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Exploring the inhibitors and opportunities to embedding circular economy principles in housing

A study of stakeholder perspectives in Sydney's new and renewed neighbourhoods

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DISCLAIMERS

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Executive summary

Balancing anticipated population growth, climate change mitigation and social equity remains one of the foremost policy challenges for urban development in NSW.

While the sustainability of housing is frequently assessed through environmental and economic metrics, it is crucial to also consider its intricate connections to social and cultural factors, as these dimensions significantly influence the overall sustainability and liveability of communities (Chiu, 2006). The current housing systems and processes of NSW are failing to adequately address the consequences of climate change and rising social inequities, leading to the need for more integrated and adaptive approaches.

Over the past two decades, the concept of the circular economy (CE) has gained increased prominence as a strategy to address these challenges. A CE advocates for the adoption of closed-loop material and energy cycles, aiming to enhance resource efficiency, reduce emissions and promote sustainability at various scales (Prieto-Sandoval et al., 2018). A CE is aligned with socially sustainable development objectives, including fostering community equity and addressing systemic inequalities (Kirchherr et al., 2018). Existing urban development processes and governance mechanisms remain insufficient for realising CE outcomes at the urban area or neighbourhood scale, particularly in rapidly growing metropolitan areas (Horne et al., 2023).

These limitations highlight the need for more robust frameworks and policy interventions that can support the implementation of CE principles in the development, maintenance and life cycle of housing, infrastructure and, more broadly, urban spaces, thereby promoting a more sustainable and equitable future for NSW communities.

This report

This research seeks to investigate the inhibitors to implementing a CE to support sustainable and liveable residential development. In doing so, the report will explore how the CE approach can foster environmentally responsible, socially equitable and economically sustainable housing. The aim is to make a NSW-specific contribution to addressing the relationship between the CE and achieving sustainable and liveable neighbourhoods, especially as some significant growth areas continue to develop and take shape.

This report draws on a comprehensive review of international and Australian policy frameworks, research evidence and thematic analysis of interviews with key stakeholders involved in the development of housing, residential areas and the CE. These stakeholders include representatives from government agencies, research institutes, industry and

collaborative partners who are contributing to the delivery of more sustainable housing in Sydney. The study explores how the CE can be leveraged to drive innovative housing that aligns with broader goals of sustainability and social equity in rapidly developing urban contexts.

Key findings

Complementary policy opportunities can support CE outcomes in both new and renewed neighbourhoods, suggesting that distinct approaches for each, a proposition this research was testing, are not required. The challenge lies not in designing entirely separate approaches for greenfield or urban renewal contexts, but in overcoming systemic barriers that limit the integration of CE principles into planning, infrastructure and housing delivery.

Several key inhibitors and challenges are identified:

- **Unclear definitions and frameworks:** The lack of standardised definitions for CE infrastructure and activities in planning instruments results in regulatory ambiguity and inconsistent application.
- **Ambiguities in roles and governance:** There is a lack of clarity around which tier of government or stakeholder is responsible for implementing and maintaining CE initiatives.
- **Tensions between housing delivery and sustainability:** The state government's current priority on accelerating housing supply can marginalise CE and environmental performance objectives.
- **Competing and complementary land uses:** Industrial lands vital for CE infrastructure are under increasing threat from rezoning and development pressures.
- **Outdated sustainability frameworks:** Existing tools such as BASIX and NABERS do not adequately account for circularity, materials reuse or broader CE metrics, limiting their efficacy and relevance.
- **High costs of practices and certification:** The real or perceived high costs of circular practices combined with the absence of formal certification pathways constrain uptake and commercial feasibility.
- **Environmental impact and community resistance:** While not widely raised by interviewees, the potential localised impacts of CE practices and infrastructure may generate resistance from communities, particularly in mixed-use or residential areas.

Several policy opportunities respond directly to the core inhibitors:

- **Tax or financial incentives:** Offering grants or financial offsets for CE-aligned development integrated sustainability into the housing delivery pipeline without undermining affordability or supply goals.
- **Define circular infrastructure:** Updating planning instruments (e.g. State Environmental Planning Policies (SEPPs), Local Environmental Plans (LEPs), Development Control Plans (DCPs)) to include clear definitions for CE infrastructure will reduce regulatory ambiguity and provide formal recognition in planning and development processes.
- **Shared materials database:** Establishing a state-or-region-led digital platform with regulatory backing will standardise data collection, material classification and resource-sharing protocols across councils and industries.
- **Increased monitoring and reporting:** Increased monitoring throughout the project lifecycle will clarify responsibilities at each government level to mandate standards, coordinate benchmarking and enforce compliance, helping to establish a more coherent governance structure. Embedding CE-specific metrics in planning and reporting frameworks will modernise outdated sustainability tools and make the frameworks more responsive to circular outcomes.
- **Protect industrial lands:** Regulatory protections at state and local levels can safeguard essential industrial and employment lands that support CE activities, such as materials recovery, repair or remanufacturing facilities.
- **Localised operations:** Co-locating CE infrastructure with residential areas, and other complementary land uses, helps to reduce environmental impact while supporting housing development targets. Zoning for CE uses in growth areas allows for concurrent delivery of housing and sustainability infrastructure.
- **Training and education:** Upskilling planners, developers and local government workers clarifies expectations and enhances institutional capacity to implement CE initiatives effectively at all levels of government.
- **Updating existing frameworks:** Updating existing frameworks and tools and aligning national waste policy would enable clearer CE performance expectations and improve the feasibility of circular housing outcomes.

Implications

To implement these policy opportunities effectively, collaboration between federal, state and local governments, industry, educational institutions, peak bodies and consumers is essential:

- **State government** must lead in embedding CE into planning policy (e.g. SEPPs, LEPs), provide fiscal incentives and establish reporting standards.
- **Local governments** are key to delivery through zoning, adaptive reuse of assets, and supporting local CE infrastructure.

- **Industry** needs to adapt to decentralised models and contribute to material innovation, logistics and waste-to-resource operations.
- **Educational and training institutions** must support workforce readiness through professional development, at all career stages, and integration of CE in curricula.

An integrated planning approach is crucial, recognising CE infrastructure as core social and environmental infrastructure, rather than an optional add-on.

Further research

To support effective implementation, the following areas beyond the scope of this research project require further investigation:

- **Business case evaluation:** Current cost-benefit frameworks often favour large-scale centralised infrastructure, overlooking long-term savings and co-benefits of decentralised CE systems. Updated methods should account for avoided transport, community engagement and shared procurements.
- **Land use mapping and suitability:** Detailed spatial analysis is needed to identify suitable sites, particularly underutilised industrial land, for CE uses near residential areas.
- **Behavioural insights and uptake:** More research is needed into consumer and business engagement with CE systems at the neighbourhood level, particularly how to foster participation in reuse, repair and remanufacturing initiatives.

Abbreviations and key terms

Abbreviations

Table 1 Abbreviations used in this report

Acronym	Full term
BASIX	Building Sustainability Index
CE	Circular economy
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DCP	Development Control Plan
EMF	Ellen MacArthur Foundation
GHG	Greenhouse gas
LEP	Local Environmental Plan
NSW	New South Wales
NABERS	National Australian Built Environment Rating System
OECD	Organisation for Economic Cooperation and Development
SEPP	State Environmental Planning Policy

Key terms

Table 2 Key terms used in this report

Term	Definition
BASIX	A sustainability assessment tool for residential buildings in NSW, established in 2004.
NABERS	An energy and carbon performance rating of commercial buildings and tenancies, launched by the Australian government in 1999.

Chapter 1: Introduction

Overview

The United Nations Sustainable Development Goal 12 aspires to ensure sustainable consumption and production patterns. Due to their significant environmental impact, changing how urban areas and the built environment are planned, built and used is critical to achieving broader sustainable outcomes.

Urban areas are experiencing rapid expansion, resulting in significant burdens on the environment, infrastructure and services. Coupled with a burgeoning global population, these changes will place substantial pressure on the environment and resources. Responsible consumption requires separating value generation, progress and development from finite resource utilisation and material consumption (Marchesi, Tweed & Gerber, 2020).

This process would require enhancing the positive outcomes of economic activities by decreasing resource use and adverse environmental impact, whilst still improving quality of life. It would require systemic cooperation across value chains, to transition from a conventional linear to a CE. In urban areas, a transition to circularity would seek to offer improved access to housing, goods and services, increased liveability and prosperity. Interacting urban systems would be durable, adaptable, modular, reduce waste and easy to maintain, predominantly composed of repurposed components and materials (Pomponi & Moncaster, 2017).

Purpose of this report

Historically, research in terms of the CE has focussed on the macro and micro scale of urban areas - that being, urban agglomerates, and the material and component dimension of buildings respectively. Macro-level research is considerably more advanced with the concept of eco-cities having gained momentum in Europe (Pomponi & Moncaster, 2017). CE research at the meso-level scale, related to buildings as units which comprise an urban area, is limited due to current research focussing on products and goods with shorter lifespans.

To transition urban areas towards circularity, solutions must be devised for both new and renewed buildings and neighbourhoods, which face different challenges. Given the extended lifespan of each phase in a building's life cycle, CE solutions designed for short-lived products are unlikely to be applicable. Manufactured products, such as materials and components that make up buildings at the micro level, are engineered, assembled, and maintained to form a unique, long-lasting entity. The inherent longevity of buildings necessitates that efforts to promote circularity must extend beyond the construction of new buildings alone.

The project aims to explore how the CE approach can lead to more environmentally responsive and socially just housing and neighbourhoods. It seeks to make a NSW-specific contribution to addressing the relationship between the CE and achieving sustainable and liveable neighbourhoods, especially as some significant growth areas continue to develop and take shape.

The way in which we design the meso-scale urban area can have significant implications. A CE approach can help curb the rise in greenhouse gas (GHG) emissions and is a demonstrated solution for the long-term challenges of material and resource management (Pomponi & Moncaster, 2017). There is a current gap in literature which explores the role of the CE at an individual building scale, and more broadly literature which explores the role of the CE in NSW.

This report seeks to address these gaps.

Research aims

The study addressed the following research question:

What are the barriers and enablers of embedding CE principles in new and renewed housing?

The proposed objectives of the study are to:

1. Review Australian and international evidence on the role of the CE in supporting environmentally, liveable and socially successful housing.
2. Identify who are the key actors and drivers for achieving CE in residential development.
3. Identify the key barriers and opportunities to enable CE initiatives and approaches in residential development.
4. Identify key policy instruments to enable CE in residential development in the NSW planning system.

Report structure

Chapter one sets out the purpose of the research report, the research aims and report structure.

Chapter two outlines the method used to investigate the research aims.

Chapter three focuses on the first research aim, providing a concise overview of existing international and Australian research on the CE. The chapter focusses on literature concerned with the emergence and history of the CE, its relationship with urban environments, and barriers and opportunities for implementation. The chapter concludes there is a significant lack of research exploring the intersection of the CE and urban environments, as current CE models are limited in their application to cities.

Chapter four analyses the federal, state and local policy context guiding the delivery and implementation of CE initiatives into new and renewed housing in NSW, highlighting the limitations for application and policy support.

Chapter five responds to the second and third research aims. It comprises a detailed analysis of the key themes that emerged from interviews with stakeholders from government, research and policy spaces. The chapter concludes that delivering circular economy initiatives in new and renewed areas would have significant environmental and social benefits, but there are currently major barriers to implementation.

Chapter six focuses on the final research aim, identifying the implications of the interview findings, policy opportunities for consideration and further research to investigate the effective delivery of CE initiatives and approaches within new and renewed residential areas. It also identifies that a planning-only approach is not sufficient to address the current barriers to implementation, but that a holistic approach is required to address current shortcomings in knowledge and policy support.

Chapter 2: Methodology

The following chapter begins with some background on my personal research context and goes on to outline the methodological approach used to investigate the research aim.

Positioning the reader

Personal context

The motivation to pursue this research project is academic as well as personal.

In 2021, I completed a Master of Urbanism (Urban and Regional Planning) at The University of Sydney. My final research report was titled 'Industrial Ecology and the Circular Economy: A review of New South Wales's local government approach to the implementation of the circular economy,' and looked at how an industrial ecology approach can be utilised to assist in the local government policy transition towards a CE. The research identified that more work was required regarding the application of the CE to existing urban areas and to residential development. This research gap has motivated my engagement in this research topic.

Since 2022, I have been employed at the NSW Department of Planning, Housing and Infrastructure (including time served at the Greater Cities Commission, prior to the rescindment of the *Greater Cities Commission Act 2022*), where I previously worked in the team responsible for aligning the planning that will shape the future of Sydney metropolitan areas. I worked on a range of projects focussed on supporting the central region of Sydney metropolitan area plan for anticipated growth to 2051.

During this time, I heard concerns raised by local government representatives regarding the sustainability and liveability outcomes of new residential areas and existing urban areas flagged for uplift. Currently, some areas in Sydney's north-west do not have the infrastructure, services and planning required to keep up with growth. These concerns grow stronger with the Department's population projections demonstrating that NSW will require approximately 900,000 additional dwellings by 2041 (NSW Productivity Commission, 2023).

More research is required on alternative approaches to sustainable residential development, both at a single dwelling and meso-scale (i.e. building scale). My own experiences in research and working in state government have inevitably contributed to the research motivation and design.

Methodology

Literature and policy review

A semi-systematic literature review is an effective approach for understanding the role of the CE in urban environments, particularly when examining the existing literature across diverse disciplines, and understanding how the definition and application of the CE has been adapted over time (Snyder, 2019). Given the concept of the CE is still emerging in the context of residential neighbourhoods, and has been studied under various frameworks and terminologies, as well as restrictions of the project timeframes, a full systematic review was considered impractical (Wong et al., 2013). A semi-systematic review allows for the exploration of how the CE has been conceptualised and applied in different regions, offering insights into the progression of research.

Semi-structured interviews

Ten interviews (approximately 1 hour each) were conducted with members of local government, the residential development industry, research institutes and bodies, and organisations with a stake in sustainable residential development. Although interviews are not the most reliable way of gathering factual information, they offer a valuable opportunity for stakeholders to discuss their own experiences, insights and perspectives (Cochrane, 2014), which may not be heard through other research methods. The intention of the semi-structured interviews was **to identify the gaps and inhibitors in transitioning to a CE in residential development.**

A thematic framework approach was taken to preparing for and scripting the semi-structured interviews. As a result, explicit questions were not included in the ethics application, however it was approved on the understanding that the interview participants would be asked about the following themes:

1. Their understanding of the CE and its relationship with the built environment, housing and residential development.
2. Their perception of the primary inhibitors and challenges to transitioning to a CE.
3. How they envisage their role in the transition to the CE.
4. Who they think are the other main players.
5. To identify key opportunities for policy action to achieve the transition to a CE.

As will be explained further in the research report; the wording of questions and themes was adapted as interviews progressed and my personal understanding of the CE developed.

I had initially planned to conclude the interview process by November 2024, however, was met with a series of obstacles. Prior to commencing interviews, I was required to receive approval of my project from the University of Sydney's ethics board. The initial ethics application for my project was submitted in mid-September, and an amendment was made in late October, to respond to comments received from the board. Due to longer than expected lead times, my ethics application was approved in early November, only after which recruitment of interview participants was able to commence.

