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ASBEC Embodied Carbon Consultation Report

Australia's policy roadmap to reduce upfront embodied carbon in the built environment

Created by thinkstep-anz on behalf of ASBEC

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Executive summary

This paper supports Australia's policy roadmap to reduce upfront embodied carbon in the built environment ('Policy Roadmap') by summarising the insights gathered through an extensive stakeholder engagement process. For three years, the Australian Sustainable Built Environment Council (ASBEC) and its members have worked closely with industry, government, and experts to develop the Policy Roadmap, drawing on past research, new analysis, and targeted engagement through an Issues Paper.

The result is a comprehensive policy framework that will support, enable, and accelerate the transition to net zero embodied carbon across Australia's built environment. This report presents the research and stakeholder feedback that helped shape ASBEC's recommendations and policy levers.

Why we need action now

Australia is committed to achieving net zero carbon emissions by 2050. By 2030, our country aims to have reduced carbon emissions by 43% below 2005 levels. To succeed, every sector of our economy must transform.

Buildings and infrastructure are directly responsible for almost one third of Australia's total carbon emissions, and indirectly responsible for over half of all emissions (Infrastructure Australia, 2024).

Upfront embodied carbon, the emissions from materials, transport, and construction that occur before an asset is used, makes up a growing share of total emissions. This is because operational emissions are declining as energy efficiency improves, the grid is decarbonised, and fuel changes are made.

While the full pathway to reducing these early-stage emissions is still emerging, this paper presents insights from ASBEC's consultation and highlights how policy can guide and accelerate action and solutions.

Figure 1 – ASBEC's Policy Roadmap

Consistency key in decarbonisation policy

Aligned policies and regulations are crucial to guiding all stakeholders toward zero carbon goals, particularly in reducing embodied carbon. However, it's important to recognise that effective interventions may differ depending on the type of asset and its sector.

Actions to decarbonise the built environment

ASBEC's Policy Roadmap outlines four policy levers (Figure 2) that will support a 60 to 75% reduction in upfront embodied carbon in Australia's built environment by 2035. The levers summarise the key actions needed to achieve the eight recommendations ASBEC outlined. (page 4 of the Policy Roadmap).

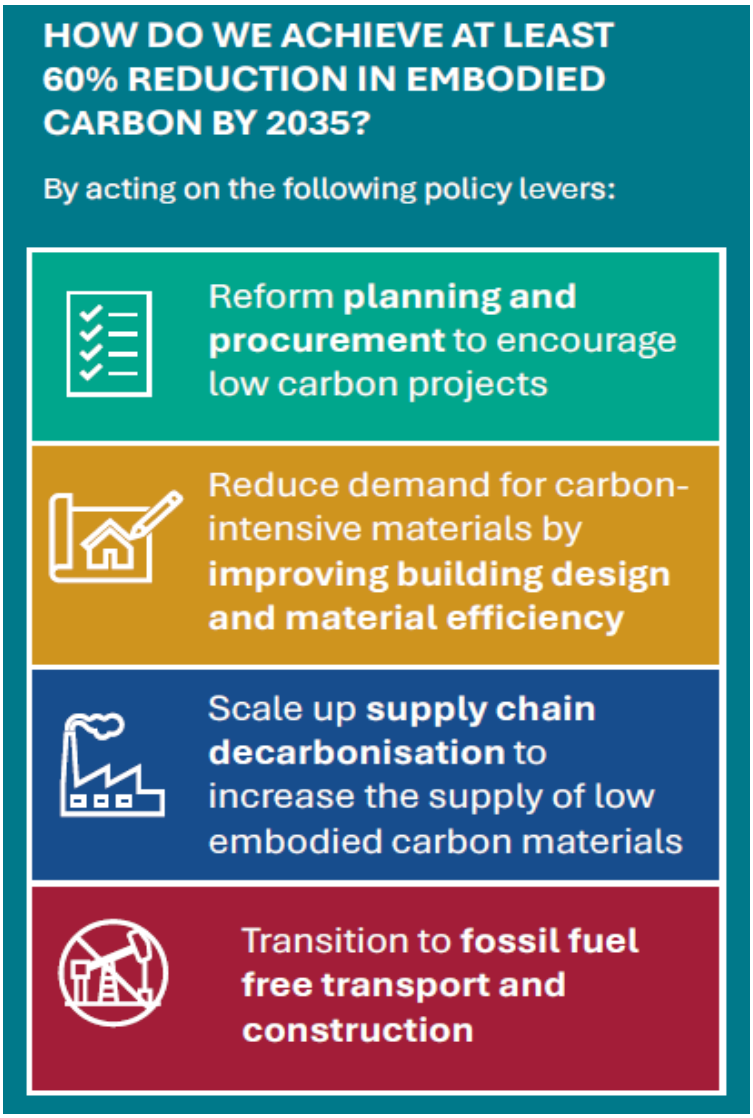

Figure 2 - ASBEC's summary of levers for change (page 3)

ASBEC's recommendations and policy levers are grounded in extensive stakeholder engagement carried out between 2022 and 2024. They demonstrate our ability to take meaningful action on decarbonisation, even as we wait for the transition of hard-to-abate materials.

This report summarises the substantial feedback received throughout the three-year consultation process by ASBEC members, which strongly supports ASBEC's recommendations.

The feedback reflects a shared understanding across industry of both the scale of the challenge and the practical steps needed to accelerate change.

Reducing upfront embodied carbon by more than 60% by 2035 is ambitious. But the consultation confirms it is achievable if we act now, apply all four policy levers, and take coordinated action across the entire built environment.

Australia can address this challenge. Our success will depend on our swift engagement with the actions proposed. The time to start is now.

