for adaptability, aiming to extend module lifespans significantly. Enabling modules to be repurposed and reconfigured to minimise waste and maximise resource efficiency.

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What Worked	
Lifespans can be extended	D5's modular system incorporates a system of connected components that allows the building to be reconfigured. This allows the building to expand or be downsized and even relocated. Rather than be demolished, buildings can be adapted as usage patterns change over time. This includes adding modules to make buildings larger, reconfiguring to support different uses, or removing modules to make buildings smaller. By using a connector system, modules can be reconfigured with minimal damage compared to when conventional fixings are used.
Modules can be traded	Modular design supports a marketplace where modules can be traded to continue the life of the asset.
Waste is reduced	Modular design reduces waste over the course of the building's life. Waste in the construction phases is reduced since modules are produced in a controlled environment where material quantities can be carefully monitored and controlled. Waste is reduced later in the life of the building as it is adapted to change rather than demolished. Exploiting the environmental benefits of modular design requires a commitment from manufacturers to ensuring modules are of adequate quality to enable a longer life.

Strategy 4: Design with sustainable materials and components

There is no universally agreed definition of what constitutes a sustainable material. In the context of this strategy, we are focussed on incorporating reused, recycled, and/or renewable materials and components within the design. This strategy also involves incorporating materials or products with minimal impact on the environment. This approach aims to reduce virgin material footprints and contribute to 'closing the loop' within the broader Built Environment sector.

A caveat is that each material must be assessed on its own merit rather than make generalisations that certain classes of material are sustainable. For example, not all renewable sources are sustainable. The sustainability of a particular material depends on the way it is produced, how durable it is in a particular application and how it is disposed.

Circular Economy Principles: keep products and materials in use & regenerate natural systems.

Design actions:

- Maximise use of reclaimed materials or products.
- Incorporate materials or products made from recycled content or those with low embodied carbon. For example noise walls along the side of Melbourne's freeways are being made from recycled milk bottles, soft drink bottles and soft plastics. In addition, a Buy Recycled Directory[21] lists hundreds of Victorian products and materials made using recycled materials. These range from construction to interior fit out materials and products.
- Incorporate renewable/bio-based materials into the design concept (where these can be sustainably sourced). Some examples of common bio-based materials are timber, straw (which can be made from agricultural waste), hemp, cork, clay, and earth. Make sure that renewable and bio-based materials are sustainably sourced. Look for independent, third party sustainability certification to confirm sustainability benefits rather than rely on supplier's claims.

Benefits

- **Reduced embodied carbon emissions**

  Designing with reused, recycled, and renewable materials prioritises options with lower embodied carbon. By incorporating sustainable alternatives, the overall carbon footprint of the construction project is reduced, contributing to climate mitigation efforts.

- **Reduced extraction of non-renewable resources**

  Using reclaimed, recycled, and renewable materials minimises the reliance on non-renewable resources. This approach helps conserve natural resources, reduce environmental degradation, and mitigates the negative impacts associated with the extraction of finite resources.

- **Improved health outcomes**

  Choosing sustainable materials often involves opting for non-toxic and low-emission alternatives. This contributes to better indoor air quality and reduces occupants' exposure to harmful substances, positively impacting health and well-being.

- **Reduced waste to landfill from demolition sites**

  By incorporating reused and recycled materials, there is a significant reduction in the amount of waste generated during demolition and construction activities. This aligns with the principles of a circular economy by minimising the environmental impact of construction-related waste.

- **Creating a new market for circular products**

  Designing with sustainable materials contributes to the creation of a market for circular products, fostering innovation and encouraging the development of more environmentally friendly alternatives. This, in turn, supports the growth of a circular economy within the broader Built Environment sector.

21 Sustainability Victoria. Buy Recycled Directory

What works example – Driving Circularity in retail fit out at Aesop

Aesop is a Victorian business success story. Launching its first store in Melbourne in 1987, the company has risen to be a global leader in providing sustainable cosmetics, with offices and stores around the world.