The second major obstacle in the interview process was related to scheduling. It was challenging to schedule interviews after receiving project approval from the university's ethics board due to the proximity to December and the end-of-year shut down period. In my own experience, during this time, work schedules tend to get busier as many project milestones are set for the end of year. I therefore amended my project timeline, and extended recruitment and interview fieldwork into early 2025, after seeking university approval, and was met with much more support from potential interviewees.

Interviewees were selected from diverse organisations and varied professional backgrounds, including precinct coordination, strategic planning, tool development, construction and project management. Many interviewees were identified using my own experiences working at DPHI and connections I made during my university career.

The study used a general interview guide approach to maintain flexibility and encourage semi-structured, conversational discussion (Patton, 2002). Due to contextual sensitivities, such as a change of government just prior to the study commencing and an upcoming federal election, it proved challenging to recruit state government representatives to participate in the interview process. The interviewees represented a spectrum of organisations, which reflected broad organisational values and alignment with a CE.

Table 3 Interviewees and organisations

Industry	Number of interviewees
Local government (or representative organisations)	4
Private sector	3
Educational institution/research	1
Peak bodies/think tanks	1
Developer	1

To further broaden the research, interviews could have been undertaken with community members and residents. However, it proved difficult to recruit participants from these groups within the project timeframe. Additionally, due to the specialised study topic, being the CE, it

was considered that engaging with community members may require an extensive education program prior to being interviewed.

Interview analysis

Due to time constraints and the limited number of interviewees, I conducted a thematic analysis on my transcribed interviews. Thematic analysis aims to uncover valuable patterns across a dataset in relation to responding to a research question (Braun & Clarke, 2013).

Thematic analysis is a flexible and accessible qualitative method suitable for a project of this scale. It allows for description and identification of recurring patterns across interviews and enables understanding on the underlying assumptions shaping stakeholder's perspectives on housing. However, thematic analysis does not utilise specific methods of data collection or theoretical frameworks, which can limit its interpretive depth. This can result in findings that primarily describe participants' concerns rather than deeply analyse or explain them (Braun & Clarke, 2013). Despite this, thematic analysis was considered a strong approach as a thematic framework approach had been taken to the interview script, as described above.

As approved in my ethics application, I utilised transcribing and recording software to record the interview fieldwork, and to enable more accurate collection of findings. A more manual approach was considered appropriate for thematically analysing the interview transcripts, due to the sample size of the interview fieldwork. Each interview transcript was read and edited to correct any errors during transcription. During this initial review, recurring phrases, significant statements and points of emphasis made by participants were highlighted. These excerpts were then assigned short, descriptive codes that captured the meaning or issue being raised. This process, often referred to as open coding, allowed for a systematic breakdown of the data into discrete units of meaning.

Following the initial coding, all codes were reviewed and grouped into broader themes based on conceptual similarities. This stage involved identifying patterns across interviews and clustering related codes to reflect common experiences or concerns expressed by participants. These emergent themes formed the basis of the research findings in this report, and were aligned with the original research aims. Thematic categories were refined iteratively to ensure clarity and coherence, and illustrative quotes were selected to support and exemplify each theme within the findings chapter. This manual, inductive approach enabled a grounded interpretation of the data, allowing insights to emerge directly from the experiences of each interviewee.

Chapter 3: Literature review

To situate this project within its theoretical context, this chapter includes a concise overview of existing international and Australian research focussed on the CE and the built environment, and further reviews instances where this literature is concerned with residential development and buildings. From the literature, the major barriers to implementing CE principles in housing stem largely from the limitation of existing CE models, which often overlook the complex, dynamic nature of urban systems – including land use, infrastructure, cultural practices and the need for local, scalable solutions. The chapter concludes that significant opportunities lie in leveraging financial, fiscal and policy instruments to support CE integration. Targeted incentives, regulatory support and innovative funding mechanisms can enable a more adaptive, place-based approach to circular initiatives in housing.

The circular economy

History of the circular economy

The closed loop economy (prior to the coining of the CE terminology) has evolved significantly over several decades, with its intellectual roots tracing back to the 1960s and 70s. This economic model advocates for reducing waste and promoting continuous use of resources through recycling, reusing and remanufacturing, as opposed to the traditional linear model of take-make-dispose.

The foundational ideas of a closed loop economy were first introduced in the 1960s, when it was stated that Earth's natural resources are finite and cannot sustain an economy based on infinite growth and consumption (Boulding, 1966). Boulding (1966) presented the idea of a 'closed economic system' where materials and energy are recycled, and the goal is to maintain ecological balance and minimise waste. This was one of the earliest calls for sustainability in economic thinking and can be seen as a precursor to modern CE theories.

In the 1970s, these ideas were significantly advanced through the exploration of potential economic and environmental benefits of extending the lifespan of products and promoting repair and reuse over disposal (Stahel and Reday-Mulvey, 1976). Stahel's (1976) work explored the notion of extending product life cycles and minimising the environmental impact of industrial production. His ideas focused on how such strategies could not only reduce environmental harm but also generate economic benefits by creating new business models centred around services like repair and refurbishment as opposed to traditional manufacturing. This thinking laid the groundwork for the development of industrial ecology and closed loop production systems (Stahel and Reday-Mulvey, 1976).

In the 1980s and 1990s, the ideas of closed loop economies gained traction in countries like Japan and Germany, where they influenced national economic policy and industrial practices. In Japan, industrial ecologists and policymakers began integrating closed loop principles into resource management, including recycling and the design of products for reuse (Moriguchi, 2007). Japan's 'sound material-cycle society' in the 1990s was pivotal in shaping the country's focus on reducing waste and resource use through a systemic approach to recycling and reuse.

Germany also became a leading advocate for CE principles during this period, particularly with the establishment of the German Packaging Ordinance in 1991, which required businesses to take responsibility for the recycling of packaging materials. Over time, Germany developed a comprehensive waste management system that embraced closed loop thinking by focusing on recycling, material recovery and product remanufacturing (Bilitewski, 2007).

The 2000s saw the further development of these ideas by industrial ecologists, particularly the concept of 'industrial symbioses. In a seminal paper, Robert Chertow (2007) expanded on the notion of industrial ecology, describing how businesses and industries can share resources, by products and waste materials to reduce costs and environmental impacts. Chertow's work focused on how industries can function like ecosystems, where one industry's waste becomes another's raw material. This idea of collaboration and mutual benefit between industries was a key advancement in understanding how closed-loop economies could be implemented in practice (Chertow, 2007).

The concept of service-based economies also gained prominence in the 2000s, building on Stahel's ideas about product longevity and business models focused on services rather than ownership. In a service-based economy, companies shift from selling products to providing services that ensure the continued use and maintenance of products, thereby reducing the need for new resources and minimising waste. This concept has been particularly influential in sectors like leasing, repair and remanufacturing, with companies increasingly offering services that extend the life of products instead of relying on new manufacturing (Williams, 2019).

Defining the circular economy beyond environmental goals

A 2017 study highlighted the complexity of defining the CE, identifying over 100 different interpretations across academic sources (Kirchherr, Reiki & Hekkert, 2017). The sheer breadth of these definitions reflects the multi-dimensional nature of the CE, which incorporated aspects of environmental sustainability, resource efficiency and economic development. Commonly, references to a CE system or model focus on the transformation of traditional linear economy systems (often described as 'take-make-dispose') into more closed loop systems.

CE models typically emphasise three key strategies:

- closed loops, which involve recycling and remanufacturing to retain materials in the economy;
- slowed loops, which aim to extend the lifespan of products through better design and maintenance; and
- narrowed loops, which optimise the use of natural resources by minimising waste and improving resource efficiency (McCarthy, Dellink & Bibas, 2018).

These approaches are central to the idea of a CE, which reframes the conventional model of energy and resource consumption. Rather than seeing resources as infinite, the CE challenges this paradigm by integrating a system of recycling, reuse and remanufacturing, which collectively aim to reduce the environmental footprint of economic activities (Petit Boix & Leipold, 2018).

One of the most critical aspirations of the CE is to eliminate the concept of 'end of life' by designing out waste and pollution, encouraging a more sustainable, regenerative economic system. By doing so, the CE seeks to fundamentally rethink how products are made, used and disposed of, aiming to close the loop on material flows and decouple economic growth from environmental degradation (Jackson, 2009).

Although the principles underlying the CE are not entirely new, they are being revisited and refined in the current context of environmental and social sustainability. As Blomsma and Brennan (2017) note, the CE is now undergoing a period of intense scrutiny and development as it moves towards being a more robust and consolidated concept. This shift represents a fundamental change in production and consumption patterns, which are currently rooted in the unsustainable linear model.

In this sense, the CE signifies a shift from the 'cowboy economy' to the 'spaceship economy' (Boulding, 1966). The cowboy economy is characterised by the assumption of unlimited resources in an open system, where economic growth is perceived as boundless. In contrast, the spaceship economy operated within a closed system where resources are finite, and the challenge is to operate within these constraints. The transition between these two economic paradigms highlights the need for a more responsible, circular approach that operates within ecological limits, promoting systems capable of continuous material, product or use reproduction.

The OECD (2020) illustrates this transition as a critical moment in the evolution of economic thought. The recognition that resources are finite necessitates the development of new economic systems that integrate material cycles, foster greater resource efficiency and promote sustainable forms of production and consumption.

While much of the CE discourse centres on resource efficiency and waste reduction, its scope also extends to broader issues of access and equity. This includes addressing challenges related to housing affordability and sustainability across different housing tenures, typologies and income groups. The application of CE principles in the built environment must therefore consider not only material flows but also who benefits from circular practices and who may be excluded. These concerns unfold against a backdrop of ongoing policy and academic debate about the influence of credit availability and taxation settings, which have historically incentivised investment in residential property. These financial structures have contributed to escalating house prices, often overshadowing efforts to improve equitable access to housing and undermining the social dimensions of sustainability.

In this regard, the social dimension of the CE has become a key area of focus, particularly in urban areas where issues of social equity, economic development and environmental sustainability intersect. The CE provides opportunities to reassess urban infrastructure and services, such as function, waste management, transportation and energy systems, in ways that promote greater efficiency and reduce environmental impacts. It also encourages new business models that create value from reused or refurbished products, which can help stimulate the local economy and reduce reliance on non-localised goods, services and resources.

Defining the circular economy in urban areas

In recent years, the closed-loop or CE concept has been adapted and applied to various industries, including the built environment. The application of CE principles to construction, architecture and urban planning has gained momentum, particularly in the context of sustainability and resource efficiency. Researchers and practitioners are exploring how buildings and infrastructure can be designed for disassembly, reuse and recycling, which could radically transform the way cities are planned and developed.

However, it is important to note that while there has been growing interest in the adaptation of CE principles to the built environment, much of the earlier work on closed loop economies - whether in industrial ecology or service based economies - did not focus specifically on urban models or the construction sector. Urban environments, with their complexity and scale, pose unique challenges in implementing these ideas effectively. For example, the infrastructure required to enable large scale recycling, material recovery and product reuse in cities is still in its infancy and requires further development in both policy and technology (WRAP, 2025).

Urban areas are critical to the success of the CE. As hubs of economic activity, urban spaces are where most consumption, production and waste generation occur. Furthermore, urban areas have considerable influence over infrastructure development and policymaking, and they

represent the focal point for implementing circular strategies in areas such as waste management, building design and transportation.

The potential for CE practices in cities is immense. As the Ellen MacArthur Foundation (EMF, 2019) outlines, the CE in urban areas can be realised through a combination of strategies: designing out waste and pollution, ensuring the continuous use of products and materials, and regenerating natural systems. These principles require systemic changes, including shifting to renewable energy sources, optimising material flows within industries, and investing in infrastructure that supports closed loop systems.

For instance, urban services like waste management need to be restructured to ensure that waste is minimised, reused and recycled rather than disposed of in landfills. Similarly, economic activities in urban areas must be strategically planned to promote circular supply chains, where products and materials are kept in use for as long as possible. The design of infrastructure also plays a key role in avoiding 'linear lock-in', where systems are built for one-way consumption and disposal. The OECD (2020) suggests that cities should prioritise circular infrastructure, such as smart grids and district heating systems, to reduce resource consumption and create more sustainable urban environments.

Identifying the need

The projected urbanisation megatrends suggest a critical need to rethink how urban areas are planned and managed to address growing environmental and sustainability challenges. By 2050, it is estimated that two-thirds (67%) of the global population will reside in urban areas (Marchesi, Tweed & Gerber, 2020). This rapid shift, from 57% in 2023 (World Bank, 2025), will significantly increase the demand for housing, infrastructure and services. However, if current trends in urbanisation and development continue, building-related CO₂ emissions are expected to double over the same period (International Energy Agency (IEA), 2014). Already, cities are responsible for almost two-thirds of global energy demand (IEA, 2016) and contribute up to 70% of greenhouse gas emissions (GHG); (World Bank, 2010), making the built environment a crucial area for intervention.

The construction industry is a significant contributor to global environmental issues, with estimates indicating that it is responsible for around 40% of all GHG emissions. Of this total, one-third of emissions arise during the construction phase, while the remaining two-thirds result from the operation of buildings (World Business Council for Sustainable Development (WBCSD), 2020). This includes energy consumption and more than 10% of carbon emissions (Commonwealth of Australia, 2024). With such significant contributions to overall emissions, the residential building sector in particular, must adopt more sustainable practices to meet carbon reduction goals and move toward energy-efficient, low carbon housing solutions.

The residential building sector offers significant opportunities for reducing environmental impact, especially when compared to more challenging sectors like heavy industry or transportation (Intergovernmental Panel on Climate Change (IPCC), 2021). Many energy-efficient technologies for housing already exist, and there is a growing wave of investment, both locally and globally, focused on developing more innovative solutions. Incorporating these technologies into new homes and retrofitting existing homes to improve energy efficiency can be a cost-effective way for achieving substantial emissions reductions. However, the level of intervention depends on the scale of adoption and extent of investment required.

The centrality of housing (shelter) to people's wellbeing (Maslow, 1943) warrants caution when making significant changes to planning and delivery. Sustainable housing solutions should not compromise the accessibility or affordability of homes for families. The comfort, safety, and practicality of both homes and neighbourhoods are essential to overall well-being, and any alterations to residential development must ensure that residents' quality of life is not negatively affected. Major shifts in living environments are likely to face resistance unless there is genuine and inclusive consultation with communities. Successfully balancing innovation with practicality requires ongoing, rigorous engagement to ensure that changes align with the needs and values of residents.

The CE concept offers a holistic framework for mitigating the environmental impact of the built environment. The built environment can be viewed through multiple levels of analysis: the meso-level (individual buildings), the macro-level (urban systems) and the micro-level (building components) (Pomponi & Moncaster, 2017). Research on macro-level systems, such as eco-cities and urban metabolism, is well-established, and focuses on strategies like industrial ecology, which aim to optimise the flow of resources at the city or regional level. This research emphasises the importance of urban systems as a whole and how they can be designed to close material loops, minimise waste and reduce emissions.

At a micro-level, research is often focused on specific building materials, particularly those with the highest environmental impact, such as cement and concrete (Purnell, 2013). While this research is valuable for identifying ways to reduce material use and improve building processes, it is limited by the complexity of existing buildings, which cannot simply be replaced by new, more efficient materials and methods. The distinctive nature of buildings, where each material/component has its own lifespan and all continuously interact dynamically, alongside their long lifespan and various functional potentials, contribute to the uncertainty around future scenarios. Although buildings consist of micro-level components that are individually manufactured, their assembly forms a cohesive entity that diverges from conventional manufacturing logic. This research report aims to address the gap left by current CE research

which focuses on short-lived manufactured products, inadvertently overlooking the complexities inherent in buildings.