Table of Contents

1. Introduction 7
   - 1.1. Why upfront embodied carbon matters 8
   - 1.2. The size of the opportunity 10
   - 1.3. Building on recent initiatives 11
   - 1.4. How ASBEC's Policy Roadmap was developed 13
2. Issues Paper consultation 15
   - 2.1. Issues Paper consultation feedback 16
3. Insights shaping the Policy Roadmap 18
   - 3.1. Stakeholders need consistency 18
   - 3.2. Developing knowledge and skills 20
   - 3.3. The cost of transition 22
   - 3.4. Trusted data collection and sharing 24
   - 3.5. Long-term investment for long-term benefit 26
   - 3.6. ASBEC's levers for change 26
4. Planning and procurement 27
   - 4.1 Upfront embodied carbon measurement and reduction 27
   - 4.2 Building less 30
   - 4.3 Procurement 31
5. Building design and material efficiency 35
   - 5.1. Better design to drive decarbonisation 35
   - 5.2 More efficient use of materials 37
6. Supply chain decarbonisation 39
   - 6.1 Establishing clear and consistent market signals 39
   - 6.2 Building industry capability for low-carbon manufacturing 40
   - 6.3 Strengthening government and industry collaboration 41
7. Fossil fuel free transport & construction 42
   - 7.1 Improving emissions disclosure and reporting 42
   - 7.2 Scaling up fossil fuel free construction and transport 42
   - 7.3 Strengthening industry policies and workforce capability 43
   - 7.4 Supporting alternative fuels and government leadership 43
8. Lessons from global policy and research 45
   - 8.1 Policy mechanisms and regulatory alignment 45
   - 8.2 Data standardisation and market incentives 46

8.3 Workforce capacity and supply chain integration 46
8.4 Case Study: Lessons from the US Inflation Reduction Act 47
List of figures 52
List of tables 53
Abbreviations and glossary 54
Annex: National database principles 57

1. Introduction

Australia is committed to achieving net zero carbon emissions by 2050. By 2030, our country aims to have reduced carbon emissions by 43% below 2005 levels. To succeed, every sector of our economy must transform.

Currently, buildings and infrastructure are directly responsible for almost one third of Australia's total carbon emissions, and indirectly responsible for over half of all emissions, as shown in Infrastructure Australia's Embodied Carbon Projections for Australian Infrastructure and Buildings (Infrastructure Australia, 2024).

Upfront embodied carbon, the emissions from materials, transport, and construction that occur before a built asset is used, is a large contributor to these emissions, and its share will increase as energy efficiency improves, the grid is decarbonised, and fuel changes are made.

Purpose of the project

Recognising this challenge, the Australian Sustainable Built Environment Council (ASBEC) has developed a Policy Roadmap to reduce upfront embodied carbon in Australia's built environment.

ASBEC is the peak body of organisations committed to a sustainable built environment in Australia. They are a trusted voice of the built environment sector that advocates for policy change for a more sustainable future.

The roadmap is built on robust research and shaped by extensive consultation with government, industry, and subject matter experts over a three-year period.

The project aims to:

- Support Australia in achieving its net zero goal
- Leverage existing Australian work and international best practice
- Provide consistency across residential and commercial buildings and infrastructure
- Build on decisions already reached through extensive consultation on previous projects, e.g. by NABERS on measurement methodology and Infrastructure Australia on data
- Encourage innovation while preparing industry for future minimum standards
- Stimulate demand for low-carbon materials and construction methods.

Purpose of this paper

This paper supports ASBEC's *Policy Roadmap* by summarising the insights gathered through an extensive stakeholder engagement process. Between 2022 and 2024, ASBEC's members worked closely with industry, government, and experts to develop the Policy Roadmap, drawing on past research, new analysis, and consultation through the Issues Paper.

The purpose of this report is to share the feedback received through that process - including common themes, challenges, and opportunities - and to demonstrate how stakeholder input helped shape the final recommendations and policy levers.

This paper provides transparency around the engagement process and highlights the strong support for coordinated national action on embodied carbon.

To illustrate the feedback received from stakeholders, quotes representing common themes appear throughout this report as shown here.

> **Stakeholder Voice**
>
> *Impact will be judged through the prism of balancing the headline outcomes with the cost of action and delivered efficacy."*

ASBEC recognises that the built environment can influence upfront embodied carbon reduction in two ways:

- Plan, design, procure and deliver projects in a way that uses fewer resources.
- Create demand for low-carbon materials and stimulate the industrial/manufacturing sector to offer solutions.

The ASBEC project explored initiatives that could enhance and complement NABERS' embodied carbon measurement tool and the Technical Guidance for Embodied Carbon Measurement for Infrastructure, aiming to scale up efforts to reduce upfront embodied carbon in Australia's built environment. Voluntary tools such as Green Star have also adopted upfront embodied carbon targets for rating buildings and are working to align with the NABERS embodied carbon tool in the next version update.

Action needed now

> *Bold policy measures now so we influence the current development pipeline. By the time the current policy signals turn into meaningful policy, we will have completed a large portion of our investment pipelines in a BAU, high-carbon, high-cost standard."*

Australia's built environment must be on a net zero trajectory today to meet our international commitments to reduce emissions. Industry and government must tackle upfront embodied carbon, now. The construction industry can do more, now. We can tackle emissions under our control (design choices, procurement practices, construction methods) and consistently signal to our supply chain that carbon reduction is both necessary and urgent.

1.1. Why upfront embodied carbon matters

Infrastructure Australia's report *Embodied Carbon Projections for Australian Infrastructure and Buildings*, released in July 2024, established a baseline for upfront embodied carbon in Australia's built environment. It estimated the carbon impact of the upcoming construction pipeline for buildings and infrastructure from 2022–23 to 2026–27.

The report found that buildings and infrastructure are directly responsible for almost one third of Australia's total carbon emissions, and indirectly responsible for over half of all emissions.