What may be less known is that Aesop is also driving circular economy outcomes through its retail store fit-outs. These outcomes are being achieved with the help of a sustainability scorecard, which they developed in partnership with Arup Melbourne.

Circular Design Features

The scorecard tracks circular outcomes across the lifecycle of each Aesop outlet fit-out, from design to demolition.

It assesses fit-outs across key circularity criteria including:

- Incorporation of reused or recycled content in raw materials or sourced products
- Extent to which products/materials can be reused/recycled at end of life
- Inclusion of products with sustainable certifications
- Estimations of whole of life carbon in products/materials.

This data is then used to provide an aggregate sustainability score for each fit-out. To encourage best practice, the tool compares each store fit out score against the regional and global Aesop averages. This data also suggests that the tool is achieving significant reductions in embodied carbon, mainly through the increased focus on procuring circular material and products.

What Worked

What Worked	
Circularity scorecard tool is integrated into Aesop procurement processes	Circular Design principles need to be incorporated early into project planning. This early integration is crucial because it allows for the design and construction processes to account for factors such as material efficiency, disassembly, and future adaptability from the outset, rather than as an afterthought. By embedding these principles at the planning stage, projects can maximise sustainability. The tool has actively facilitated this, as it is now a requirement as part of Aesop’s procurement and reporting process.
Alignment with the company aesthetics and brand	Aesop is famous for being meticulous in its approach to branding. It was therefore critical that the tool was designed to closely align with Aesop’s brand image and aesthetics. This facilitated strong take-up and use from fit-out designers.
Simplicity of the tool facilitated strong take up	Critical to the success of the tool has been the simplicity of design which, while comprehensive, is easy and quick for non-specialists to understand and use. This has encouraged strong take up across the company.
Improved supply change	Aesop have found that an important by-product of the tool has been an improvement in the organisation and tracking of their procurement data. This enabled improved partnerships with their suppliers.

Strategy 5: Design to maximise material recovery at end of life

This strategy centres on the adoption of design and construction methods aimed at facilitating the disassembly of assets at the conclusion of their initial lifecycle. It involves a design philosophy that allows for the systematic dismantling of a product or structure at the end of its life, without compromising the integrity of its constituent materials or components. By doing so, it promotes effective value retention through the possibilities of reuse or recycling. Additionally, this strategy underscores the importance of selecting materials that are not only durable but also easily able to be recycled or repurposed ensuring that the materials themselves can continue to contribute to a circular economy even after the asset's initial lifecycle ends.

Circular Economy Principles: Design out waste and pollution & keep products and material in use at highest value.

Design actions:

- Work with the supply chain to incorporate 'product as a service' options where possible (for example plant and equipment).
- Plan for end-of-life disassembly to maximise reuse and recycling from the outset.
- Specify materials and products that are easy to disassemble e.g., modular.
- Use connection systems and construction methods that enable disassembly.
- Avoid use of composite materials that are difficult or harmful to disassemble.

Benefits

- **Enhanced Material Recovery**

  Product as a service business models (where the user buys the utility of the product rather than the asset itself) can increase the likelihood of materials or components being recovered at the end of the asset's life. This is because the producer retains ownership of the product and has incentive to re-use products and materials. This aligns with the waste hierarchy principles, prioritising reuse over recycling, and contributes to a more circular and sustainable approach to material management.

- **Resource Conservation**

  Maximising material recovery reduces the need for extracting new resources, promoting a more resource-efficient and environmentally responsible approach. This supports the conservation of natural resources and minimises the environmental impact associated with resource extraction.

- **Economic Efficiency**

  Product as a service options may lead to more efficient use of resources and materials which can lead to economic benefits for either suppliers or buyers over the long term. This can be through optimising supplier operations from increased certainty of supply, reducing costs associated with material procurement, and potentially creating new revenue streams. Since the product remains the property of the supplier, disposal costs are internalised to the supplier and incentivise re-use, refurbish or recycled the product.