The opportunity cost of adopting more sustainable urban planning practices for residential areas lies in balancing the immediate costs with the long-term benefits. Investing in sustainability often requires significant upfront capital, particularly for infrastructure upgrades and energy-efficient public services. Transitioning to more sustainable urban environments also demands careful, long-term strategic planning, especially when it involves reviewing policies, zoning laws, and planning frameworks. Major changes to urban landscapes could disrupt existing markets and industries, potentially affecting the construction sector, developers, and businesses reliant on traditional planning models. Additionally, established communities may resist these planning reforms, especially if they lead to disruptions in daily life. While the shift to sustainable urban planning offers clear environmental, social, and economic benefits in the long run, it is essential to carefully consider the broader implications, including the potential short-term trade-offs involved.

Benefits of implementing circular economy initiatives in urban planning

The Ellen MacArthur Foundation (EMF; n.d.) states that implementing the CE will have tangible system-wide economic and environmental benefits. The transition would drive economic growth through increased revenue from circular activities and reduced production costs. It would generate significant job opportunities, particularly in labour intensive recycling and remanufacturing, across various industrial sectors and business sizes, through increased innovation and a new service-based economy.

While it is often more costly in the short term to deconstruct and recycle a building than to demolish it, these upfront costs can be offset by long-term environmental and economic gains. Deconstruction enables the recovery and reuse of high-value materials, reduces landfill reliance and preserves embedded carbon, aligning with emissions reduction targets. Embracing circularity fuels innovation by replacing linear systems, encouraging technological advancement and creating profit avenues. The CE has the potential to reduce carbon dioxide, greenhouse gas and primary material consumption (the latter by 32% by 2030), including construction materials and fuels. By improving land productivity and soil health, the CE could also mitigate land degradation costs and enhance the value of land assets. Ultimately, while some circular practices may involve higher initial costs, they offer substantial systemic benefits that justify investment through policy reform and fiscal incentives.

The EMF (n.d.) also states that implementing the CE would present significant opportunities and benefits for businesses and individuals. Businesses could lower costs and create new profit streams. By using less virgin material and more recycled inputs, companies reduce exposure to

volatile raw material prices and enhance supply chain resilience. The shift also creates demand for new services like reverse logistics, parts and components remanufacturing, product refurbishment and product remarketing. Innovative business models deepen customer engagement and loyalty, providing insights for product improvement. Embracing circularity drives profitability by reducing costs through resource efficiency, waste minimisation, and creating new revenue streams from services like recycling and remanufacturing. It also enhances resilience by reducing reliance on unpredictable commodity markets, helping businesses better withstand supply chain disruptions and price fluctuations.

The integration of CE principles into urban planning has the potential to be transformative for cities. Urban areas, where many economic, social and environmental decisions are made, stand to benefit from a transition to a more circular, resource efficient economy. Transitioning to circular practices can optimise land use, improve transportation networks, and enhance environmental quality, while also driving economic growth. It reduces production costs, creates jobs in recycling and remanufacturing, and fosters innovation in sustainable infrastructure. In terms of transport, circularity can boost efficiency by promoting new urbanist principles, such as shared mobility and eco-friendly infrastructure. While local circular economies may seem at odds with large-scale transport networks, they can be integrated into broader regional systems to maximise both local sustainability and efficiency at larger scales.

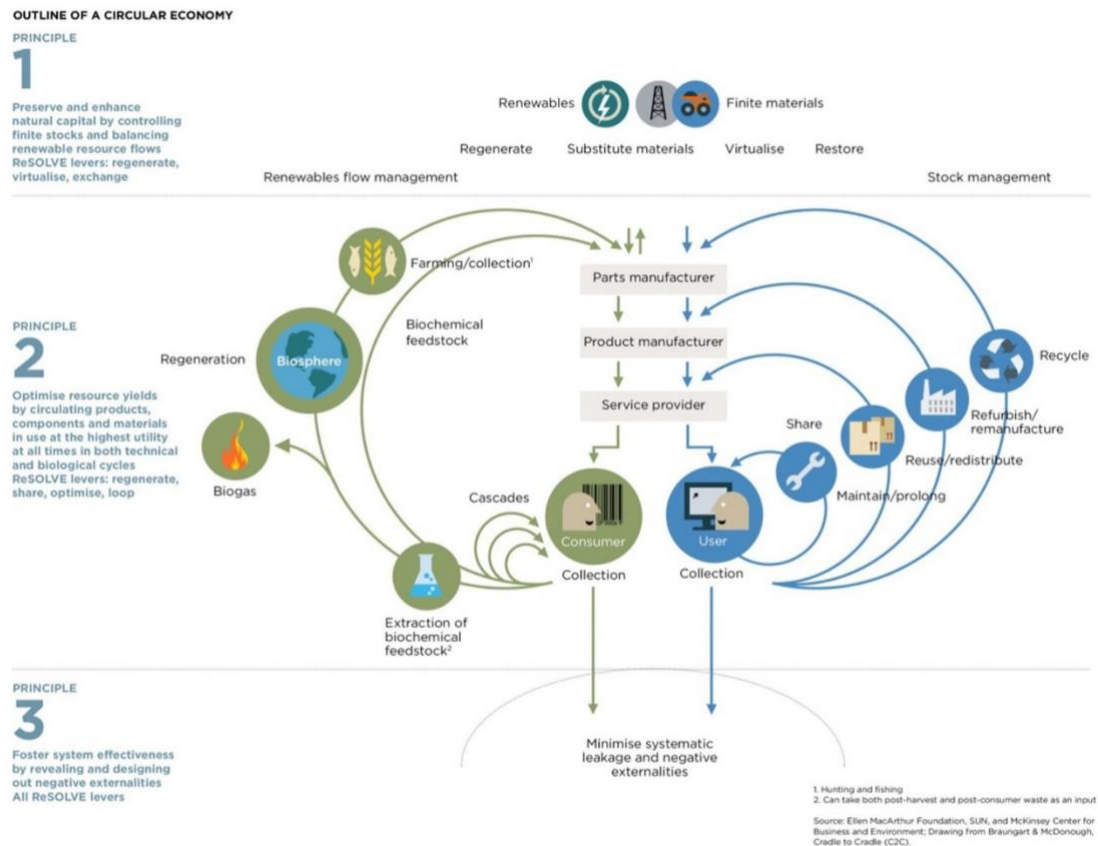
The CE model also has the potential to make urban areas more resilient to environmental challenges such as climate change, resource scarcity and economic uncertainty. By designing cities around the principles of resource efficiency and waste minimisation, urban areas can reduce carbon emissions, resource consumption and pollution, making them more liveable and sustainable. As urban areas continue to expand, integrating circular principles into planning frameworks become essential for creating urban environments that are not only economically adaptive but also environmentally sustainable and socially inclusive.

Barriers to implementing circular economy approaches in urban areas

As discussed, the goal of the CE is not just to prevent environmental harm but to adopt a regenerative approach. It seeks to repair damage by redesigning systems to be more sustainable, emphasising repair and renewal of natural ecosystems (UNEP, 2006). The EMF has developed a widely recognised RESOLVE Framework for a CE, which outlines key principles and actions that can support the transition to a CE. The framework conceptualises the CE as an economic model that provides “multiple value creation mechanisms decoupled from the consumption of finite resources” (EMF, 2015, p. 14). It defines the CE through three core principles:

1. **Preserve and enhance natural capital** by controlling finite stocks and balancing renewable resource flows,
2. **Optimise resource yields** by circulating products, components and materials in use at the highest utility at all times, and
3. **Foster system effectiveness** by revealing and designing out negative externalities related to resource use.

Figure 1 RESOLVE Framework for a CE (EMF, 2015)



The RESOLVE Framework also identified six strategic actions to implement circular practices:

1. **Regenerate:** shift to renewable energy and materials; regenerate the health of ecosystems and return recovered biological resources to the biosphere.
2. **Share:** keep product loop speed low and maximise utilisation of products, by sharing them among different users.
3. **Optimise:** increase performance/efficiency of a product; remove waste in production and supply chain; leverage big data.
4. **Loop:** key components and materials in closed loops (reuse, recycle, recover, remanufacture) and prioritise inner loops.
5. **Virtualise:** dematerialise resource use by delivering utility virtually.
6. **Exchange:** replace products/services for lower resource-consuming options.

These principles and actions provide a foundation for the conceptualisation of a circular resource management approach in urban environments. However, the RESOLVE Framework does have some limitations when applied directly to the built environment and can be adapted to more appropriately respond to more strategic urban resource management solutions (Williams, 2017).

Despite the effectiveness of the RESOLVE Framework in guiding industrial circularity, its application to urban environments presents several challenges. Williams (2019) identifies six key limitations in using RESOLVE to transition towards circularity in cities, each tied to the unique characteristics of urban systems.

A complex urban ecosystem

The RESOLVE Framework aims to foster circular practices in industrial sectors, prioritising ecological optimisation within the economic system. However, urban areas present a unique challenge due to their complex, interconnected nature, encompassing diverse actors and sectors across multiple scales (Lenhart et al., 2015). Unlike the targeted approach of the RESOLVE Framework, the concept of a circularity in urban areas recognises urban areas as dynamic ecosystems with intricate resource flows which evolve with a changing context (Gunderson, 2000). The health of the ecosystem is dependent on looping waste resources, protecting services and localising resource flow where possible.

Consumption and culture

The RESOLVE Framework concentrates on production, rather than consumption, despite urban areas serving as epicentres for both. Vital to achieving resource decoupling in urban areas is changing the consumption habits of urban residents. Without widespread acceptance of circular practices, products and services, the vision of a circular society remains elusive. Equal emphasis on fostering circular consumption and production systems within urban areas is imperative. Further, the RESOLVE Framework fails to consider the complex systems of provision across multiple sectors, how these systems interact with diverse urban lifestyles producing different social practices and how lifestyle factors influence the adoption of circular practices.

Land

The RESOLVE Framework overlooks land's critical role in urban resource management. Vacant land represents wasted potential, hindering resource optimisation. Facilitating land recycling can unlock opportunities for circular activities that are crucial for sustainability. In hedge cities, such as Sydney, land speculation prioritises high-value activities over low-value circular actions (e.g. recycling industries, etc.) (Williams, 2019). Recognising land's ecosystem service potential, urban areas often depend on large hinterlands for resources and waste assimilation.

Allocating land for ecosystem services can reduce external dependencies and foster urban regeneration. Land use patterns and urban form profoundly influence resource consumption, with developments like mixed-use development promoting travel and localised industry efficiencies (Stead, 2001; Pandis, 2014), whilst land zoning and allocation can create significant barriers to both. Integrating land considerations, including allocation for lower-value activities, is vital to achieve a circular approach to resource management in urban areas.

Infrastructure

The RESOLVE Framework overlooks infrastructure despite its pivotal role in governing resource supply, management and consumption in urban areas (Chester and Allenby, 2018). Integrated infrastructural systems facilitate circular resource flows across urban sectors, mitigating resource intensiveness and waste production of urban areas (Jonsson, 2000). However, institutional, regulatory and technological barriers often segregate infrastructural systems, reinforcing linear consumption patterns (Williams, 2013). Urban infrastructure accounts for a sizeable portion of global resource consumption and energy use, emphasising the need for prioritising infrastructure reuse and recycling in circular cities (Lacovidou & Purnell, 2016). Integrating infrastructure into the conceptualisation of circular resource management acknowledges its role as a resource repository and influencer of resource flows, promoting circularity in urban systems.

Adaptation

The RESOLVE Framework fails to address the crucial need for adaptive infrastructure in fostering the CE, particular in urban settings (Gunderson, 2000). Urban infrastructural systems often lack the capacity to adapt to societal changes (Chester & Allenby, 2018), leading to underutilisation or obsolescence of resources. To limit waste, planning for change and flexibility in infrastructure design is essential. This requires innovative planning techniques, embracing technical advancements and interdisciplinary collaboration throughout the infrastructure lifecycle (Chester & Allenby, 2018). Incorporating modularity, compatibility and flexibility in infrastructure design can enable adaptation to evolving societal needs. Planning for infrastructural adaptiveness is integral to promoting sustainability and resource efficiency in urban areas.

Scale and localisation

Urban ecologists emphasise the significance of self-sufficiencies for ecological optimisation in urban areas (Rosales, 2017), a concept overlooked by the RESOLVE Framework. Localising resource flows is crucial for decoupling consumption from growth (Curtis, 2003), reducing transportation and emissions. Symbiotic local capital, integrating natural, social and financial elements is pivotal to this approach (Williams, 2005). Localised resource loops, enabled by

physical proximity and institutions, promote circular resource management. Though globalisation imposes constraints, increased localisation, alongside other circular practises, enhances resource efficiency.

Enablers of circular initiatives

Legislation, policy frameworks and regulatory directives play a critical role in advancing CE objectives. These efforts operate across multiple scales - international, regional and local - and are shaped by differing governance arrangements and institutional capacities. Globally, a mix of legal, financial and fiscal tools have been instrumental in embedding CE principles into housing and development policy, with notable examples in China, South Korea, the UK, the USA, Nordic countries, and the European Union (Murray, et al., 2017; Patala, et al., 2014). These policy instruments act as both barriers and enablers, influencing how CE principles are adopted and adapted across different sectors, including residential development (Cetin, et al., 2021). In the Australian context, the effectiveness of such mechanisms must be carefully assessed considering the unique features of the housing system, such as planning frameworks, tax structures, land markets and intergovernmental responsibilities, to ensure that policy design supports meaningful and context-sensitive CE outcomes.

Horne, et al. (2023) identify that circular housing can be reinforced using financial, fiscal and regulatory instruments. The following table provides brief definitions of these strategic instruments.

- Financial instruments: Enhance funding for investments in energy-efficient neighbourhoods and buildings, as well as for retrofitting or the recycling and repurposing of construction materials.
- Fiscal instruments: Government support via direct funding or revenue distribution, grants, procurement strategies, and indirect mechanisms such as tax benefits.
- Regulatory instruments: Mandatory or voluntary regulations, compliance frameworks and enforcement actions that direct, constrain or shape the behaviour of actions.

Financial instruments: Enabling investment

Financial instruments play a key role in shaping circular economies by increasing access to capital for circular initiatives, such as retrofitting existing housing stock and scaling systems for material recovery and reuse. A wide range of financial mechanisms can guide and influence market behaviours, including sustainability bonds, green loans, blended finance and venture capital tailored to CE innovation. Financial intermediaries, such as sustainability focused investment platforms and green banks, can help de-risk circular projects and direct capital into sectors that traditionally struggle with upfront costs or uncertain return timelines.

International examples illustrate the impact of aligning financial flows with CE outcomes. The EU's CE-aligned taxonomy now influences institutional investment decisions (European Commission, 2018), with the European Investment Bank (EIB, 2024) and national promotional banks providing loans through dedicated CE investment platforms. Models such as appliance leasing and outcome-based funding (e.g. payments linked to recycling rates) show how value can be retained and returned over time. Australia's own Clean Energy Finance Corporation (CEFC, 2020) already funds green social housing, demonstrating that CE-aligned investment is possible within existing frameworks.