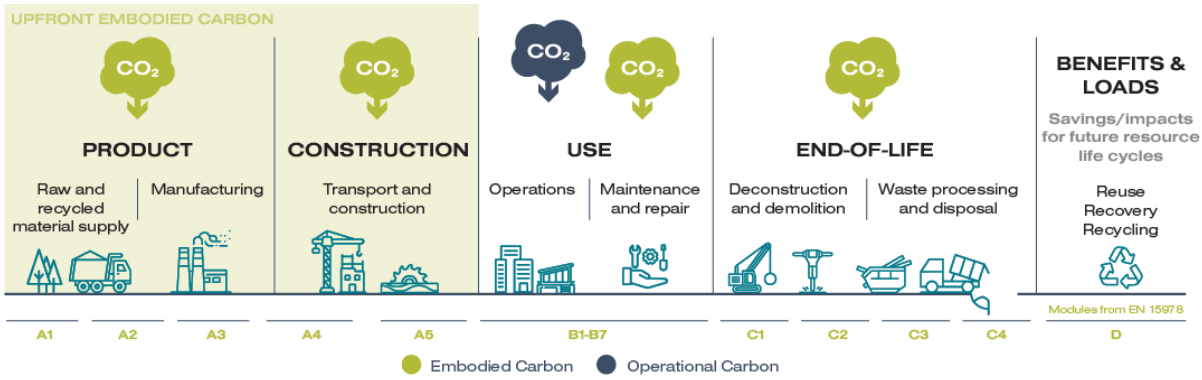

Figure 3 – The asset life cycle and carbon emissions. Source: thinkstep-anz

Carbon emissions from buildings and infrastructure come from two main sources:

- **Operational emissions** (up to 21% of the national total)
  Associated with using an asset. They come mainly from using electricity and fossil fuels such as diesel and natural gas.
- **Embodied emissions** (up to 11% of the national total)
  Associated with constructing and maintaining an asset, as well as treating waste at the end of the asset's life.

Embodied carbon emissions are divided into the three stages at which they occur in an asset's life. The data below, based on Infrastructure Australia's report, shows the portion for each stage out of the 10% total national contribution.

- **Upfront** (65% of embodied carbon). *Modules A1-A5 in Figure 3.* Occur before an asset is used and come from materials, transport, construction waste and the construction process.
- **Use** (33%). *Modules B1-B7 in Figure 3*. Occur during the asset's life when elements are maintained, repaired, replaced or renovated. Examples include regular fitouts of buildings, recladding buildings and maintaining/replacing pavements.
- **End-of-life** (less than 3%). *Modules C1-C4 in Figure 3.* Occur at the end of the asset's life when it is deconstructed or demolished.

Upfront carbon emissions calculations are based on real data, but 'use' and 'end-of-life' emissions are based on modelled estimates of potential future activities. In other words, we shouldn't mix up upfront with end-of-life, as the first has a higher degree of certainty of being true, and actionable, whereas the second is an estimate.

ASBEC's work on embodied carbon builds on previous work by the Green Building Council of Australia (GBCA), the National Australian Built Environment Rating System (NABERS), Infrastructure Australia, Infrastructure NSW and others. The ASBEC roadmap is built on the insights gained through engaging industry on past projects and ongoing industry input.

Emissions become 'locked in'

Buildings and other assets have long service lives. What is built today will be part of the zero-carbon world of 2050. While some assets' operational carbon emissions can be reduced over time, for example through decarbonisation of the energy grid, upfront embodied carbon is 'locked in' before the asset is operational.

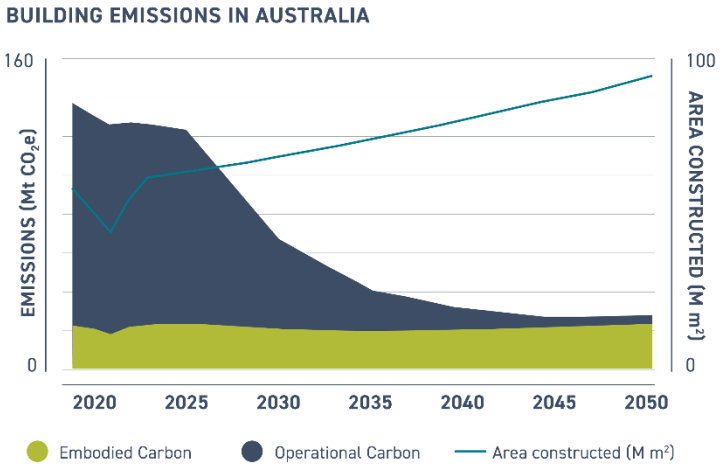

Figure 4 – Embodied and operational carbon in Australia's buildings, with yearly area constructed (GBCA and thinkstep-anz, 2021)

Reducing embodied carbon in new infrastructure and buildings requires changes in how we plan, design, procure and deliver. We have to act now to cut carbon at each stage of the life of the asset. Figure 4 demonstrates that, while operational carbon emissions are forecast to decrease significantly by 2050, embodied carbon is forecast to rise (due to the increasing building area constructed) without deliberate intervention to decarbonise the supply chain.

Embodied carbon will become the dominant source of carbon emissions for buildings, unless effective action occurs at the national scale.

Addressing upfront embodied carbon not only focuses on the highest and most immediate emissions, it also draws lower-carbon products onto the market. This helps to reduce the impacts of maintenance, renovations and replacements for both existing and new developments.

Embodied carbon can be more complicated to abate than operational carbon, and policy measures need to be implemented across the built environment value chain. While embodied carbon emissions of some building products and materials will reduce as the grid decarbonises, others will not. This is because the carbon footprint of many building products comes from process heat and direct emissions from chemical processes (e.g. steel and concrete) rather than from electricity. We also recognise that design choices, procurement practices and construction methods can all influence the upfront carbon emissions produced.

1.2. The size of the opportunity

To address the built environment's impacts on climate change, we need to reduce all carbon emissions at every stage in the life of an asset. Reducing carbon emissions from operating buildings and infrastructure assets is already happening through energy efficiency, fuel changes, and a decarbonising grid – this has been happening for nearly two decades. However, the same has not occurred for embodied carbon.

Infrastructure Australia found that a 23% reduction in upfront carbon emissions for 2022–2023 is possible by 2026–27 by applying existing like-for-like decarbonisation strategies that can be achieved by industry and government actively working together.