- **Waste Minimisation**

  Designing for material recovery minimises the amount of waste generated at the end of an asset's life. This is crucial in adhering to waste hierarchy principles, where the emphasis is placed on reducing, reusing, and recycling materials before resorting to disposal in landfills.

What Works example – WSP Arden Precinct

The Arden Precinct, North Melbourne, will see the establishment of a sustainable and forward-thinking innovation precinct that sets the standard for best practice in sustainable urban renewal.

WSP's[22] Waste & Circular Economy team worked in collaboration with the City of Melbourne to provide strategic waste engineering and circular economy advice, and to develop a precinct wide waste management plan that exceeds current Australian Standards in sustainable waste management. The ultimate goal is to

[22] WSP is an engineering and professional services firm.

deliver one of Melbourne's first circular and toward zero waste precinct, in line with net-zero carbon emissions targets, that will contribute to make the city more liveable, resilient, and sustainable.

The Arden Circular Economy Strategy provides practical guidance on how circular economy principles can be achieved through strategic design, construction and operation at the master planning level.

What worked

What Worked	
Context assessment	It was also important to consider the Arden context, including the role of its existing infrastructure. While the overarching goal was to embed circular economy throughout the whole Arden Precinct, WSP recognised that this process would look different for different zones of the precinct.
Consider lifecycle stakeholders	Design stakeholders have opportunities to integrate Circular Design principles from the outset (e.g. designing for disassembly, longevity, flexibility and adaptability). As decisions made during this phase will have an impact on the whole life cycle of a project, the design team will need to work in collaboration with key stakeholders from the early stages. Construction stakeholders have opportunities to minimise the impact of construction practices (in alignment with goals and objectives set by the design team). Operational stakeholders have opportunities to utilise the design effectively and keep materials in use as long as possible through actions such as avoidance, reuse and repair. End of service stakeholders have opportunities to responsibly disassemble and/or handle materials at the end of their current use, so that they may be directly kept in use or returned to the system. Learn more about the Arden precinct here.[23]

Circl Pavillion – The Netherlands

Circl Pavilion in Amsterdam's Zuidas district embodies a radical shift in construction philosophy. Instead of merely building, it pioneers a concept of "designing for disassembly." Every aspect of Circl's creation revolves around this principle, from materials selection to construction methods.

[23] WSP. https://www.wsp.com/en-au/projects/building-more-resilient-zero-waste-and-circular-precincts

Materials with a history - reclaimed wood and recycled aluminium - find new life in Circl.

Unlike conventional construction projects, the construction process of Circl Pavilion involves a collaborative effort among architects, engineers, and material suppliers. The primary objective of this coordinated endeavour is to fabricate a structure that can be seamlessly disassembled at the end of its lifecycle, thereby minimising waste generation, and optimising material reuse.

The role of material passports

The Circl building is a leading example of the use of material passports.

Just as a travel passport provides information on an individual's identity, a material passport defines the 'identity' of a building. It does this by providing open-source data on the material and products used within the building, which in turn helps to establish market value for recovery, reuse and recycling purposes. Material passports are a critical tool to facilitate and increase the circulation of building and construction materials across the Built Environment sector.

A material passport was used to record Circl's materials, components and parts to facilitate resource recovery at end of life.

Passports can be developed for new and existing buildings. It is critical that the databases are transparent to facilitate market comparison and accurately demonstrate the value of circular materials.

Material Passports have several potential benefits including:

- Enhancing or preserving the value of materials, products, and components over time.
- Encouraging suppliers to create circular materials and building products.
- Assisting in selecting materials for projects designed for disassembly.
- Simplifying the process for developers, managers, and renovators to opt for healthy sustainable, and circular building materials.
- Streamlining reverse logistics and product/material/component take-back processes.

Material passports are being actively used especially in the EU. For example, the Circl building discussed earlier in this report has had all its materials, components and parts recorded in a digital passport to facilitate resource recovery at end of life. In Australia the National Framework for Recycled Content Traceability is a valuable initiative in this space.