In Sydney's greenfield developments, these financial approaches could support CE-aligned infrastructure, such as decentralised energy systems, on site water recycling and materials reuse centres, through targeted investment criteria or value capture mechanisms. In urban renewal areas, financial innovation could focus on retrofit and adaptive reuse by linking access to capital with circular performance outcomes (e.g. reused materials, low-waste construction). CE venture capital and social impact funds could be channelled toward start-ups that specialise in modular housing, design for disassembly or digital material tracking, helping to embed circularity into emerging urban systems.

Fiscal instruments: Public spending and taxation

Fiscal policy is a powerful enabler of CE in the built environment, with tools ranging from direct public investment and grants to tax incentives, procurement guidelines and education funding. These instruments help reduce the perceived risk of circular approaches, stimulate early adoption and reward innovation across the housing supply chain. Well-designed, fiscal tools can shift both market preferences and behaviours, supporting circular building materials, deconstruction over demolition and long-term thinking in construction practices.

Globally, fiscal leadership has accelerated CE uptake through city-led initiatives and national programs. The '100 Circular Cities' project offered grants for demonstration housing (European Union, 2022), while fiscal co-investment in CE businesses, education programs and green procurement criteria can further embed circularity in local markets. Taxes on landfill and waste exports, coupled with the redirection of those revenues into CE education and infrastructure, is one example of how fiscal levers can both discourage harmful practices and fund the transition.

In the Australian context, a lack of national coordination around fiscal levers, particularly waste levies, creates perverse incentives that undermine CE efforts. Significant discrepancies in landfill levies between states have led to the export of waste across jurisdictional boundaries, especially from states with higher disposal fees to those with lower or no levies. This not only distorts the market, but also undermines local investments in recycling and recovery

infrastructure. A nationally uniform levy system would create a level playing field, discourage waste exports, and reinforce the “polluter-pays principle” (OECD, 1972). Crucially, revenues from such levies could be looped back to support CE infrastructure, innovation hubs and education initiatives.

In Sydney’s renewed suburbs, fiscal tools can help cover the additional costs of circular retrofit, deconstruction and material recovery through targeted grants or tax rebates. Local and state governments could adopt circular procurement policies, ensuring government delivered housing and infrastructure projects prioritise suppliers and products aligned with CE standards. In new growth areas, fiscal incentives could reward developers who embed CE in their design and delivery, such as by offering reduced developer contributions or fast-tracked approvals for projects that include CE demonstration components. Public funding could also be directed toward training programs for architects, builders and planners in circular design principles, helping to build capacity at scale and across the sector.

Regulatory instruments: Embedding circularity in planning systems

Regulatory instruments create the legal and institutional frameworks necessary for mainstreaming CE practices in residential development. These include binding rules, voluntary standards and compliance mechanisms that define, mandate or guide specific actions, from waste reduction and building performance to zoning and land use. Regulations ensure consistency, accountability and minimum standards while enabling innovation through clear signals and incentives.

International practice demonstrates the diversity of regulatory approaches to CE. Paris’s ‘15-minute city’ model and Scotland’s green mobility plans show how urban design and infrastructure can be regulated to support circular living (Driving Urban Transitions, 2024). In the Netherlands, Positive Energy Districts and local heat planning illustrate how regulation can direct development toward systemic circularity (Urban Europe, 2020). Certification schemes like the Living Building Challenge (International Living Future Institute, 2019) also provide voluntary yet rigorous standards that shift industry practice.

In Sydney’s greenfield developments, regulation can shape precinct-scale CE outcomes through planning instruments that require the inclusion of recycling hubs, shared facilities or reuse centres, and embed CE principles into zoning and development controls. Building regulations could introduce minimum requirements for recycled content, modular design or life cycle assessments. In renewed areas, planning approvals could be tied to mandatory deconstruction plans or recovery targets, while performance indicators could be introduced to measure material flows and emissions across projects. Over time, integrating CE into building codes,

land use strategies and development contributions will be essential to ensure that circularity is not just an option, but a baseline requirement.

Spatial opportunities

Effective policy action to support the CE in residential development must be spatially sensitive, recognising the different responsibilities, capacities and levers available at state, local and metropolitan levels of government. Each scale plays a distinct role in shaping how circular principles are embedded in the built environment, and alignment across these levels is critical to achieving a cohesive, system-wide transition.

At the state level, governments have the authority to drive structural reform through strategic planning instruments, funding programs and legislation. State planning policies and environmental strategies should embed CE as a core principle through explicit integration into housing targets, infrastructure planning, waste strategies and procurement frameworks, instead of in abstract terms as is currently being used. States can also plan for and invest in large-scale enabling infrastructure, such as regional materials recovery facilities or innovation precincts to support areas of significant residential uplift and set standards that guide local planning decisions. Furthermore, state governments are best placed to mandate cross-industry data-sharing tools like the materials database, as discussed above, ensure the protection of industrial land at the metropolitan scale, and regulate construction and demolition waste across jurisdictions.

At the local level, councils are uniquely positioned to implement a CE in tangible, site-specific ways. They can adapt LEPs and Development Control Plans (DCPs) to reflect CE principles, such as by requiring material audits for major development, incentivising reuse through planning bonuses, or setting local requirements for deconstruction plans. Councils also have the ability to pilot and scale community-facing initiatives, such as neighbourhood reuse hubs, tool libraries, composting networks or temporary circular installations in underutilised or vacant lots. Moreover, they can facilitate partnerships between developers, social enterprises and circular businesses by offering access to underutilised spaces and streamlining approval pathways for CE-compatible uses.

At the metropolitan scale, coordination becomes crucial. Circular systems, such as reverse logistics and materials exchange platforms, operate most effectively when planned and governed across multiple local government areas (LGAs). Councils and regional collaboration bodies can support this by developing shared CE roadmaps, aligning zoning protections for industrial and circular infrastructure, and coordinating investment in cross-boundary initiatives such as transport-linked resource depots and knowledge-sharing platforms. These bodies also play a key role in balancing competing land use pressures, for instance, ensuring that industrial

and logistical uses that support circularity are preserved within urban footprints and not displaced by residential intensification.

Spatially targeted policy action is essential to operationalise the CE. State governments can legislate and invest; councils can innovate and implement; and bodies at the metropolitan scale can coordinate and harmonise. Only by leveraging the unique strengths of each level, can the residential development transition from a linear development model to one that is circular, resilient and regenerative.

Lifecycle opportunities

The transition to a CE may offer different opportunities depending on whether development is occurring in new (greenfield) or renewed (infill and brownfield) areas. Both present unique challenges, timelines and policy levers, requiring differentiated approaches to planning, infrastructure investment and regulatory reform.

In new development areas, there is a rare and valuable opportunity to embed circular thinking from the ground up. These sites can be master planned with whole-of-lifecycle resource efficiency in mind. For instance, one respondent offers that precincts can be designed for material flow efficiency, with co-located waste consolidation points and local reuse facilities integrated into early infrastructure planning. Streets and buildings can be planned to enable future adaptability. For example, using modular systems, shared service corridors and decentralised utilities that support disassembly and upgrade over time. Planning instruments can zone for circular infrastructure land uses early in the development process, ensuring long-term space for resource processing, repair industries and secondary material storage. State-level infrastructure funding and planning controls can support these ambitions by providing core capital investment in shared CE infrastructure and setting minimum circularity performance requirements through development approval and consent processes.

By contrast, renewed areas, including infill development and renewal of existing suburbs, demand a different set of interventions centred on material retention, adaptive reuse and urban mining (that is, extracting materials from extracted urban waste). These areas contain large quantities of embedded resources that can be preserved or repurposed, but are often lost due to conventional demolition practices. Policy action here should focus on:

- Mandating pre-demolition material audits,
- incentivising deconstruction over demolition, and
- establishing material recovery obligations for large developments.

Local governments can support this shift by creating reuse and salvage hubs, partnering with nonprofits and social enterprises to repurpose components and experimenting with interim land uses that support circular operations.

Renewed areas are also better suited to policy-driven incentives such as expedited approvals or density bonuses in return for high-performance circular retrofits, reuse of existing structure or reduced construction waste. As these precincts typically involve more stakeholders, shorter projects timelines and complex site conditions, data and transparency become critical. A digital materials and resource database, as mentioned earlier, would be especially useful in these contexts where visibility of available materials and coordination between developers could enable a more fluid, responsive market for reused building products.

Chapter 4: Policy instrument context and analysis

As Sydney continues to experience significant population growth and intensifying development pressures, governments, industry and urban planners are increasingly looking to both greenfield development sites and urban renewal corridors as key opportunities to implement more sustainable, resilient forms of growth. In this context, NSW has begun to position the CE as a strategic policy tool to reshape how residential environments are planned, built and maintained. From resource recovery and waste reduction targets to infrastructure and land use planning reforms, a range of national and state-led initiatives now aim to integrate circular principles into the broader planning and development system. This section outlines the evolving policy landscape in NSW, highlighting both the progress made and the gaps that remain in embedding the CE within the built environment.

National Waste Policy and Action Plans

Australia's **National Waste Policy 2018** (Commonwealth of Australia, 2018) and the **2019 National Waste Policy Action Plan** (Commonwealth of Australia, 2019) aim to transition to a CE through waste avoidance, resource recovery and promoting recycled materials. The Australian Waste Policy 2018 describes the five key elements of the CE as:

1. **Avoid waste:** Focus on preventing waste at the source by promoting efficient use of materials, encouraging reuse and repair, and redesigning products and buildings to be durable, adaptable and easy to disassemble or recycle.
2. **Enhance resource recovery:** strengthen collection systems and recycling processes to ensure higher recovery rates and improve the quality and usability of recovered materials.
3. **Boost recycled material uptake:** Stimulate demand for recycled materials by supporting markets, procurement policies and product innovation that prioritise recycled content.
4. **Optimise material flows:** Manage the movement and treatment of materials to reduce harm, maximise environmental and economic value and support healthier communities.
5. **Strengthen data and transparency:** Improve access to accurate, timely information to drive innovation, support investment decisions and empower consumers to make more sustainable choices.

One of the key limitations of the policy is the absence of strong enforcement mechanisms to ensure that national targets, like reducing waste generation by 10% per capita and an 80% resource recovery rate by 2030, are met. Reliance on voluntary industry participation and market dynamics risks delivering inconsistent outcomes, particularly in sectors like residential

development where barriers such as cost, availability and the reliability of recycled or repurposed materials continue to pose challenges.

Another issue lies in the policy's scalability and consistency across jurisdictions. While it sets clear national targets, the lack of clear coordination between state, local and federal governments can lead to fragmented implementation. Regional disparities in planning approaches, infrastructure investment and regulatory enforcement make it difficult to create a cohesive, system-wide shift towards circularity. Additionally, the policy does not sufficiently address the creation of a stable market for recycled materials, making it harder to encourage widespread adoption of a CE approach.

Australian governments (via the Council of Australian Governments (COAG)) committed to phasing out the export of key waste materials, including plastic, paper, glass and tyres (Commonwealth of Australia, 2020). This policy shift was paired with a national push to strengthen Australia's domestic capacity to produce high-value recycled materials and stimulate demand for them. Since late 2020, these changes have been reinforced by the *Recycling and Waste Reduction Act 2020* (Commonwealth of Australia, 2020), which not only enforces the export bans but also enshrines in legislation a commitment to advancing a CE. This includes goals to extend the life cycle of materials and products, reduce environmental impacts and promote more sustainable resource use across the economy.

The Act followed a major 2018 Commonwealth Inquiry into Australia's waste and recycling sector (Commonwealth of Australia, 2018), which made key recommendations aimed at embedding CE principles into national policy and industry practice. Together, these developments signal a shift from managing waste as a by-product of economic activity to viewing materials as assets that can be continually cycled through the economy. The federal approach is complemented by a growing number of state and local government strategies in jurisdictions across Australia, all of which are actively pursuing more circular systems through infrastructure investment, planning reform and innovation programs.

Despite this momentum, the implications of these reforms for housing and the built environment remain underexplored. As a major generator of materials flows, the construction and residential development sector must be more deeply integrated into CE policy frameworks. This is a critical opportunity to align planning, development approvals and infrastructure strategies with national CE goals, ensuring that housing plays a central role in reducing waste, supporting material reuse and enabling long-term environmental resilience.

State policies

The **NSW Circular Economy Policy Statement** (NSW CE Policy Statement; NSW Environmental Protection Authority, 2018) provides a comprehensive framework for implementing initiatives throughout a product's life cycle. It encourages sustainable practices such as durable design, maintenance, repair, reuse, sharing and transforming products into services, as well as remanufacturing and recycling. The policy identifies eight focus areas to guide government efforts in facilitating the transition, including circular design, sustainable procurement and support for re-use and repair.

Whilst the policy statement provides practical strategies to achieve the focus areas, its effectiveness is limited by three key factors. While the policy outlines principles and aspirations, it does not mandate CE practices across all sectors, limiting its enforcement mechanisms. Without clear regulations and enforceable measures, the policy risks inconsistent consideration and application, with some industries potentially choosing to adopt only voluntary guidelines, leading to slower uptake. In addition, the transition to a CE demands significant investment in infrastructure and innovation. In the current climate, resource allocation and funding for the necessary infrastructure and technologies may present significant issues. The policy also does not provide a path forward for coordinating stakeholders with differing priorities and capacities.

The **NSW Waste and Sustainable Materials Strategy 2041** (NSW Environment Protection Authority, 2021) outlines specific targets to reduce waste and improve recovery rates, with goals such as a 10% reduction in per capita waste production and an 80% average recovery rate by 2030. It also includes incentives and regulations to promote the adoption of CE principles in construction. The strategy points to significant challenges in scaling waste management infrastructure to meet future demands. Non-putrescible landfill space is expected to be depleted by 2028, and putrescible landfill space by 2036. Whilst being backed by a \$356 million budget, continuous financial support is required for the maintenance of existing programs and the scaling of new projects. The strategy's success is also contingent on significant behavioural change across both consumers and industries.

Taking a more circular approach to planning and design aligns with the vision and targets set by the NSW Government in the **Net Zero Plan Stage 1: 2020-2030** (NSW Department of Planning, Industry and Environment, 2020), which aims to fast-track emissions reduction in the state. Recently, the government announced a target to reduce emissions by 70% by 2035, compared to 2005 levels, with the overarching goal of achieving net zero emissions by 2050 and a 50% reduction by 2030. Materials used in the built environment are a major source of carbon emissions. Additionally, the built environment is a significant contributor to landfill waste

in NSW. Circular design and planning strategies offer substantial opportunities to reduce carbon emissions associated with new and renewed residential development. The policy's effectiveness may be limited by factors such as the availability and reporting of materials, challenges in retrofitting existing housing stock and the need for widespread adoption.

State planning framework and guidelines

The **State Environmental Planning Policy (Sustainable Buildings) 2022** (SB SEPP; NSW Government, 2022) was made effective from 1 October 2023. It encourages the design and delivery of more sustainable residential and non-residential development in urban areas within NSW. Its primary objectives include reducing GHGs, minimising water consumption and promoting the efficient use of energy and resources in building design, construction and operation. One key initiative which was mandated, alongside associated EPA Act regulation amendments, was the reporting of embodied emissions of construction materials. It also applied the standards for the Building Sustainability Index (BASIX).