This is equivalent to a reduction of 9 Mt CO_2e, roughly 2% of Australia's gross national GHG emissions of 529 Mt CO_2e in 2022–23.

Emissions can be further reduced through optimising design and strategies focused on reuse or building less, which were outside the scope of the Infrastructure Australia report.

Australia needs to tackle embodied carbon to achieve its target of net zero carbon emissions by 2050.

1.3. Building on recent initiatives

Infrastructure Australia's 2024 report Embodied Carbon Projections for Australian Infrastructure and Buildings put forward six recommendations to the Australian Government to consider in its work towards the reduction of embodied carbon from infrastructure and buildings.

These recommendations encourage the Australian Government to:

- Develop a comprehensive national plan to promote the decarbonisation of embodied carbon in the built environment.
- Build confidence and literacy to enable the uptake of low-carbon products and solutions across the built environment.
- Continue developing a nationally standardised embodied carbon measurement system, which allows for consistent methods to collect, measure and assess data about embodied carbon.
- Agree and implement a common national approach to drive market demand for low-carbon solutions.
- Develop new methods for project delivery which share risks and rewards for innovative approaches.
- Work with industry to drive national alignment on low-carbon expectations through performance-based standards and specifications and identify faster ways to update them.

NABERS Embodied Carbon tool

The NABERS Embodied Carbon rating tool, released in late 2024, enables new buildings and major refurbishments to measure, verify, and compare their upfront embodied carbon with similar buildings. As Australia had no consistent method for measuring embodied carbon, the development of this tool is a critical step towards achieving our 2050 net zero emissions target.

The tool was shaped through extensive collaboration and consultation with industry, including ASBEC members, since 2021. It has been created in partnership with the GBCA, building on their Green Star rating tool that has resulted in hundreds of buildings having to reduce their upfront carbon emissions. The tool received approval from the NABERS National Steering Committee and endorsement from all states and territories.

Alignment around the NABERS Embodied Carbon tool presents a unique opportunity to build a policy platform to address the significant upfront carbon emissions that will occur as the country continues to grow.

This is similar to how the Commercial Building Disclosure (CBD) program has used NABERS Energy ratings throughout the commercial sector in Australia to reduce energy consumption by 30-40% over the past decade.

Embodied Carbon Measurement for Infrastructure

The technical guide Embodied Carbon Measurement for Infrastructure, launched in 2024 by the Infrastructure and Transport Ministers, provides guidance for measuring embodied carbon in infrastructure projects. It outlines standardised methods and practices for assessing carbon emissions associated with materials and construction processes throughout the life cycle of infrastructure assets.

The document aims to support consistent reporting and reduction strategies to help achieve Australia's broader decarbonisation targets. It serves as a resource for project developers, policymakers, and industry professionals working to minimise the carbon footprint of infrastructure projects. Its content can be used to assist any project seeking to reduce embodied carbon impacts.

1.4. How ASBEC's Policy Roadmap was developed

The Policy Roadmap was developed through a structured and collaborative process led by ASBEC's members between 2022 and 2024. This process brought together industry leaders, government representatives, technical experts, and advocacy groups to build a clear, practical framework for reducing upfront embodied carbon in the built environment.

The approach used to develop the Policy Roadmap is summarised in Figure 5.

First, existing work was collated, including industry consultations by NABERS, GBCA, and Infrastructure Australia during 2022 and 2023. Australian and international carbon policy documents, government papers, research papers, and carbon measurement tools were analysed (Figure 6 and Figure 7).

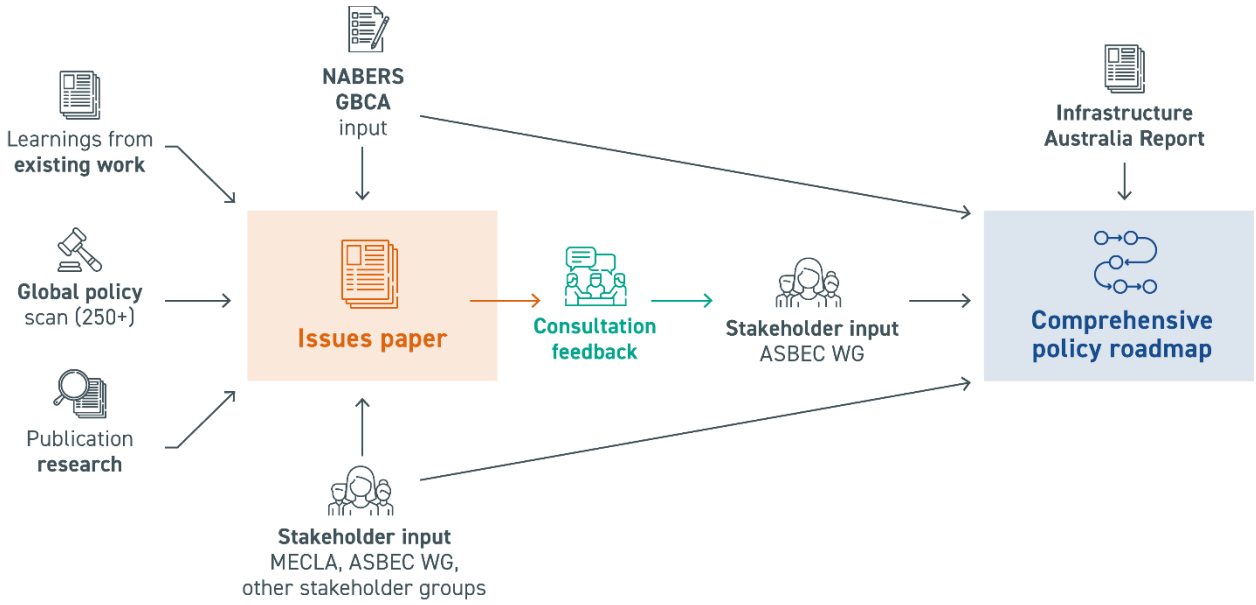

Figure 5 – Development Process of the Issues Paper and Policy Roadmap

Industry feedback from the consultations was consolidated into common themes and issues, which were presented to the Materials and Embodied Carbon Leaders' Alliance (MECLA) through a webinar and survey to collect further feedback.