Further Resources:

This section has provided a high-level overview of five Circular Design actions. The following resources are recommended for those seeking more detailed guidelines on Circular Design actions:

- ARUP Circular Buildings Toolkit - Circular Buildings Toolkit (arup.com)
- The Circular Built Environment Playbook - The Circular Built Environment Playbook - World Green Building Council (worldgbc.org)
- NSW Circular Design guidelines for the Built Environment - Circular Design guidelines for the Built Environment (nsw.gov.au)
- South Australia Circular economy in South Australia's Built Environment – Action Plan (2023) - Circular economy in South Australia's Built Environment – Action Plan (2023) (greenindustries.sa.gov.au)

Section 2: The business case for Circular Design

To move Circular Design in the Built Environment to mainstream practice, the business case (including the positive financial benefits for business) needs to be clear.

As an emerging practice there can be perceptions that financial challenges arise when integrating circularity into building projects (particularly across the entire lifecycle of products and materials). Nevertheless, it is encouraging to learn that recent surveys of stakeholders across the Australian Built Environment sector have found that the economic costs of adoption are no longer believed to be a significant barrier in the Australian context.[24] A survey of participants in the Built Environment sector has found that raising awareness of the business benefits of Circular Design is a key enabler to advancement.[25]

To assist develop the business case for Circular Design this section highlights some of the potential triple bottom line (economic, social, and sustainable) advantages to business from embracing Circular Design.

Financial opportunities

There is now a strong emerging business case for the Built Environment sector to embrace Circular Design actions.[26] Circular Design can involve higher costs, particularly in the design and construction phase, partly since it is a relatively new approach for the Built Environment sector, and partly since in some cases, materials and techniques can involve higher upfront costs. However, there is now a strong evidence-base[27] highlighting potential financial benefits of Circular Design, especially in consideration of the entire lifecycle of a building and its constituent materials and products.

Table 2 highlights some of these opportunities, based on a review of expert literature and interviews with Built Environment sector stakeholders. These opportunities – such as those during the operational and end of life phases – are far more likely to be captured through effective Circular Design of a building or structure. It is important to acknowledge that difficulties exist in capturing some of these benefits using existing markets and regulatory frameworks. For example, financial incentives may be split across different builders, owners and tenants across the life of an asset. While tenants may save operating costs by leasing a more energy efficient space, this may not translate to a higher willingness to pay the building owners who initially determine the level of energy efficiency. Another example is where the builder owner/developer has little or no incentive to optimise the building for renovation or disassembly as they are likely to sell the building after refurbishment rather than own it until end of life.

As such, businesses in the Built Environment sector need to be able to rigorously evaluate and demonstrate these opportunities on a case-by-case basis. Supported by suitable tools (e.g. standards, regulated disclosures, contracts that align incentives), the benefits in Table 2 point to the financial potential of embracing Circular Design for business in the Built Environment sector.

[24] Ibid, p.63

[25] Shooshtarian et al (2022). Circular economy in the Australian AEC industry: investigation of barriers and Enablers. BUILDING RESEARCH & INFORMATION 2023, VOL. 51, NO. 1, 56–68 https://doi.org/10.1080/09613218.2022.2099788

[26] Ghafoor et al (2023), Unlocking the Power of the Circular Economy in the Australian AEC Industry.

[27] Ghafoor et al (2023), Unlocking the Power of the Circular Economy in the Australian AEC Industry.