BASIX currently focuses on achieving equitable and effective reductions in water consumption and GHGs throughout the state, without a direct focus on CE practices. In October 2023, the requirements of the BASIX Standards increased, including the introduction of a new material index. This index will assess and report the embodied carbon emissions associated with the construction of a home. Given the complex relationship between the thermal performance standards of a home and embodied emissions, there will not be an immediate cap on these emissions; however, this issue will be carefully reviewed and alternative approaches explored in future revisions (NSW Department of Planning and Environment, 2023).

The **NSW Apartment Design Guide** (ADG; NSW Department of Planning and Environment, 2015) is referenced in the State Environmental Planning Policy No 65 - Design Quality of Residential Apartment Development. It provides essential guidance on apartment design quality, addressing factors like solar access, ventilation and acoustic performance. While the ADG does mention sustainability through considerations like waste minimisation, such as adaptive reuse of buildings and the longevity of structures via material selections, it does not fully incorporate CE principles. CE approaches focus on reducing consumption and waste, promoting resource efficiency and designing for longevity, adaptability and material reuse. Without clear directives on these practices, such as designing for disassembly or specifying materials with a known end-of-life plan, the guide falls short in enabling apartment developments to fully embrace circularity.

The ADG's current scope could limit the built environment's potential to meet broader sustainability goals. While it addresses some environmental considerations, it does not go far

enough in encouraging developers to reduce embodied carbon or optimise resource recovery through circular design strategies.

The **NSW Circular Design Guidelines for the Built Environment** (Office of Energy and Climate Change, NSW Treasury, 2023) were developed to embed CE principles into the planning, design, construction and end-of-life phases of buildings and infrastructure. The guidelines aim to assist stakeholders in integrating circularity into project lifecycles by offering practical strategies and design considerations. Key objectives include promoting material reuse and recovery, enabling adaptability and flexibility in design, designing for disassembly and ensuring the selection of materials with low embodied carbon and known reuse or recycling pathways.

Despite their forward-thinking intentions, the guidelines are advisory rather than mandatory, lacking regulatory enforcement or alignment with planning instruments such as the ADG or the SEPP frameworks. This limits their influence on mainstream development practices. Secondly, while they provide general strategies, they stop short of offering quantifiable performance metrics or tools for measuring circularity in building design, making it challenging for developers to track progress or demonstrate compliance. To maximise their impact, future iterations may need to include clearer benchmarks, integrate with statutory planning documents, and mechanisms for compliance and verification.

Local planning framework

The **Standard Instrument (Local Environmental Plans) Order 2006** (NSW Government, 2006) sets the common format and content that all local government Local Environmental Plans (LEPs) must adhere to. The current template does not include any specific provisions for CE practices, waste minimisation or resource recovery. As a result, while LEPs are required to follow a standardised structure, there is no clear mandate for incorporating a clause or provisions related to circularity in the local planning process. As the LEP is the local government statutory environmental planning instrument, this gap in the Standard LEP template limits the ability of local governments to directly influence CE practices at the planning level.

Development Control Plans (DCPs) offer detailed planning and design guidelines that complement the planning controls outlined in LEPs. Similar to gaps identified in the LEP making process, there is currently no consistent or standardised approach to integrating CE principles within DCPs. While DCPs play a critical role in guiding development, they do not uniformly address key sustainability aspects like waste minimisation, resource recovery or the CE. The lack of consistency in the implementation of these outcomes presents a missed opportunity to drive more sustainable development practices. Without a clear, cohesive strategy for

incorporation, developers may not be incentivised to adopt practices, especially if they operate across multiple local government areas.

Chapter 5: Results and discussion

This chapter provides an overview of the results of the thematic analysis of interviews. This chapter concludes that implementation of the CE at a neighbourhood scale would have significant benefits for growth areas. The chapter also identifies current barriers/gaps to implementation and contributes to outlining recommendations to address them.

Interview process

Interviews were undertaken with ten strategic land use planners, sustainability consultants/managers and CE researchers and specialists. They were asked about their understanding of the CE and its potential implications on residential and neighbourhood development in Sydney.

Respondents were initially contacted as they were identified as key players, policy makers or subject matter experts on the implementation of the CE or adjacent sustainability measures. As a consequence, respondents tended to already share a belief in the value of the CE and its potential for more favourable environmental, social and economic outcomes. They did not all view the CE in the same way, though, and their perceptions were often influenced by the industry or experience they had. Most viewed the CE as contributing to environmental sustainability, which had been practically adapted to also address social and economic inequity – findings which aligned with this research report's literature review. Some respondents, however, encouraged me to reflect further on the 'economic' aspect in the term CE, and reflected on how the use of the term CE had been stretched beyond its initial intentions. Many respondents seemed to refer to the CE as a tool for system transformation, rather than an end state. A discussion of this has been provided in section 8.1.1 of the report below. This thinking was often at odds with the findings of my literature review, which leaned towards seeing the CE as an ideal state.

As the interviews progressed, the script, flow and operation of the interviews adapted, as I learned how to more effectively engage with respondents and learned which questions or themes drew out greater responses. By the third interview, I was introducing my research project in the context of my own personal interest and motivation, as provided in this research report. Interestingly, respondents tended to have a similar or aligning interest in social and environmental sustainability, which could be traced back to their early career, and in some cases even prior. This interest was often a guiding motivation throughout their professional career and was evident in their responses; they supported the expansion and implementation of the CE given the financial, fiscal and regulatory opportunity and necessary tools. After completing the research which informed my literature review; being able to speak to

individuals who were active CE advocates and had dedicated their careers to progressing more sustainable thinking provided me with increased motivation to complete this research project.

The analysis of interviews is presented in terms of responses to the interview themes. As mentioned, some respondents encouraged me to reconsider thinking of the CE as an end state and see it as more of a tool. This resulted in my progressive reframing of the themes to the following.

1. Their understanding of the role of the CE as a tool in shaping the built environment and residential development.
2. Their perception of the primary inhibitors and challenges in utilising the CE to shape residential and neighbourhood development.
3. How they envisage their role in applying the CE to facilitate the transition to more sustainable practices.
4. Who they think are the other key players in leveraging the CE to drive change in the built environment.
5. What they see as the key opportunities for policy action to enable the effective use of the CE as a tool for sustainable development.

Insights provided below have been synthesised from interview transcripts using the coding technique explained in the Methodology section of this research report. A general summary of common findings has been provided, as well as some key points which would be taken from specific interviews. Due to resource and time restrictions, a more comprehensive analysis of interview transcripts, which varied from 40-60 pages, was not able to be conducted. Often during interview sessions, respondents would organically progress onto points of discussion which were not in the remit of land use planning and, consequently, out of the scope of this research project.

Findings from the interviews suggested that making consideration of the CE more salient in early stages of the planning process for growth areas is not going to be a quick change. Rather, there are many factors on which pressure needs to be applied to leverage and apply the CE to drive more sustainable change in residential development, housing and the built environment.

Discussion

The role of the circular economy

Key elements and fundamental principles of the CE were familiar to all respondents, due to their expertise in and experience working with CE concepts. All respondents agreed that

utilising the principles of the CE would lead to greater environmental, economic and social outcomes in residential areas. Thematic analysis of interviews identified three main themes regarding the role of the CE as a tool in shaping residential development and neighbourhoods.

Responding to growing trends

When asked how the CE principles relate to the built environment, most respondents agreed that their integration into future urban planning and residential development is essential to addressing Greater Sydney's trend of rapid urbanisation and urban sprawl. Several also pointed to the increasing risks of climate change, particularly extreme weather events predicted to disproportionately impact Western Sydney, as further evidence that conventional approaches to planning and development need to be reconsidered.

Respondents consistently framed the CE as not just an environmental or technical fix, but as both a philosophical approach and an economic lever. Many described an ideal planning process as one that positions CE as part of a broader framework akin to the five-capital model (Porritt, 2007), financial, built, human, social and natural capital, where economic growth and sustainability are mutually reinforcing rather than competing objectives.

“Achieving a circular economy, which should be a means to totally reduce the impact of the economy on our planet and to distribute resources equally to people... Circularity is a tool to ultimately help us achieve it, or it should be.” – Circular economy specialist, private sector

“It has to relate to the built environment in not only are you [the] biggest user of materials in the entire economy, but you arguably provide one of the most valuable services on Maslow's hierarchy of needs, which is shelter.” – Circular economy specialist, private sector

This framing aligns with the view that CE enables tangible business opportunities across the built environment, discussed further in the next subsection. From reducing material waste and lifecycle costs to creating new markets for circular products and services, CE was seen as capable of driving both efficiency and innovation. In this sense, the CE is not only a sustainability tool but also a vehicle for economic resilience and competitiveness in a rapidly changing urban and climatic context.

“The real question we need to ask ourselves as a society is what is our economy for?... If our economy was for a life of equality and health and dignity for everybody on it and future generations within the planet's means, circular could be a mechanism to help us achieve that.” – Circular economy specialist, private sector

Emerging market opportunities

At a higher level, several respondents noted that sustainability as a buzzword has been gaining momentum in Greater Sydney and globally, in urban planning and project delivery due to the recent effects of extreme weather and climate change related events. Despite this, practical measures to improve sustainability are not often effectively integrated into planning for new or renewed areas. Increased levels of investment into 'green' initiatives, projects and technologies seem to indicate that there is a market for it. One respondent noted that sustainability on an urban or larger scale had progressed, however no mention of eco-cities or smart cities was referenced by any of the respondents.

Some respondents indicated that the attraction to sustainability and circularity may then be driven by personal interests, however, it is being unmet by the current market. Most respondents agreed that Australia is relatively new to CE thinking, particularly as it relates to the construction industry. Advancements have been driven by a few progressive contractors, supported by likeminded clients. One respondent discussed how a shift away from short-term profit to more sustainable thinking could be market driven. This respondent further explained that unmet interest or demand in the market, for more circular services or products, opens up significant opportunities for smaller, more niche companies to enter the market.

They cited Urban+ as an example, an Australian street furniture and drinking fountain supplier, that has embraced a CE model. By extending the life of manufacturing resources, minimising waste and operating through circular principles, Urban+ aligns its business mission with the growing emphasis on sustainability and circularity, also evident in other companies' strategic guiding statements and plans. This alignment has contributed to its success in a shifting market landscape, and now some of its largest clients are local governments.

"[The CE] opens up economic opportunities... it opens up business opportunities." –
Sustainability and research manager, state-owned development organisation

Framing of the circular economy

The CE is frequently framed as a desirable end state; that is, a closed-loop system in which waste is eliminated, resources are perpetually cycled, and environmental sustainability is optimised. One respondent was clear that while this vision is conceptually powerful, it can also be misleading. Treating the CE as a fixed destination risks reducing it to a checklist or compliance goal, disconnected from the dynamic realities of how urban systems function. In the built environment, this thinking may manifest in superficial approaches, like substituting materials or recycling construction waste, without addressing the more profound changes needed in land use planning, housing delivery models or construction methodologies. The CE should instead be understood as an evolving set of principles and a tool for transformation,

guiding a continual shift toward regenerative, adaptive systems, rather than promising a perfect, static future.

“Circular could be a mechanism to help up achieve that, it’s not in itself an end goal... This giant question or circular [or] any economy, even capitalism, even communism, needs a big moral rudder behind it... All of those are just like a different pair of shoes but like, where are you going? You don’t want to wear heels to the track.” – Circular economy specialist, private sector

Importantly, the CE emerged from an economic paradigm, rooted in industrial ecology and systems thinking, as discussed previously in the report. This foundational concept sought to realign business models with ecological limits. Its original focus was on decoupling economic growth from resource consumption through better design, reuse and value retention across production systems. Over time, however, the CE concept has adapted, sometimes stretching, into a catch-all term for sustainability, losing clarity and precision. In the context of the built environment and residential development, this expansion can dilute its economic intent: rather than creating new value changes around material recovery, adaptive reuse or shared infrastructure, CE is too often translated into compliance measures or aesthetic gestures. This obscures the potential of the CE as a framework for rethinking economic and spatial value, such as treating buildings as material banks to designing neighbourhoods as circular systems or exchange, not just zones of consumption and disposal.

In the built environment, reclaiming the CE’s economic roots and applying them as a guiding strategy is vital. It enables stakeholders to focus on system-wide value creation, long-term asset stewardship and the regeneration of both natural and urban capital. Rather than seeing the CE as the end goal of a sustainable project (e.g. ‘CE housing’), it should be the approach through which transformation happens, and influences how decisions are made about land, materials, infrastructure and policy. This reframing is particularly relevant to housing and neighbourhoods’ development, where lifecycle thinking, spatial equity, and infrastructure planning intersect. When a CE approach is deployed as a strategic tool rather than a static ideal, it can help reimagine housing not just as shelter, but as a node in a broader circular system which is economically viable, environmentally restorative and socially resilient.

Localised operations

Respondents emphasised the importance of a localised or place-based approach to achieving residential construction activities in a more circular manner. This aligns with the concept of a ‘hyperlocal economy’ (Reed, Twill and Christesen, 2018), which seeks to shorten and strengthen supply chains by prioritising local sourcing, repurposing and reuse. Rather than relying on linear, resource intensive flows of materials and energy, respondents noted that a hyperlocal

approach could generate multiple benefits, including improving efficiency, reducing embodied carbon and energy in construction, and fostering more sustainable urban development.

Beyond environmental outcomes, one respondent argued that localisation can also redistribute equity and justice, ensuring that the shift to circular practices does not reinforce existing social and political disparities, but instead creates pathways for fairer participation in the economy. In this sense, a place-based CE was seen not only as a technical solution, but also as a lever for social and economic transformation.

“Because we ‘re going on that journey from a decarbonisation perspective and then into nature and human rights, I think naturally we would start to look at those organisations that are doing those things differently from a circular economy perspective... Any organisation that... has a product or service that they’re offering would then have a locally produced one... It would be a lower carbon solution... something that respects nature a little more.” – Sustainability and research manager, state-owned development organisation

Primary inhibitors and challenges

This theme occupied most of the discussion time when conducting interviews. Responses were varied and often broad, depending on the respondent’s industry, occupation and background.

Unclear definitions and provisions

The transition to a CE requires the establishment of clear definitions and frameworks that provide a common understanding of key terms and concepts, as well as benchmarks and key metrics to monitor and measure progress. Without such frameworks, the adoption of CE principles across sectors can be inconsistent, leading to fragmented efforts and a lack of accountability. Clear guidelines and measurable goals are essential for tracking progress, evaluating the effectiveness of initiatives, and ensuring that CE principles are integrated into planning, development and operational practices in a meaningful way.

“Our understanding of circular systems and circular models sometimes is limited by what councils are willing to do... It depends on the council, how they can define the circular economy, how they can do within the council and... support in their procurement process to achieve a circular economy.” – Regional waste coordinator, local government representative organisation

Moreover, there is a notable gap or inconsistencies in current local planning frameworks regarding the inclusion of CE principles and enabling infrastructure in Local Environmental Plans (LEPs). While zoning regulations in some industrial areas may allow for warehousing and waste

or resource management facilities (CE adjacent infrastructure), these provisions do not acknowledge the specialised functions and unique needs of CE infrastructure. CE facilities often require specialised functions that go beyond traditional waste management, including material recovery, repair and refurbishment, recycling and resource remanufacturing. These facilities need to be designed to support the circular flow of materials and facilitate the sustainable management of resources across their lifecycle. Without clear provisions and zoning allowances for such infrastructure in LEPs, there is a risk that CE principles will be hindered in application, and recognition of their unique and specialised functions will be limited by ill-suited planning frameworks.