The most important items were prioritised in collaboration with the ASBEC Steering Committee and the ASBEC Embodied Carbon Working Group. To gather stakeholder perspectives, ASBEC released Issues Paper: Embodied Carbon Emissions in Australia's Built Environment in 2024. This paper outlined key challenges and proposed potential solutions. Over 60 organisations and individuals responded, offering detailed feedback on priorities, barriers, and enablers for decarbonisation across the built environment

The feedback gathered through the Issues Paper consultation directly informed the development of the Policy Roadmap. Common themes and recommendations were distilled and used to shape the final policy levers and actions outlined in the roadmap.

> *Keep talking to industry as you are."*

This consultation report presents a summary of that feedback. It outlines the key themes raised by stakeholders, identifies challenges and opportunities, and shows how this input shaped the roadmap's final recommendations. By presenting this feedback alongside ASBEC's policy thinking, the paper provides transparency, builds confidence in the process, and reinforces the case for urgent and coordinated action across the sector.

Figure 6 – The research in numbers

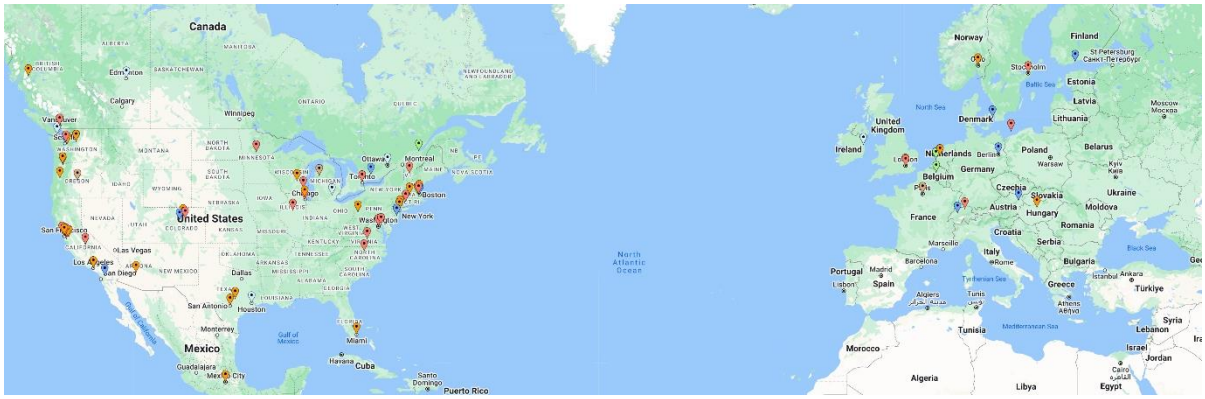

Figure 7 – Carbon Leadership Forum Embodied Carbon Policy Tracking Map

2. Issues Paper consultation

ASBEC's Issues Paper described the challenges for lowering embodied carbon in the construction of Australia's built environment (Figure 8). The challenges were presented as seven 'decarbonisation dilemmas'.

Figure 8 – ASBEC's Issues Paper: Embodied Carbon Emissions in Australia's Built Environment

The Paper then presented 45 potential solutions, categorised into the seven dilemmas.

Figure 9 – The 7 dilemmas presented in ASBEC's Issues Paper

A survey sought feedback to prioritise the solutions for Policy Roadmap. Participants were asked to rank the relative importance of different options as well as having the opportunity for long text feedback.

2.1. Issues Paper consultation feedback

Around 65 people/organisations provided feedback. Approximately 30,000 words of feedback were received, as well as the rankings. Some key recommendations from the feedback with widespread support are summarised below.

Overall, the strongest message was that **both industry and government are seeking consistency and coordination of action**.

Direction

- Action by the Australian Building Codes Board (ABCB) is highly supported, seeking clear signals and inclusion of embodied carbon in the National Construction Code (NCC).
- Using planning policies to mandate and incentivise action was one of the most popular solutions.

Develop

- Capability building was highlighted as a critical action to ensure that the sector is well-informed and has the necessary skills to undertake the transition needed.
- Currently, the sector is unprepared for a large-scale transition effort and the whole value chain requires support.

Disclose

- Consistent national standards for measurement for both buildings and infrastructure are critical. NABERS and Infrastructure NSW have been leading this effort.
- Trusted, credible data sources for product emissions are needed for many more products than at present.
  - A national database for approved carbon footprint data is needed to make it easier to choose trusted low-carbon options.
    Note: NABERS has published a first version of a national database since the consultation was completed. It contains emission factors needed for the NABERS Embodied Carbon tool. Stakeholders have requested a national database that also includes available Environmental Product Declarations (EPD) data to enable easy choices of better products on the market.
  - The development of more EPDs to cover more of the building products market is urgently needed.

> *"We support the need for EPD measurement approaches to be utilised as a highly accepted domestic and international form of carbon measurement."*

Demand

- Clear demand for low-carbon products and ensuring that the intended products are installed on site is key to making progress. Enforcement of low-carbon specifications is fundamental to achieving decarbonisation.
- Clear specification and contract clauses are needed to require reduced embodied carbon.
- The emerging MECLA pledge policy is supported as a means to create change through demand.
  - '*Require head contractors to have a publicly available organisational target commitment to reduce embodied carbon in construction materials as a pre-requisite to be able to tender.*'
- Financial and fiscal incentives are needed to support the transition.
- Sharing of risk and opportunity in contracts will remove some barriers from adoption.

Design

- A change in design practice is needed to start decarbonisation efforts at the concept phase, and to employ design solutions before product choices.
- Ensuring that we consider reuse and building less will be key, especially as the demand for more floor area escalates with population growth.