Table 2: Circular Design financial benefits across the life of an asset

Theme	Potential financial benefits
Design and construction costs	– **Reduced raw material costs** from using recycled/re-used products and/or embracing retrofit practices.
	– **Reduced construction site waste**, and associated landfilling costs, through efficient building techniques (for example through off-site modular design) or through re-use and retrofit strategies that avoid total rebuilds.
	– **Reduced land acquisition cost** through adopting retrofit and reuse strategies that add value to existing land.
	– **Reduced exposure to current or future resource supply bottleneck** through materially efficient design and/or using reuse/recycling strategies.
Sales & Market Opportunities	– **Reduced upfront and/or lifecycle operational costs to users** from using product as a service rather than ownership models for example, office fixtures.
	– **Increased lease/sale price,** particularly due to reduced building energy and service costs, which if managed will offset the any higher initial design and construction costs involved with circular/sustainable design.
	– **Higher sale price,** due to demonstrated good climate risk management, and resilience to changes in climate in future years, and/or higher ESG ratings.
Operating Costs	– **Reduced energy** costs due to higher energy efficiency.
	– **Reduced maintenance costs and/or extended asset life** through design strategies such as durability, flexibility and repairability.
	– **Increased potential to capture the value of building materials/resources,** through design for disassembly, reuse, and recycling strategies.
End of life costs	– **Reduced landfilling costs,** through design for disassembly, reuse, and recycling strategies.

Social and environmental opportunities

Table 3 highlights some of the social and environmental benefits that have been cited from Circular Design building projects. These are further illustrated below in our section on case studies.[28]

[28] See i.e Wuni 2022, Burden of proof beyond the triple bottom line: Mapping the benefits of circular construction. Sustainable Production and Consumption 34 (528-540) & World Business Council for Sustainable Development (wbcsd). The business case for circular buildings: Exploring the economy, environmental and social value. Found at:

Table 3: Circular Design environmental and social opportunities across the life of an asset

Theme	Potential Social and Environmental Opportunities and Benefits
Environmental Value	– **Reduced lifecycle CO2 emissions –** resulting largely from the lower embodied carbon associated with implementing Circular Design strategies.
	– **Reduced use of virgin materials –** due to the material efficiencies and substitution of circular and sustainable alternative products and components associated with Circular Design strategies. Reducing virgin resource in favour of circular materials can reduce impacts to land, air and water, including climate change impacts.
	– **Reduced waste production –** designing out waste through Circular Design strategies can result in reduced waste generation across the lifecycle of the built asset. The environmental benefits of reducing waste include land use and potential for contamination from landfills, and the waste of valuable and resource intensive products and materials.
Social Value	– **New Employment Opportunities –** Incorporating Circular Design requires specialist skills and strategies such as repair provide local skilled jobs compared to importing new goods.
	– **Improved health and safety outcomes –** Circular Design considers toxicity of materials and therefore reduces worker (and user) exposure to toxic substances.
	– **Meeting community expectations –** Considering Circular Design in the Built Environment can lead to buildings that align with expectations to reduce waste, reduce technology and reduce climate impacts. Refurbishing or refitting existing buildings also preserves the history associated with the building. In turn, buildings with stronger ESG credentials attract higher rent and market value than other buildings[29]
	– **Knowledge Sharing –** Incorporating Circular Design can progress the integration of circular principles in the Built Environment so that it becomes a mainstream practice that others can benefits from.

Looking ahead at the future for circularity in the Built Environment

As pressure on resources increases, the business case for Circular Design will likely strengthen over time. The Built Environment sector, like others is encouraged to consider that those who innovate first, and adopt Circular Design approaches are likely to be placed at a competitive advantage as the transition to a circular economy accelerates in coming decades.

Community expectations are likely to increase over time. Established trends indicate that businesses who do not have a well-defined ESG (environmental, social and governance) approach to their operations may lose relevance. There is strong evidence that Circular Design practices can assist businesses in the Built Environment sector achieve higher ESG scores, primarily because of the improved environmental and social outcomes delivered through these projects.[30] Higher ESG scores can have 'positive brand and reputational effects' that support business growth.

Resources are likely to get scarcer. Supply constraints driven by resource bottlenecks, geopolitical or climate events, or simply the economics of suitable resources being located far from use points influence resource scarcity and costs in affected sectors.

[29] Looking at ESG's positive impact on property values, EY (2022), Accessed: 3 December 2024.