“So how do we [redacted] take up more... circular opportunities and implement systems that deliver circular outcomes? You’ve got to have the infrastructure to underpin that, and that’s really difficult at the moment... The planning system just doesn’t recognise circular economy infrastructure. It’s not waste infrastructure, it’s not manufacturing; it falls into this black hole in between... and the planning system will just say no.” – Regional waste coordinator, local government representative organisation

The absence of dedicated CE infrastructure provisions in local planning documents can create significant barriers to the realisation of a CE. Local governments play a crucial role in zoning, land use planning and determining the suitability of various activities within their jurisdiction. However, without a clear framework to accommodate and promote CE activities, local governments may be resistant or unable to fully support the infrastructure needed to close the loop on resource flows. This limitation highlights the need for updated planning regulations that specifically account for the diverse types of infrastructure required to support CE practices, from material recovery facilities to eco-industrial parks.

Crucially, the lack of planning support for such infrastructure can exacerbate ratepayer resistance to the siting of local waste disposal or resource recovery facilities. Without strategic communication, education and demonstratable alignment with broader sustainability goals, residents may perceive these facilities as undesirable or incompatible with local amenity, especially in residential or mixed use areas. This “Not In My Backyard” (NIMBY) sentiment often stems from a lack of trust, misconception about environmental impacts or concerns about declining property values. Clear planning provisions that frame CE infrastructure as essential, safe and beneficial public assets with great public benefit, paired with transparent engagement processes, can help shift public perception. Embedding CE principles into local strategic planning not only enables physical infrastructure delivery but also builds the social license needed to overcome local opposition and foster community ownership of CE initiatives.

Ambiguities in roles and governance

The transition to a CE in residential development is hindered by unclear roles and fragmented governance across local, state and federal levels of government, as well as amongst other key stakeholders.

The state government plays a key role in setting strategic directions, prescribing state-wide regulations and facilitating development approval pathways for state-significant planning proposals. One respondent commented that state level interventions, aimed at streamlining development approval processes and reducing pressure on local governments to process complicated planning proposals, have often eroded the authority of local governments. This has consequently reduced council's individual abilities to shape land use and development decisions in their jurisdictions in line with local sustainability goals, such as those prescribed in LEPs, Development Control Plans (DCPs) and Local Strategic Planning Statements (LSPs). State level interventions for development approvals have concentrated decision-making power at the state level, leaving local governments with limited autonomy to influence the integration of CE principles in residential development.

"I think we're seeing the erosion of the influence of local government in the planning space. I think we're seeing more and more state direction... [which] has meant that there's less influence of local government strategic planning." – Regional waste coordinator, local government representative organisation

The absence of dedicated CE policies and expertise at various levels of governments means that sustainability measures may not be meaningfully implemented or consistently monitored. Without the necessary expertise and guidance at the local, state and federal levels, there is a risk that CE principles will not be adequately embedded into residential development processes, stalling progress towards more sustainable housing.

Another challenge lies in the lack of coordination and integration between industry, government and consumers in achieving a CE in the housing sector. Developers and contractors often face difficulties navigating the varying regulations and expectations from different levels of government, making it harder for them to engage with and adopt CE practices. While state governments may set high-level policies, local governments must contend with the reality of implementing those policies on the ground, without clear support or a unified approach. Furthermore, consumers who play a critical role in driving demand for sustainable housing, are often left out of the conversation, with little awareness or incentive to push for CE principles in residential development. To overcome these governance challenges, a more cohesive and collaborative approach is needed, one that involves the establishment of clear role definitions,

targeted education and strong cross-sectoral coordination to ensure that the transition to a CE in residential development is not only feasible but also effective and impactful.

Balancing housing delivery and sustainability

In recent years, NSW has faced a severe housing crisis, with rapidly rising property prices and rents, and an increasing demand for affordable housing. This crisis has dominated government priorities, with the state government focusing heavily on the need to deliver more housing quickly to address shortfalls and needs. The pressure of a growing population, coupled with a lack of affordable housing stock, has led to an urgent push for housing development, often at the expense of other critical considerations, such as sustainability and long-term environmental impact. In response to this demand, the state has introduced a range of policies and initiatives, such as the Transit Oriented Development (TOD) and Low- and Mid-Rise programs, aimed at accelerating the approval and construction of new and renewed housing projects, frequently emphasising speed and volume over integrated, sustainable approaches.

This rush to meet housing demands has inadvertently led to a scenario where environmental and sustainability goals are sidelined. While there have been some efforts to address climate change and incorporate sustainability measures into urban planning, these are often secondary to the pressing need to meet housing targets. There is a concern, shared amongst some respondents, that in the push for rapid housing delivery, sustainability measures such as the incorporation of CE principles have not been given the attention they require. Developers, facing tight timelines, financial pressures and resourcing and material shortages, often prioritise cost-effective construction methods that may not align with sustainable building practices. As a result, the integration of key sustainability measures, including waste minimisation, reuse of materials and environmentally conscious designs, has been inconsistent and insufficient, despite the development of relevant guidance materials, such as the *Circular design guidelines for the built environment*.

“It’s quite important for government to have more than just one policy [focus]... Not only does that send a signal to the market, but it also then gives certainty of pipeline for businesses to scale.” – Head of policy, think tank

The current climate in NSW also reflects a broader tension between the need for urgent housing delivery and the long-term need for sustainable urban development. There is a growing recognition that the way housing is delivered now will shape the future of cities and communities. As the cost of living continues to rise, and the effects of climate change become more pronounced, it is increasingly clear that housing policy must incorporate sustainability as a core principle. However, the present focus on immediate housing needs often leaves little room for the broader, systemic changes necessary to transition to more sustainable forms of

urban development. Balancing the demand for more housing with the need to build resilient, energy-efficient and environmentally responsible communities will require a shift in priorities, as well as stronger integration of sustainability into the planning and construction processes.

“They don’t want anything to hold them back from delivering housing, and if they think that taking a circular economy approach even remotely stymies that, they won’t support it.” – Director, private sector

Competing and complementary land uses

As NSW faces growing demands for housing, appropriately located and zoned land essential for CE activities is increasingly under threat. Industrial zones, which provide the space needed for resource management, waste processing and materials recovery, are at risk of being repurposed to accommodate future housing or commercial needs. This competition for land raises concern about the long-term availability of sites crucial for CE infrastructure, which requires specialised facilities. As urban sprawl encroaches on these areas, the need to protect industrial land for circular activities becomes even more critical.

It is also essential to consider how to better integrate CE activities into appropriately located and compatible land use zones, such as some residential areas and mixed-use zones. In addition to utilising industrial zones for CE infrastructure, there are opportunities to create smaller, localised circular hubs within residential or compatible areas. These hubs could facilitate waste reduction, material recovery and local recycling efforts, contributing to more sustainable communities without requiring large-scale industrial operations. For example, creating localised waste management systems or community-level repair and refurbishment centres can encourage residents to adopt circular practices while reducing the environmental impact of transportation and material handling.

Importantly, embedding CE practices into everyday community spaces also plays a vital role in acculturating residents to the principles and benefits of the CE. When people are given the opportunity to participate directly, they are more likely to develop a sense of ownership and responsibility for resource stewardship. This cultural shift can, over time, help reduce community resistance to the development of local waste and resource recovery infrastructure, as residents come to see these facilities as essential components of a sustainable and resilient neighbourhood. Integration of CE activities into residential areas can both enable practical circular outcomes while building public awareness and acceptance critical to long-term policy and infrastructure success.

“It could be some principles or some objectives, but starting it from that rezoning perspective to say we’re going to have land uses aligned to each other near each other.”

– Sustainability and research manager, state-owned development organisation

Outdated sustainability frameworks

Frameworks such as BASIX (Building Sustainability Index) and NABERS (National Australian Built Environment Rating System) were instrumental in setting early benchmarks for sustainability in residential and commercial developments. They provide quantifiable metrics to guide energy efficiency, water usage, and thermal performance, which assists in embedding sustainability into planning and construction processes. However, as the understanding of sustainability evolves and the transition to a CE becomes more urgent, these frameworks are increasingly seen as static and misaligned with contemporary CE principles. For instance, one respondent emphasised that a CE approach calls for regenerative design, long-term or extended material reuse and system wide thinking across supply chains, which are areas that traditional sustainability tools offer limited guidance. This disconnect can result in developments that are ‘compliant’ by outdated standards but fall short of what is needed for a regenerative, circular approach.

“The BASIX is based on outdated climate modelling and doesn’t even look at future climate modelling. If we can’t update BASIX, then... what chance do we have of getting all of this other stuff in place.” – Regional waste coordinator, local government representative organisation

The slow pace of updating these frameworks can stifle innovation. Developers and planners may be disinclined to pursue advanced circular-economy-aligned strategies if they are not recognised or rewarded under existing compliance schemes or frameworks. The rigidity of these systems may also limit local government or developer capacity to experiment with novel materials, design-for-disassembly practices or circular procurement models. In this way, frameworks originally designed to encourage sustainable development can inadvertently become inhibitors when they are not agile enough to accommodate new, and potentially more effective, thinking. This signals a need for more dynamic, iterative policy tools that reflect the rapidly shifting expectations of environmental stewardship and enable actors across the development sector to align with the principles of circularity more effectively.

“There is that sort of shift in what housing looks like, but I don’t think there’s much consideration around... I mean, at best there might be stuff around waste management, which is very minimum and basic, but there’s not much consideration around how we do design with local materials, reduce [or] reuse what’s already there.” – Sustainable systems associate, private sector

Cost of practices and product certification

In both new and renewed urban areas, the high cost (real or perceived) of implementing CE practices emerged as a significant barrier identified by interviewees. In new developments, upfront costs associated with circular design and non-standard construction and planning techniques can discourage adoption, particularly where profit margins are already tight and regulatory support is lacking. For example, designing for disassembly, incorporating recycled materials and sourcing certified low-impact products often require specialised expertise, new supply chains or bespoke solutions, all of which increase procurement complexity and costs (Pomponi and Moncaster, 2017).

“In some Western Sydney areas, you couldn’t sell an apartment with a whole bunch of extra sustainability features because you don’t have the audience who would pay... So you see a lot of proliferation of you know, design led excellence causes and things in the east.” – Regional waste coordinator, local government representative organisation

“All those decisions are being driven by cost, time and compliance... So if it’s not part of needing to be compliant, it falls under the radar.” – Sustainable systems associate, private sector

In renewal areas, where demolition and redevelopment are common, stakeholders noted that retrofitting existing structures to apply more circular principles often proves more expensive than conventional demolition and rebuild approaches. This is compounded by the lack of standardised certification pathways for reused or remanufactured components, as discussed above, which introduced both administrative burden and market hesitation. The absence of financial incentives, such as tax relief or expedited approval pathway, further entrenches this cost perception. Interviewees stressed that while CE practices could lead to long-term operational savings, the lack of near-term commercial return remains a key disincentive in both development contexts. This aligns with findings in literature that highlight the role of perceived financial risk and uncertainty as persistent barrier to CE implementation in the built environment (Adams, et al., 2017).

“It’s going to cost you a lot of money to retrofit this existing building that wasn’t designed for that purpose. You know, even as a practitioner, I’m a little bit worries because, like, how o we do this?... Ideally you don’t want to knock down and rebuild but, equally, if you keep something that’s sub-optimal, I need to throw so much more money to make it viable and sustainable... It’s not down to one person to fix that problem.” – Sustainable systems associate, private sector

Environmental impact

While the environmental impacts of housing which adopts CE principles are well established in literature (EMF, 2015), interviewees limited discussion of the environmental impacts of CE infrastructure itself. This may reflect the profile of interview participants, many of whom are actively engaged in CE practices and viewed environmental concerns as inherent in their work. From a broader community perspective, these impacts may be more contentious. The siting of material recovery facilities, decentralised waste management centres or reverse logistic hubs, particularly those in or near residential areas, may raise concerns around noise, traffic, odour or visual amenity, even if the infrastructure demonstrates public benefit and is environmentally justified.

This gap in interview findings suggest that while CE actors may consider the environmental performance of their initiatives or operations as justified, broader public acceptance should not be assumed. For example, resistance from ratepayers or local communities to waste sorting or reuse hubs can hinder the integration of CE infrastructure, especially in urban renewal areas where land use is highly contested (Wilson, 2007). Building social license for such infrastructure therefore requires not only sound environmental design but also community engagement and education. As CE planning expands into residential zones, local government and developers must navigate these socio-environmental trade-offs, ensuring that CE infrastructure remains both contextually appropriate and publicly supported.

Key players

Thematic analysis of interviews identified five main players in the integration of the CE as a tool in residential development. Whilst government was identified as the main player in shifting market thinking and operation, most respondents indicated a large role for consumers and the lay person.

Local government

Local governments are crucial in driving the adoption of CE practices in the housing and residential development sectors given their localised knowledge and strategic vision for how land use planning and growth should unfold in their local government area. They have a unique understanding of the specific needs and behaviours of their communities, making them well-positioned to approve appropriate development and implement tailored, place-based strategies that prioritise sustainability and resource efficiency. Local governments can influence planning and zoning decisions, both for residential and supporting land uses, ensuring that CE principles are embedded in local housing policies, infrastructure and development projects. By promoting circularity through local strategies and local planning requirements, building

regulations and community engagement, local governments can advocate for local procurement opportunities, and encourage developers to adopt sustainable practices, such as including circular planning controls in development control plans and advocating for the protection of industrial land.

“I think our role [redacted] is two-fold. I think councils are the closest organisation to communities to do outreach and education, and I think Council’s often have the skills to do that quite well... From the cultural change thing and advocating to other levels of government about when change is needed at their level for us... I think we can be setting up strategic and plans about how we manage our industrial land to be able to account for the new types of development that might need to spring up to support it.” – Strategic planning and economic development manager, local government

Local governments often face challenges in executing their responsibility for land use planning decisions in their own local government areas due to the erosion of some of their powers by state governments. In many cases, state governments streamline planning pathways that override local authority, limiting the ability of local governments to direct growth and development and enforce any local CE requirements. This tension between local flexibility and state-level authority can undermine efforts to promote local and sustainable development practices at the local government level. Another respondent contributed that developers often find it challenging to navigate the varying controls and prescriptions of different councils, with some opting to target state government approval pathways to bypass local requirements. Despite these challenges, local governments remain integral to shaping how CE principles are applied on the ground, particularly when it comes to engaging residents, fostering community buy-in and ensuring that local built environments reflect the strategic direction desired by councils and reflect sustainable, resource-efficient practices.

One respondent cited the example of London, which has introduced policies that specifically mandate consideration of circular practices in construction and development projects, detailed further below.

The Greater London Authority’s Circular Economy Route Map and the policies outlined in the London Plan mandate that large-scale residential projects submit CE statements, which include requirements for material reuse, waste management, and sustainable construction practices. These state-level policies not only drive change across the housing sector but also serve as a model for other regions. Through their decision-making powers, state governments have the ability to set the direction for the industry, influencing both local governments and developers to align with CE goals.