Detail

- NABERS requirements must be the expected norm for product carbon data, supported by developing more EPDs.
- Hard-to-abate industries are calling for higher levels of support to transition, both from government funding and also industry support with clear and consistent demand for lower-carbon products, and early collaboration on projects.
- Product decarbonisation is enabled partly through the adoption of renewable energy sources – electricity as well as liquid and gas fuels – and support to increase availability of renewables is needed.
- Choice of products should always account for trade-offs and be mindful of the full life cycle and circularity strategies.

> *"Buildings that are more energy efficient due to building product selection, e.g. double glazing over single glazing, will have more embodied carbon."*

Deliver

- Industry and government need to step up to deliver a low-carbon built environment.
- Use the NABERS tool and methodology to measure outcomes.
- The best lever to achieve faster decarbonisation on projects is for the owner (government or private) to signal embodied carbon reduction expectations and reward decarbonisation on projects.

3. Insights shaping the Policy Roadmap

The recommendations in ASBEC's Policy Roadmap are grounded in extensive consultation and evidence gathering. This chapter outlines the overarching insights that informed the roadmap, drawing from industry engagement, research, and stakeholder discussions conducted between 2022 and 2024.

Key contributions to this report include formal consultations on embodied carbon with NABERS, Infrastructure Australia, and ASBEC, as well as broader industry dialogues and feedback on the Issues Paper. While some sources were structured and data-driven, others—such as informal conversations and industry observations—provided valuable context and nuance. Together, these insights create a comprehensive evidence base that reinforces the need for coordinated policy action on embodied carbon.

This chapter outlines strong, overarching consultation feedback themes that apply across all findings.

The following chapters highlight the themes derived from the consultation which informed ASBEC's specific recommendations and developed into the levers illustrated in Figure 2.

3.1. Stakeholders need consistency

The central theme from all of the feedback was a call for consistency of approach for upfront embodied carbon management in the built environment:

- From all levels of government
- Across buildings and infrastructure alike
- In both public and private sector specifications for built environment construction and products.

There are many policies, programs and tools that focus on embodied carbon, which creates risks associated with inconsistent standards, definitions, targets or timelines. It also creates inefficiencies for both program administrators and industry and government stakeholders. Table 1 illustrates some of the initiatives that highlight the need for national consistency with coordinated effort, simplifying processes and achieving economies of scale.

> *"Clarity and consistency around policy, implementation timing and action mitigates against inefficient or unforeseen investment."*

> *"A pathway that considers Australia's layered policy landscape and most efficiently and effectively regulates embodied carbon – need accepted and agreed methods, data and reporting, also clarity, consistency and confidence."*

> *"There's a pressing need for consistency not only in embodied carbon regulation but also between federal and state emission reduction policies to ensure coherent and effective climate action across the country."*

Table 1 – Examples of initiatives focused on, or linked to, embodied carbon

Type of initiatives	Examples
Government policy / standards	→ National Construction Code – pathway for reporting embodied carbon (Department of Climate Change, Energy, the Environment and Water (DCCEEW))
Decarbonisation strategies	→ Net Zero sector plans (DCCEEW) → Net Zero built environment sector pathway (Climate Change Authority) → Net Zero Transport and Infrastructure sector pathway (Climate Change Authority) → Low carbon building product guides (Materials and Embodied Carbon Leaders Alliance (MECLA))
Infrastructure planning	→ Embodied carbon projections for Australian infrastructure and buildings (Infrastructure Australia) → Valuing emissions for economic analysis (Infrastructure Australia) → Decarbonising Infrastructure Delivery Policy (Infrastructure NSW) → Embodied carbon measurement for infrastructure (Department of Infrastructure, Transport, Regional Development, Communications and the Arts)
Reporting	→ Mandatory climate-related financial reporting (Treasury)
Measurement tools	→ Life Cycle Assessment (Australian Life Cycle Assessment Society (ALCAS)) → NABERS Embodied Carbon rating → Green Star Buildings v1.1 (GBCA) → Green Star Responsible Products Program (GBCA)
Disclosure	→ Environmental Product Declarations (EPD Australasia and others) → NABERS embodied carbon database → ReMade in Australia – recycled content (DCCEEW)
Circular economy	→ Circular Economy Ministerial Advisory Council - recommendations for the built environment → Australia's Circular Economy Framework (DCCEEW)
Responsible procurement	→ Environmentally Sustainable Purchasing Policy & Reporting Framework (ESP Policy) (DCCEEW)

Stakeholders said that a consistent approach will help to:

- Standardise requirements and specifications
- Reduce differences in requirements between buildings and infrastructure
- Reduce risk and its economic implications
- Prepare industry for a smooth transition to regulation
- Increase the opportunity for voluntary action
- Create a level playing field for domestic vs international product suppliers.

This would lead to an effective response to reducing upfront embodied carbon in Australia's built environment by:

- Creating efficiencies in manufacturing and construction practices
- Supporting business cases for change
- Create economic opportunities for industry to develop new business models to support emerging methods such as:
  - Design for Manufacturing, Assembly and Disassembly (DfMAD)
  - Pre-fabrication
  - Modular off-site construction.

Stakeholders called for ongoing government investment to support continued and improving alignment in measurement and reduction frameworks and tools across residential, non-residential and infrastructure sectors.

Conclusion: There is a case for a centralised approach

> *"To be effective for change, there needs to be alignment and harmonisation of the right policy levers across all tiers of government and departments."*

Industry and government feedback consistently highlights the need for consistency as the key enabler of change. The perception of risk associated with transitioning to lower-carbon practices underscores the importance of clear and stable expectations, including aligned regulations, standards, specifications, and reporting frameworks at both local and global levels.

To drive meaningful progress, efforts across buildings and infrastructure must be fully integrated, rather than merely aligned. A truly effective transition requires a centralised approach—a single coordinating body that ensures connection and consistency across multiple portfolios and jurisdictions. Without this, fragmented efforts risk undermining the certainty and confidence needed for industry-wide action.