[30] Ibrahim YahayaWuni (2022). Burden of proof beyond the triple bottom line: Mapping the benefits of circular construction. *Sustainable Production and Consumption* 34 (2022) 528–540

Policy direction is likely to support a circular economy. Australian governments at the national and state levels are driving increasingly ambitious climate and circular economy policy that will incentivise circular business models.

The circular market is likely to mature. Over time the market for circular products will mature, driving down costs and improving the business case.

Digital enablers will become more common. Increasing digital application of data, metadata and artificial intelligence (AI) will be used to generate, track and report on material properties and movements, material passports and similar enabling initiatives.

The role of building sustainability ratings tools to drive circular in the Built Environment

Sustainability rating tools drive the uptake of Circular Design in the Built Environment by providing a way of comparing the sustainability performance of assets in the Built Environment throughout the planning, design, construction and use phases. They have been developed to reflect community expectations, environmental and social issues, government policy and market demand. They also play a role in extending the challenge to building designers and developers to innovate to create higher rating buildings.

Increasingly, ratings tools emphasis the use of circular economy principles across these stages. Three prominent ratings tools that incorporate circular principles are outlined in

Table 2.

Table 2: Sustainable rating tools incorporating circularity principles

The Green Building Council of Australia (GBCA)

GBCA integrates circular economy principles into its initiatives, particularly through its Green Star rating system, which emphasizes resource efficiency, material reuse, and sustainable design in the Built Environment. Key actions to support circular economy principles include:

Green Star Ratings:

The Green Star rating system assesses the design and construction of buildings (including fitout) and incorporates eight categories which aim to improve the sustainability outcomes for buildings and health and wellbeing of occupants. The rating criteria encourage projects to optimize resource use by reducing waste, utilizing recycled content, and designing for adaptability and disassembly. This ensures that materials can be repurposed at the end of a building's life.

Responsible Products Framework:

This framework supports the selection of products that align with circular economy goals, such as those with recycled content or cradle-to-cradle certifications.

In addition to developing and maintaining ratings tools, the GBCA provides education and advocacy to support the sector to understand and apply circular economy principles. This includes guidance on material lifecycle assessments and strategies to minimise environmental impacts.

Collaboration and Innovation:

By partnering with stakeholders, GBCA facilitates the sharing of best practices and innovations in circular construction, such as modular design and regenerative building practices.

These initiatives foster end markets for sustainable products and practices, supporting Australia's transition toward a circular economy in the building sector. This helps reduce construction waste, encourage the use of renewable or recycled materials, and promote sustainable design approaches.

Find out more about the GBCA here: Home - Green Building Council of Australia (gbca.au)

The Infrastructure Sustainability Council (ISC)

The Infrastructure Sustainability Council (ISC) incorporates circular economy principles into its frameworks to promote sustainable infrastructure development. Through the IS Rating Scheme, the ISC encourages projects to adopt circularity by embedding resource efficiency, sustainable procurement, leadership, and innovation practices. These efforts aim to reduce material waste, minimise raw material extraction, and enhance resource recovery in infrastructure projects.

The IS Rating Scheme assesses the planning, design and construction of infrastructure projects and includes lifecycle impacts, operations and decommissioning. The IS Design/As-Built provides the most comprehensive approach to embedding sustainability into infrastructure projects, with the IS Essentials rating also providing an option to identify, measure and deliver economic, social and environmental sustainability outcomes in the design and construction phases.

Find out more about the ISC here: Infrastructure Sustainability Council (iscouncil.org)

The Living Building Challenge (LBC)

The Living Building Challenge (LBC), developed by the International Living Future Institute, integrates circular economy principles as part of its rigorous regenerative design framework. The LBC focuses on creating buildings that generate more value than they consume across seven "Petals": Place, Water, Energy, Health & Happiness, Materials, Equity, and Beauty. These practices align with circular economy principles by minimising resource consumption and enhancing regeneration.