[Regarding the Greater London Authority's Circular Economy Route Map]. *"You have to write a circular economy statement for any kind of new development or... refurbishment that happens, and there's a really great guidance document... that talks about what the principles are, what you had to include in the statement, and how many statements you have to write. And it's really brilliant because it's meant that all the major projects in London now have to consider circularity."* – Senior sustainability consultant, private sector

State government

With authority over major planning and zoning decisions and regional strategic planning, state government has the ability to introduce and enforce incentives that drive the adoption of CE practices across the sector. These initiatives could include requiring the integration of circular design principles into building codes or pattern books aimed at streamlining approval processes, incentivising developers to adopt sustainable construction methods, setting long term sustainability targets to guide the residential development sector and enhancing material and construction cataloguing to ensure visibility across the sector. A common theme throughout the discussions was the need for governments to take a more proactive role in establishing clear expectations, regulatory standards and frameworks that would compel or mandate industries to adopt CE practices.

Several interviewees emphasised the importance of embedding CE principles directly into planning requirements, building regulations, policy documents, assessment criteria and tender processes. By specifying circular elements as mandatory considerations with relevant frameworks, governments would create clear, enforceable expectations that would compel developers, contractors and industry stakeholders to integrate sustainable practices into residential construction projects. As one respondent noted, this approach would act as a catalyst for change, compelling companies to rethink their practices and integrate circular principles into their operations. This could range from material selection and waste management to designing for disassembly and promoting resource efficiency.

"Having federal and state policies has really helped councils sort of push on with it... We don't really see it pushing down through economy systems, manufacturing processes or design principles. We're really seeing it coming through energy, through waste, a little but through water, rather than having [redacted] procurement systems and economic systems pushing down." – Regional waste coordinator, local government representative organisation

“I think it would be more beneficial... that the conversation is facilitated and led by government and that it involves a lot of ongoing consultation with industry.” – Strategic planning and economic development manager, local government

A consensus emerged among most respondents that engagement and collaboration across various industries is essential for the successful implementation of state government strategies in the residential sector. CE adoption cannot solely be driven by policy makers or individual sectors in isolation. For government strategies to be truly effective, they must engage a diverse range of stakeholders involved in housing development, including architects, construction companies, local governments and financial institutions. This cross-industry collaboration ensures that policies are not only practical but also relevant, addressing specific challenges and opportunities prevalent in each sector. By fostering collaborative relationships, government can ensure that CE practices are integrated more seamlessly into industry operations, creating a more cohesive and effective transition.

“Not only one sector can fix the problem... Government sectors, institutions, communities, builders and researchers... I think the sector [who should be leading the collaboration] should be the state government.” – Project officer, research institution

Ultimately, respondents agreed that for government incentives and mandates to succeed, they must be paired with education and industry-wide engagement. Only through a holistic and collaborative approach can circular practices be meaningfully adopted and embedded across sectors, ensuring lasting impact and progress towards more sustainable housing.

Industry

The transformation of the residential development sector through the adoption of the CE as a tool is increasingly seen as dependent on strong leadership from larger, better-resourced companies that can drive change, as well as substantial support from the federal and state government. This support should go beyond more regulation and include explicit references to the CE principles in housing and development policy guidelines and targeted education, industry upskilling and training initiatives. As highlighted by several interviewees, the industry must not only be subject to enforcement measures but also incentivised. Such incentives are crucial for sparking innovation and accelerating the widespread adoption of circular construction practices in residential development.

“It’s just the normal way that change happens where you have the people who are leading and that’s a sort of aspirational thing, and then at the bottom, you’ve got the regulation that’s following a few years later to kind of pick up all of the laggards.” – Strategic planning and economic development manager, local government

Access to capital remains a critical factor for the growth and sustainability of circular housing initiatives. This may require engagement with the financial sector to pilot innovative financing models that are not traditionally applied to residential projects, such as green bonds, tax incentives and low interest loans for sustainable housing development and operation. These financial mechanisms can provide the necessary flexibility to scale circular practices within residential construction.

A fundamental consideration in advancing CE practices in residential development is the preservation of local equity, particularly in housing. The aim is to foster an environment where local communities are involved and benefit from the other opportunities that emerge from incorporating the CE as a tool in developing more sustainable housing. By focusing on inclusive development, equitable access to resources, and localised procurement of labour, resources and material, this approach is essential for creating a more resilient and sustainable housing framework that services both current and future generations.

Peak bodies

Professional bodies and peak industry organisations play a crucial role in driving the adoption of CE practices within the housing and residential development sectors. Some respondents agreed that these organisations are often at the forefront of providing commentary and assessing existing frameworks, identifying gaps in current practices and researching innovative approaches that can drive the sector towards more sustainable and circular methods and processes. Their expertise and industry authority make them well-positioned to advocate for the integration of CE principles and highlight the benefits of adopting these practices at a systemic level, especially within residential construction and development.

One of the key functions of these professional bodies is conducting research into new and more sustainable approaches to housing. They explore new and emerging methods, such as the use of sustainable materials, adaptive reuse of buildings or energy efficient design, and assess their feasibility and impact. Through this research, these organisations provide valuable data and evidence that can guide the industry and influence decision makers in government and development.

“Normalising future consumption is really important. We can deconstitute an old printer and turn it into material that’s useful for a manufacturer... So how do we then socialise that that material is available?... Maybe it’s kind of the role of peak bodies.” – Head of policy, think tank

Professional bodies play a pivotal role in disseminating findings and more effective practices across the sector. They circulate latest findings, best practices and case studies through industry

reports, webinars, workshops and conferences. This enables professionals across the industry, including developers, architects and contractors, to stay informed and integrate CE principles into their work. By fostering industry-wide engagement and encouraging the uptake of innovative, sustainable practices, professional bodies can ensure that the CE becomes a central focus in the residential development sector, helping to drive long-term change towards more sustainable communities.

Consumers

Consumers are increasingly seen as a critical catalyst for driving meaningful change in sustainable practices. While this may not be directly within scope of this study, it is crucial to recognise the vital role that consumer education and behaviour change will play in advancing the CE, particularly in residential development. Engaging with consumers effectively requires more than just providing data on materials and emissions; it involved creating a deeper connection between individuals and communities and the sustainable choices they make.

“Customers and consumer... want something potentially that is good for the planet, but they also have really strong cost constraints and cost of living and housing prices overlaying on that that really create that difficult tension.” – Sustainable systems associate, private sector

This connection must be built on a foundation of clear, accessible data that links material usage and carbon footprints to tangible outcomes. One respondent offered that it is not just about demonstrating the environmental benefits, products and initiatives need to resonate with consumers on a personal level, offering value beyond their sustainability aspects. Sustainable housing, or housing products, must present both environmental and personal benefits to inspire lasting behaviour change. For example, a home built with greater energy-efficient materials and systems not only reduces carbon footprint but can also provide significant long-term savings on utility bills, improved air quality, enhanced comfort and increased longevity of the housing product.

For consumers to truly embrace sustainable options, they must actively be involved in the decision-making process. This could involve providing homeowners with the opportunity to select eco-friendly materials, locally sourced materials or resources, or energy efficient solutions for their homes, giving them a sense of control over their environmental impact. One respondent who worked at a high-growth council stated that consumers were already demonstrating support for more sustainable options and were willing to spend more money on a more sustainable housing product. By emphasising both environmental and personal benefits, the housing sector can drive behaviour change and build a deeper, more meaningful connection between consumers and the CE.

Educational institutions

While the focus of this study may not extend to education and training, it is important to highlight that educational institutions play a crucial role in both preparing new professionals and providing ongoing learning opportunities for those already in the workforce. By incorporating the teaching of CE, and more broadly sustainability focused modules, into curriculums, schools and universities can ensure that future architects, engineers and construction professionals are equipped with the necessary knowledge and drive to implement sustainable practices into development.

“If we don’t train it from the beginning and build that awareness and stewardship, you know, and then, well then it’s not going to really work.” – Sustainable systems associate, private sector

It is not enough to focus solely on educating the young and emerging professionals. One respondent indicated that there is a pressing need to provide ongoing career training and upskilling for individuals already in the workforce. Continuous professional development through workshops, short courses and industry partnerships is essential to ensure that the workforce can keep pace with new technologies and sustainability strategies. One respondent referenced a 2022 French government program (the ‘Formation À La Transition Écologique Des Cadres De L’État’) which aims at providing ongoing training and support to civil servants and government executives on sustainability related topics, including the ecological transition.

“We can’t wait for the new generation so there’s also some retrofitting into professional environments in order.” – Sustainable systems associate, private sector

Key opportunities for policy action

Respondents highlighted and discussed a wide range of perspectives on the key opportunities for policy action in enabling a CE. It was challenging to clearly distinguish which opportunities fell within the formal remit of land use planning. This reflects the complexity and evolving nature of planning systems, as well as differing interpretations of their scope among stakeholders. The summary below focuses on those interventions which were discussed most commonly amongst respondents and which most clearly aligned with land use planning levels. Broader policy opportunities, which were considered beyond the remit of this report, are presented in the following section of the report, as areas for further research.

Table 4 Key opportunities for policy action

Policy opportunity	Category	Spatial level	Lifecycle relevance
Tax or financial incentives	Financial Fiscal	• State: Design and administration of grants, subsidies and tax relief	New and renewed neighbourhoods

Policy opportunity	Category	Spatial level	Lifecycle relevance
		<ul style="list-style-type: none"> • Metropolitan/regional: targeted funding aligned with regional housing and sustainability strategies • Local: Application of developer contributions, incentives 	
Streamline approvals	Regulatory	<ul style="list-style-type: none"> • State: Embed CE-aligned criteria into statutory planning instruments (e.g. SEPPs, LEPs) and establish clear streamlined approval pathways • Metropolitan/regional: Consistent CE-aligned assessment frameworks and processes across jurisdictions • Local: Reduced assessment times for projects meeting benchmarks 	New and renewed neighbourhoods
Protect industrial lands	Regulatory	<ul style="list-style-type: none"> • State: Policy frameworks for industrial zoned land • Metropolitan/regional: identification of precincts to safeguard for CE-related activities • Local: Land use zoning and development controls 	New and renewed neighbourhoods
Define circular infrastructure	Regulatory	<ul style="list-style-type: none"> • State: Update SEPPs and other EPIs to recognise CE infrastructure • Metropolitan/regional: Integrate CE infrastructure in regional plans • Local: Embed definitions in LEPs and DCPs 	New and renewed neighbourhoods
Shared materials database	Financial Regulatory	<ul style="list-style-type: none"> • State: Develop and manage platform; regulate participation • Metropolitan/regional: Use data to forecast resource flows and coordinate material reuse through the region • Local: Require integration through planning approvals 	New and renewed neighbourhoods Particularly renewed
Increased monitoring and reporting	Regulatory (Potential financial if linked to performance based incentives/penalties)	<ul style="list-style-type: none"> • State: Mandate CE-related reporting standards in planning and development legislation • Metropolitan/regional: Coordinate regional benchmarks and provide data platforms for comparative performance • Local: Embed reporting requirements into DA conditions and local planning instruments; conduct audits during construction and post-occupancy 	New and renewed neighborhoods
Localised operations	Financial Regulatory	<ul style="list-style-type: none"> • State: Introduce standard land use definitions into the Standard Instrument and offer grants/tax incentives for localised CE infrastructure • Metropolitan/regional: Identify priority CE infrastructure or precincts through Regional Plans and support inter-council collaboration on shared facilities or bulk procurement of required equipment • Local: Zone and protect appropriate land for CE activities near residential areas; repurpose underutilised public assets for small scale CE operations; support co-location with innovation areas 	New and renewed neighbourhoods
Training and education	Regulatory	<ul style="list-style-type: none"> • State: Curriculum development, professional training mandates, CPD requirements • Metropolitan/regional: Facilitate cross council and industry training programs • Local: Upskill council planners, decision makers and local businesses and interested parties 	New and renewed neighbourhoods
Updating existing frameworks	Regulatory	<ul style="list-style-type: none"> • State: Update state frameworks to incorporate CE metrics, making them 	New and renewed neighbourhoods

Policy opportunity	Category	Spatial level	Lifecycle relevance
		mandatory considerations in planning and building approvals. Negotiate interstate agreements on waste disposal tariffs to localise reuse and recycling loops. <ul style="list-style-type: none"> • Metropolitan/regional: Align regional and district plans with CE performance targets, prioritising precinct-scale initiatives. • Local: Embed CE considerations into LEPs, DCPs and DA assessment criteria/considerations. 	

Tax or financial incentives

Robust and diversified funding mechanisms are essential to support the systemic transition to a CE in residential development. Financial incentives, ranging from tax rebates and grants to low-interest loans, infrastructure co-funding and public-private partnerships, can help derisk innovation and make circular practices more commercially viable. Many strategies which incorporate CE principles, such as adaptive re-use, on-site material recovery or investment in modular construction systems, have high upfront costs that are difficult to recoup in traditional development timelines. Targeted public funding can bridge this gap, enabling developers and councils to trial new approaches without compromising financial feasibility.

“If you tax differently because you’re using local materials, low carbon materials, reusing things on site or you’re reusing from another... I think putting some targets and thresholds from which you get zero... or better taxation.” – Sustainable systems associate, private sector

A few respondents emphasised that there was a significant role for the government to play in this regard. Performance-based incentives can be designed to reward circular outcomes, such as resource efficiency, embodied carbon reductions or the reuse of reclaimed building materials. For example, bonus floor space ratios, fast-tracked approvals or reduced developer contributions could be offered to projects that achieve specific circular performance benchmarks. Similarly, dedicated innovation funds or green bonds can support research, pilot projects or the commercialisation of circular technologies in construction.

Importantly, these incentives should be accessible across the spectrum of development actors, from large developers to small-scale builders and community housing providers. Respondents emphasised that the latter two developer types may not have as much capital to dedicate to development innovation or research. Equity-focused funding programs can help ensure that the CE transition is inclusive and doesn’t concentrate benefits in already well-resourced segments of the industry. In parallel, public sector investment in shared circular infrastructure, such as reuse hubs, material libraries or disassembly and storage facilities, can support the whole market and reduce entry barriers for smaller players. A comprehensive, layered system of

monetary incentives is therefore critical to catalyse widespread uptake of CE principles and enable innovation at scale.

Streamline approvals

Streamlined planning and development approvals that integrate, or show consideration for, CE principles can be a powerful lever to accelerate industry uptake. By embedding CE-aligned assessment criteria, such as resource efficiency, embodied carbon reduction, adaptive reuse or on-site material recovery, into assessment and approval processes, governments can both incentivise better practices and reduce costly delays for projects that deliver measurable circular outcomes. Respondents noted that initiatives currently being rolled out by the state government, such as the recent Government Architect NSW Pattern Book, which introduce pathways for faster approvals or reduced regulatory hurdles act as a non-financial incentive, improving project feasibility and which could also encourage developers to prioritise CE aligned strategies from the outset of project design.

“If the planning framework doesn’t incentivise a different way to approach... design approvals and how you’re going to design things... Design, material choice and extended life of the building, how it’s going to be maintained. All of that is not necessarily factored into the planning.” – Sustainable systems associate, private sector

Importantly, this opportunity recognises that planning pathways are often as influential as financial levers in shaping development outcomes. Many respondents reflect that delays, inconsistencies or uncertainties in the approval process discourage experimentation and innovation. By creating a clear, predictable framework that rewards projects incorporating CE principles, governments can help derisk innovation and send strong market signals. Such measures could include alternative assessment pathways for developments that achieve certain sustainability benchmarks.