3.2. Developing knowledge and skills

The need to develop knowledge and skills was universally acknowledged across all sectors and professional levels, although the degree of need varies. Infrastructure NSW identified that while embodied carbon is a reasonably well understood concept for infrastructure, there is a clear skills gap in its practical application. In contrast, sectors such as

> *"We see a serious communication risk as there is a misguided assumption that everyone understands and is engaged in decarbonisation, and the directions outlined by governments."*

> *The key will be getting everyone on board – industry and community – requiring detailed understanding, ongoing support, and commitment to action."*

residential development have much less awareness, often driven by financial constraints, as many builders focus on staying afloat rather than investing in sustainability knowledge.

New regulations, policies, standards and organisational commitments are driving decarbonisation in the built environment. However, this presents challenges for professionals at every level, who must navigate a rapidly evolving landscape and understand its impact on their work.

Stakeholders consulted in this process emphasised that significant action to upskill the workforce and share knowledge is essential to achieving swift and effective decarbonisation. Addressing this issue requires targeted strategies to raise awareness, enhance technical knowledge, and develop practical skills across multiple stakeholder groups. Examples are shown in Table 2.

> *There is a strong likelihood that we squander investment and goodwill as people, organisations and businesses try to respond to something they don't fully understand or know how to implement."*

Table 2 – Knowledge and skills required for decarbonisation

Stakeholder group	Knowledge / skills required
Product manufacturers	→ Embodied carbon and why it's important → Data required by the market to support EPDs, NABERS, Green Star etc → Carbon reporting regulations and measurement tools → Decarbonisation opportunities and threats
Project teams – architects, designers, quantity surveyors, builders etc	→ Embodied carbon and why it's important → Strategies to reduce carbon in the design phase → Managing trade-offs with other features such as compliance, circularity and durability → Resources: standards, rating systems, measurement tools for embodied carbon and full life cycle carbon, guides, case studies
Procurement - government, industry, homeowners	→ Embodied carbon and why it's important → How to specify for low carbon products and materials → Managing trade-offs with other features such as compliance, circularity and durability
Local government	→ Embodied carbon and why it's important → Integrating carbon measurement and reporting, in anticipation of NCC 2028
Specialist consultants	→ Carbon accounting, carbon measurement and verification, LCA, EPDs

Conclusion: Targeted capacity building is needed

Developing knowledge and skills is critical to accelerating decarbonisation in the built environment. While awareness of embodied carbon varies across sectors, the need for upskilling is universal. Without targeted education and capacity-building efforts, industry and government commitments risk being undermined by a lack of technical capability. Stakeholder feedback underscores that building knowledge at all levels—through training, collaboration, and clear guidance—is essential to achieve meaningful progress.

> *"Clear and concise education and value-based rationales directed to those who aren't already on a mission to reduce upfront carbon."*

3.3. The cost of transition

Cost is a key consideration for stakeholders across the built environment. While there is strong recognition of the need to reduce embodied carbon, decisions are often influenced by financial constraints, project budgets, and economic feasibility. Understanding the cost implications of different abatement strategies—both in the short and long term—is essential to driving effective and scalable action.

Infrastructure Australia, in their 2024 report *Embodied Carbon Projections for Australian Infrastructure and Buildings*, stated that:

"23% of upfront carbon from public infrastructure could be abated by 2026–27 … A 23% reduction in upfront carbon emissions from public infrastructure is equivalent to a reduction of 9 Mt CO_2e, roughly 2% of Australia's gross national greenhouse gas emissions of 529 Mt CO_2e in FY 2023. This scenario would lead to a cost saving of $160 million, which is equal to 0.14% of the total value in Infrastructure Australia's Market Capacity Program pipeline."

This report demonstrated that it is possible to decarbonise the built environment by a very significant 23% over a five-year period, using known technologies that are available today. On an economy-wide basis, it showed that there is a net cost benefit. On an individual project basis, it is expected that this could vary according to factors such as geography and local availability of key resources, with some projects potentially experiencing a cost increase to achieve these carbon savings.

Infrastructure Australia further demonstrated which products are the most beneficial and cost-effective using a Marginal Abatement Cost Curve (Figure 10; p.37 of the report).

Making further changes in the sector will likely cost more. Support mechanisms such as capability building, policy and regulatory changes, updated standards and specifications, and transitioning away from fossil fuels in manufacturing and energy generation will require investment.

However, the report did not consider the potential benefits of better design, reuse and retrofits, and avoiding building as much as currently planned. These measures can potentially reduce costs, dependent on circumstances for each project. Requiring that they are considered can enable those with cost effectiveness to be pursued.