Find out more about the LBC here: Living Building Challenge – Living Future (living-future.org)

Section 3: Activating Circular Design across the supply chain.

Activating Circular Design principles will take more than just the creative work of architects and engineers. For Circular Design principles to be activated across the life of a building or structure will require action from stakeholders across the entire bult environment sector supply chain. Table 3 draws on expert literature to highlight some key actions different stakeholders can take to contribute to circularity.[31,32]

Table 3: Key actions across the supply chain to mainstream Circular Design in the Built Environment.

Industry player	Key Actions to advance Circular Design in the Built Environment
Government	– Provide incentives and/or regulations that stimulate uptake of Circular Design. – Work with industry to create viable pathways for Circular Design. – Provide leadership through the support of Circular Design in infrastructure and building projects they are involved in.
Industry peak bodies	– Establish a clear vision and associated roadmaps for members to mainstream Circular Design. – Highlight case studies and other evidence illustrating the business case for Circular Design.
Developers and Investors	– Set targets as part of Environmental, Social and Governance (ESG) strategy. – Incorporate lifecycle thinking into planning and investment decision making processes. – Measure and report progress to recognise Circular Design in the Built Environment.
Manufacturers and suppliers	– Target the use of reused and recycled material when producing building materials. – Explore product as a service business models. – Collect and share data to alert the market and stimulate demand. – Assist with development of material passports. – Conduct life cycle analysis (LCA) to determine the impacts of products and materials over their life cycle.
Designers	– Incorporate Circular Design principles and strategies into design approach. – Use building information modelling (BIM) early in the project to analyse the reuse potential of the materials in different types of designs. – Refer to LCA results to ensure suitable materials are used for specific applications to maximise the environmental benefits during the design stage.
Building Contractors	– Use building methods that are compatible with Circular Design principles. – Use sustainable products and materials – e.g., non-toxic, reused, recycled and low embodied carbon.
Asset Owner/Occupiers, users and managers	– Embrace circular initiatives such as hubs for upcycling, reuse, repairing and sharing. – Champion adaptation and flexibility. – Adopt strategies to minimise operational waste.
Deconstruction/End of Service Stakeholders	– Request detailed information from designers and/or asset managers on products, materials, and building design.

[31] World Green Building Councils, Circular Built Environment Playbook, Shooshtarian et al., (2023)

[32] The Circular Economy In The Australian Built Environment : The State Of Play And A Research Agenda, Shooshtarain et al., (2021)

Industry player	Key Actions to advance Circular Design in the Built Environment
	– Asset managers use circularity tool to evaluate existing buildings and find the best possible solutions for refurbishment or office de-fit. – Disassemble and/or handle materials in a way consistent with reuse and recycling. – Develop business models for the recovery, storage, and supply of reused/recycled materials.

Successful Circular Design projects are typically highly collaborative, involving input from multiple stakeholders with an interest in a building project. Survey research across the Built Environment sector shows lack of collaboration is frequently cited as a key barrier to circular projects; conversely, fostering greater collaboration and successful partnerships is seen as a critical enabler.[33]

The Wilam Ngarrang Apartments highlighted in this report, for example, illustrate effective collaboration in practice. Key project stakeholders all shared a vision for a sustainable and financially viable retrofit, which facilitated strong collaboration between the landlord, consultants, architects, project manager, builders, and planning consultant. The asset manager set a positive and inclusive tone from the beginning.

For businesses wanting further guidance on effective collaboration to advance circularity, the Victorian Government's CEBIC has published a report on What Works for collaboration in a circular economy.

The report showcases insights and case studies from leading circular economy practitioners and demonstrates how businesses stand to gain from effective circular collaboration while delivering environmental outcomes for Victoria.

Featuring collaborative insights, a practical guide to circular collaboration, and 8 inspiring case studies, the report will assist Victorian businesses embarking on their own circular journey and support Victoria's transition to a circular economy.

Their report can be found here: What works for collaboration in a circular economy?

Thank you

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33

vic.gov.au/circular-economy