“Governments or large organisations that are leading in this space need to revisit how we invest and derisk the process... if we subsidised... for a period of time, that’ll give confidence, remove the risks. People will invest translates into actual solutions, scale stuff up... Then there’s efficiency, then it works and it’s cheaper than the conventional solution.” – Sustainable systems associate, private sector

This form of procedural incentive could be particularly impactful for smaller developers, community housing providers, and council who may lack the capital to pursue innovative circular initiatives. Faster and simple approvals can lower administrative costs, reduce holding expenses and free up resources to invest in more sustainable practices.

Protect industrial lands

The transition to a CE relies heavily on the availability of industrial land for a range of enabling functions, manufacturing with secondary materials, storage of salvaged components, repair and refurbishment operations, and materials processing. However, in many metropolitan areas, industrial lands are under pressure from rezoning to higher-value residential or mixed-use development, driven by escalating land prices and demand for housing. This trend undermines the physical and economic foundations required to sustain a circular built environment.

“Think about the strategic role and economic role of industrial lands in the future of the economy... What is the role of the circular economy in industrial precincts across Sydney?” – Head of policy, think tank

Policymakers need to reconsider the strategic value of industrial lands, not only in terms of jobs and economic activity but also for their role in climate resilience and circularity. Long-term protection of well-located industrial lands, particularly near urban renewal precincts, must be reinforced through regional strategic plans, state planning policies, and land use zoning protections. Incentives should be offered for industries engaging in CE-related activities to cluster in these zones, creating circular innovation precincts. Concurrently, stronger policy frameworks should prevent speculative upzoning and ensure that these areas remain viable and accessible for future circular infrastructure needs.

“We can be setting up strategies and plans about how we manage our industrial land to be able to account for the new types of development that might need to spring up to support it... whether that’s waste transfer, waste processing sites, storage, etcetera.” – Strategic planning and economic development manager, local government

Establish a circular infrastructure definition

A key barrier to implementing CE practices is the absence of defined land use provisions that support the delivery of CE infrastructure and activities, such as materials recovery facilities, component reuse hubs, reverse logistics centres, and localised remanufacturing operations, within the current planning framework. Most existing land use zoning instruments are still rooted in a linear model of production and consumption, often failing to explicitly accommodate circular activities. This can create regulatory uncertainty, lead to costly planning delays and result in missed opportunities to establish localised circular ecosystems.

“It’s got to be classified as one of [a development or infrastructure type], but it’s not one of those [standard definitions]. It’s actually quite different... So how do we get the

planning system to acknowledge that it's not just waste disposal, it's not just manufacturing... it can be all-encompassing, it can be big and small, but the system is also not there to strategically plan what is needed to underpin and deliver that, so it's really difficult.” – Regional waste coordinator, local government representative organisation

To overcome this, planning instruments at both the strategic and statutory levels must embed CE as a core land use principle. This includes exploring the feasibility and potential impact of introducing new land use terms, such as ‘circular economy enabling infrastructure’ or ‘circular economy hub’. These definitions would clarify what constitutes CE-supportive land use and help enable its delivery.

Additionally, the inclusion of CE land use definitions in state-wide planning instruments, particularly the *Standard Instrument (Local Environmental Plans)*, should be assessed for viability and desirability across stakeholder groups. This would ensure consistent adoption across all local government area jurisdictions and reduce ambiguity in planning processes. Local Environmental Plans (LEPs) and Regional Plans should be updated to explicitly identify and zone land for CE activities, especially near urban renewal areas or major greenfield development sites. Doing so would establish the physical and regulatory conditions necessary for CE infrastructure to co-locate with residential development. Development assessment guidelines should also be revised to streamline approvals for CE-aligned land uses, including the adaptive reuse of existing industrial spaces.

Increase monitoring and reporting

A foundational barrier to implementing CE principles in residential development is the lack of visibility over material flows. Without clear, accessible data on what materials are entering and leaving development sites, it is nearly impossible to coordinate reuse, recycling or redistribution at scale. To address this, planning systems must move beyond high level policy commitments and embed robust mechanisms for monitoring and reporting resource movements throughout the development lifecycle.

“Mandatory and embodied carbon reporting is really important because the circular economy is a way to reduce your carbon emissions, and carbon is the metric we use for quantification.” – Circular economy specialist, private sector

A government-mandated digital materials and resource database, where developers log every material input, output (waste, offcuts) and residual resource (e.g. salvaged materials that remain onsite or in storage), could radically improve transparency and coordination. Such a platform, publicly accessible and spatially enabled, would allow councils, developers and

circular businesses to view what materials are available or becoming available, where and when. This visibility would enable more efficient reuse and sharing of surplus materials across projects, reducing waste and unlocking localised circular supply chains.

To be effective, this system should be embedded in planning and construction approvals and construction compliance systems, with a regulatory requirement that all developers and contractors track and report resource movements throughout the construction lifecycle. Similar to the London Plan, which mandates that large scale developments submit Circular Economy Statements detailing material reuse, waste reduction strategies and sustainable construction practices, the Greater Sydney region could implement parallel requirements. These CE statements could be tailored to LEPs, DCPs and other local government planning provisions and serve both as a compliance tool and a catalyst for market transformation.

“They should be recording a lot of stuff... it should all be going into a national, statewide or citywide materials database... so first point of call [for the construction team] is looking at the inventory or it’s digitally integrated in the design.” – Circular economy specialist, private sector

“It’s amazingly, incredibly hard to get sustainability or, particularly, the circular economy at the heart of people’s ambitions, and I definitely found that really challenging... because I didn’t find that was the case back in the UK because of [their reporting] policies.” – Circular economy specialist, private sector

One respondent offered those technologies like QR tagging, digital twins or blockchain based smart contracts could enhance data accuracy and traceability. This would unlock numerous circular opportunities, including one developer’s demolition waste becoming another’s construction input, surplus materials can be shared or sold instead of dumped, and planners can forecast regional resource needs based on real-time data.

Over time, the aggregated database could inform CE-aligned procurement policies, guide infrastructure investment and even underpin circular certification schemes. This would shift resource management from a waste-disposal paradigm to a resource-stewardship model, supporting a more intelligent and connected built environment.

Localise operations

One of the key decisions influenced by planning frameworks is whether CE infrastructure can be delivered through large, centralised facilities or through decentralised networks of small-scale operations. While centralised facilities often align more easily with traditional planning models, such as industrial areas being clearly distinguished from residential areas, they may

overlook the broader lifecycle costs of transporting materials across long distances. This is particularly relevant in urban contexts, where congestion, emissions and cost of logistics can outweigh the efficiencies of scale.

“Try and create local jobs and support local businesses so that local wealth is created and sustained in local communities or regional communities, rather than just assuming that it’s a race to the bottom.” – Head of policy, think tank

Conversely, networks of small-scale CE facilities integrated into local industrial zoned land, or underutilised urban infrastructure, can provide more agile, community-responsive services. Land use planning can support this model by zoning for CE-supportive uses in proximity to residential and urban renewal areas, enabling localised materials recovery, warehousing and storage, organics processing or remanufacturing activities. As discussed previously, updating planning instruments to explicitly define and enable such uses, would allow councils to better identify and leverage existing assets, reduce transport-related emissions and foster community engagement.

Small scale CE facilities offer unique opportunities to integrate with education, innovation and skills development initiatives locally. Planning provisions that facilitate the co-location of these facilities with local innovation hubs, businesses or ‘maker-spaces’ could potentially support the conversion of waste materials into high-value products. These synergies not only advance environmental objectives and demonstrate how land use planning can enable CE-aligned outcomes in residential areas, but also stimulate local economic activity and workforce development.

“Community wealth is almost like the social element of the physical and environmental construct of a circular economy, and so the two go neatly together.” – Head of policy, think tank

Promote education and training

Embedding CE principles into the planning profession requires a fundamental shift in how planners are educated, trained and supported throughout their careers. While sustainability is increasingly integrated into tertiary planning programs, CE thinking – focused on material flows, regenerative systems and long-term stewardship – remains relatively new to most curricula. Planners are uniquely positioned to shape the spatial, regulatory and policy conditions that either enable or constrain circular outcomes. Building their capacity to understand, apply and advocate for CE principles is therefore critical to driving systemic change across the built environment.

“I was quite appalled to hear that the new curriculum... removed sustainability or environmental components... if we don’t train it from the beginning and build awareness and stewardship... it’s not going to really work.” – Sustainable systems associate, private sector

“I think it really will start with people and getting that... holistic understanding of what’s going on in the world right now. We are all asleep at the wheel. Everybody’s trying to make ends meet and get on with their life, which is hard enough without considering biodiversity loss and circularity and the crazy collapse that we’re about to face that I don’t think people understand.” – Sustainable systems associate, private sector

This educational transformation cannot be limited to young people and emerging professionals alone. Many of the most influential decisions are made by experienced planners, urban designers and policy makers who are already embedded within the industry. Upskilling mid- and late-career professionals is essential, not only to continue circulating ideas to address contemporary challenges, but also to leverage their institutional knowledge and decision-making power to implement CE practices at scale. Given the worsening impacts of climate change, resource depletion and construction waste, there is an urgent need for continuous professional development programs that equip the current workforce with tools to respond to these issues now, and not only in the future.

“In France, you have a government-led system for training. Every organisation has a budget being allocated to upskilling people on sustainability. It’s part of the corporate learning and development budget and it’s subsidised by the government.” – Sustainable systems associate, private sector

Embedding CE literacy across all levels of the planning profession will transform the role and capabilities of planners from regulators of land to stewards of regenerative urban systems.

Update existing frameworks

Updating existing sustainability assessment frameworks such as BASIX and NABERs presents a significant policy opportunity to operationalise CE principles in housing. While these tools have played an essential role in mainstreaming energy efficiency in buildings, they were not designed to capture circular metrics such as embodied carbon, material and stock reuse, building adaptability or design for disassembly (Pomponi and Moncaster, 2017). Updating these frameworks to incorporate CE indicators could normalise circular design and planning approaches and send clear regulatory signals to developers and industry stakeholders.

For new residential developments, this reform could incentivise the use of prefabricated systems and module construction techniques that reduce waste and allow for future disassembly and reuse (Zhang, et al., 2022). Developers could receive credit for retaining materials on-site, sourcing reused components or designing for material recoverability, with these actions embedded in compliance and performance scoring. In urban renewal contexts, updated frameworks could also reward the conservation of embodied energy through adaptive reuse, provide assessment methodologies for deconstruction planning and offer clearer pathways for integrating secondary materials from local circular supply chains (Durmisevic, 2019). Such revisions would encourage more resource-conscious retrofits rather than demolition-led redevelopment.

“We can talk about pattern books. We can talk about apartment design guides... That was a really good example of when, you know, all sides of the fence came to the table... Generally, there was a general support for doing things better... There was a lot of opportunity and agreement to change there.” – Regional waste coordinator, local government representative organisation

Additionally, local government could incorporate requirements for applicants to demonstrate how their development supports circular outcomes, such as through the reuse of building materials, the minimisation of construction waste or integration of shared or modular infrastructure. These criteria could be included in LEPs, DCPs and referred to in the justification of development proposals, ensuring that circularity becomes a standard consideration alongside existing sustainability, design and amenity benchmarks. This approach would not only promote consistency in how CE outcomes are evaluated but also offer transparency for industry stakeholders seeking to align with evolving planning expectations.

“They’re very good at ‘where should houses go and where should jobs go’? But we are not very good at ‘where should services go’? And I think circular economy needs to be embedded as a service.” – Strategic planning and economic development manager, local government

The effectiveness of these proposed reforms is contingent on complementary action at the national and interstate levels, particularly in relation to waste disposal tariffs and regulatory harmonisation. A key barrier to widespread reuse and recycling is the uneven and sometimes prohibitive cost of waste disposal, which can disincentivise recovery practices and favour linear approaches. Negotiating national or interstate agreements on consistent waste disposal tariffs, and aligning regulatory frameworks for construction and demolition waste, would create a level playing field for industry actors and encourage best practice across jurisdictions. Harmonised standards and pricing would also strengthen the economic case for circular design,

improving the feasibility of secondary materials markets, and support cross-border collaboration in material recovery, processing and reuse.

Chapter 6: Implications

The policy opportunities identified through the interview process demonstrate a clear and consistent theme: achieving CE outcomes in residential development does not require wholly distinct solutions for new and renewed neighbourhoods. Instead, a suite of adaptable and scalable interventions, spanning regulatory, fiscal and financial instruments, can be applied across both contexts within contextual nuance. This finding has significant implications for policy harmonisation and cross-scalar coordination, particularly in Greater Sydney where both urban renewal and greenfield development are occurring simultaneously.

Implications and next steps

The policy opportunities outlined across various spatial levels highlight the central role of government, particularly state and local, as both enablers and regulators of CE outcomes. State government is best positioned to lead systemic reform by embedding CE principles into statutory instruments such as the *Standard Instrument LEP*, State Environmental Planning Policies (SEPPs) and fiscal levers like grants, subsidies and tax relief programs. At the metropolitan and regional scale, coordination mechanisms are critical to ensure consistency across local governments, particularly where shared infrastructure (e.g. decentralised CE hubs or material reuse networks) and cross-boundary planning are required.

Local governments emerge as key delivery agents, especially in zoning, land use planning and the integration of CE infrastructure into local urban form. The analysis underscores the potential for councils to leverage existing assets, such as underutilised buildings or local industrial land, to host small-scale CE operations. Equally, councils can play a leadership role in upskilling and education by embedding CE principles in DA approvals and professional development programs for staff and local stakeholders.

Common ground across life cycle stages

A notable insight from this research is that most policy opportunities discussed are applicable in both new and renewed neighbourhoods. Whether through tax incentives, land zoning or CE infrastructure definitions, these tools can be flexibly applied across different development contexts. This refutes the assumption made at the commencement of the research, that separate policy streams are required for greenfield versus brownfield or urban renewal developments, and instead supports an integrated planning approach. For example, monitoring and reporting mechanisms, localised operations and establishing a shared materials database can be embedded throughout the lifecycle of a projects from design and construction to occupancy and ongoing operations.

Key actors and systems collaboration

Achieving these outcomes will require strong partnerships between state and local governments, industry, peak bodies, consumers and educational institutions. State agencies must lead regulatory reform and funding mechanisms, while local governments need support to deliver place-based solutions. Industry, particularly in construction, logistics and waste management, will be vital in operationalising CE models and providing innovation pathways. Peak bodies and professional associations can foster knowledge transfer and set industry benchmarks, while consumers must be engaged as co-creators in the transition. Educational institutions also play a critical role in upskilling the current and future workforce, embedding CE values in professional practice and furthering research into implementing CE approaches.

Areas for further research

Several areas warrant further investigation to support policy design and implementation. As has been discussed previously in this report, a significant period of time was spent deliberating over the scope of this research project. Whilst the aims were to explore the land use and regional planning opportunities in enabling CE outcomes, it became clear that systemic change could not happen without other, complementary changes.

First, a deeper analysis of business case evaluation methods is needed to ensure they properly account for the long-term economic and environmental benefits of localised CE infrastructure. This includes incorporating avoided transport costs, community education value and inter-council collaboration for procurement and operations. Second, more work is needed to map the availability and suitability of industrial (and complementary) and mixed use land that could be repurposed for CE activities, especially in high-growth or high-density areas.

Finally, there is a need to explore behavioural dimensions of CE adoption, particularly how consumers and small businesses engage with reuse, repair and remanufacturing systems at the neighbourhood scale. Understanding these dynamics will help ensure that planning and policy frameworks are not only technically feasible but also socially resonant and practically implementable.

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