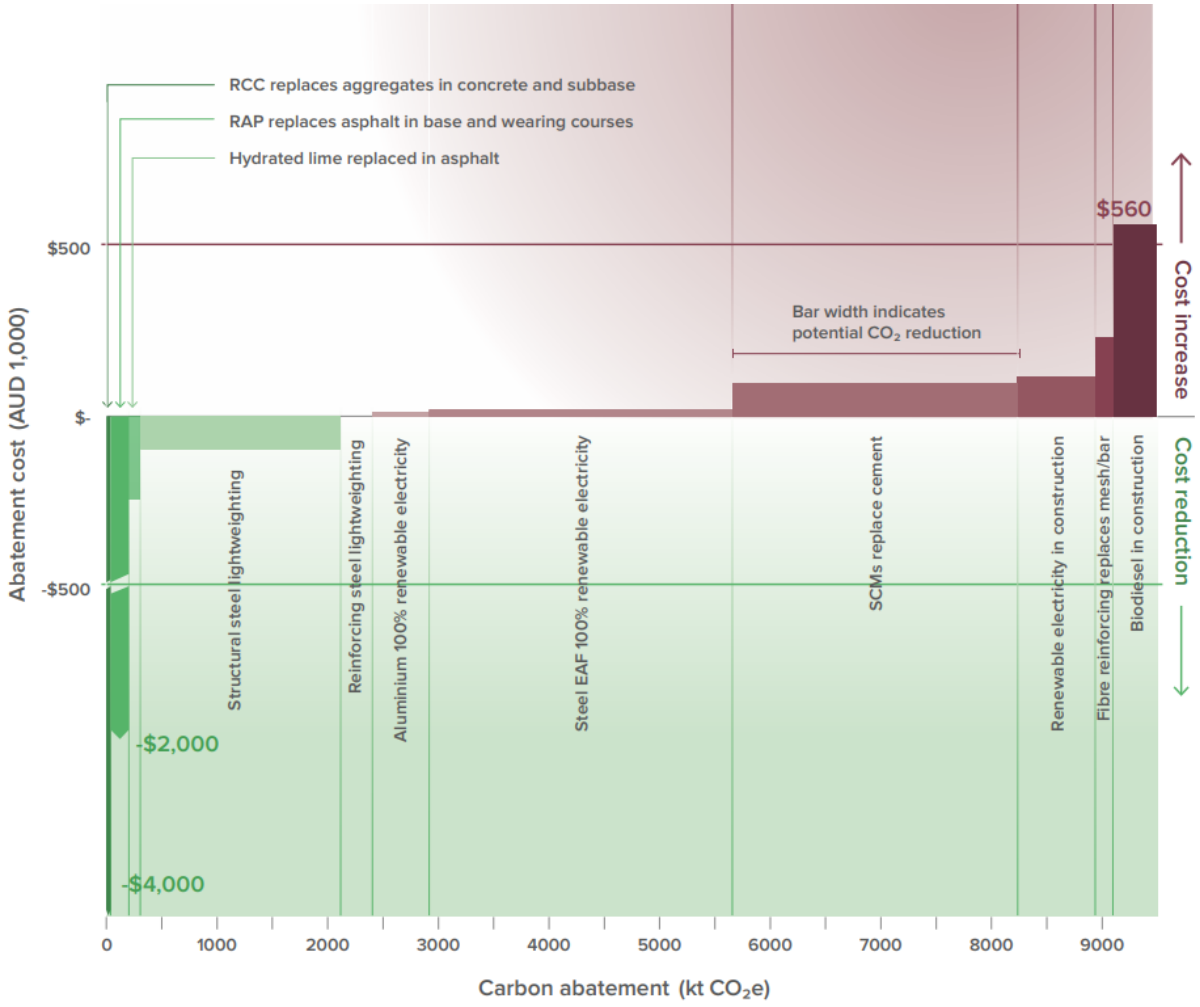

Figure 10 - Marginal abatement cost curve 2025-26 Source: Infrastructure Australia (2024)

Circularity measures can help to manage cost

There are cost efficiencies to be gained from adopting circular economy principles. All of Australia's environment ministers have agreed to work with the private sector to design out waste and pollution, keep materials in use and foster markets to achieve a circular economy by 2030.

Analysis by the Clean Energy Finance Corporation (CEFC) found that circular economy practices like using waste products as concrete supplement was one of the most cost efficient and effective abatement options in the built environment.

Conclusion: Cost-effective decarbonisation is possible

Infrastructure Australia's analysis shows that significant emissions reductions in the built environment are achievable quickly and cost-effectively using existing technologies. While individual project costs will vary, the broader economic case for action is clear.

Further reductions will require investment in capability building, regulatory changes, and transitioning away from fossil fuels. However, design improvements, reuse, and other circular economy practices offer additional cost-saving opportunities.

With strong policy and market support, the sector can accelerate decarbonisation while balancing cost and feasibility. Further economic analysis will be key to guiding this transition.

3.4. Trusted data collection and sharing

> *A single national agreed building products embodied emissions database would make trusted data easier to find and access. This is absolutely fundamental in ensuring accurate product/building embodied emission calculations, which help (everyone) understand the options available and allow them to make the best choices for products."*

The built environment sector is collectively seeking an easily accessible source of trusted building product emission factors. This resource will empower project teams to efficiently select lower-carbon products, streamlining the specification process.

To ensure data comparability when product-specific emission factors are unavailable, consistent use of conservative estimates is essential. NABERS has laid the groundwork for this by publishing a national database of conservative emission factors.

Stakeholders asked for a national database of building product upfront carbon emission factors including up-to-date EPD data.

> *Even more emphasis on Australian 'national database' and 'consistent national measurement and reporting methodology' across buildings and infrastructure."*

This needs to be maintained across buildings and infrastructure. Managing and updating this database with scientific rigour and credibility will drive accurate measurement for both products and at the asset level and make low-carbon decision-making easier and more accessible for all stakeholders.

The database needs to be hosted by a credible entity, with adequate technical rules and governance to ensure ongoing integrity and suitability of the database. It must also be regularly maintained to ensure it contains up-to-date data.

The database is needed to support ongoing measurement processes for both buildings and infrastructure using the NABERS Embodied Carbon tool and the Embodied Carbon Measurement for Infrastructure: Technical Guidance.

The database must be credible and reliable to support effective decarbonisation. Ongoing access ensures long-term progress toward net zero.

The stakeholders that will benefit from the database include:

- **Government agencies**: Owner and/or manager of the database
- **Construction industry professionals**: Primary users including architects, engineers, contractors, quantity surveyors and suppliers
- **Environmental and regulatory bodies**: Secondary users for regulatory compliance and policymaking
- **Public and researchers**: Tertiary users for transparency and academic research.

Fundamental principles that must apply to the management and maintenance of a national database include:

> *(The database) requires independence and governance oversight given monopoly creation."*

Governance principles

- Establish a Steering Committee.
- Ensure quality stewardship of the data.
- Exercise operational governance, utilising clear documentation and quality training for users.
- Ensure the database is accessible and serves the needs of users.

Technical requirements

- Database structure is simple and well-documented.
- Data is managed through regular updates, validation checks and version control.
- Data integrity is ensured through use of complying EPDs or similar third-party verified data.
- Data accuracy and reliability is regularly tested.
- Data comparability is enabled through use of material grouping and normalisation into appropriate units for calculations.
- Data is tested for representativeness and adjusted when determining both conservative and average emission factors.
- An update mechanism is applied at least annually to ensure the database contains the latest available emission factors and qualifying products.

> *The database needs to be regularly maintained and actively promoted as the single agreed Australian (embodied carbon) dataset, and this dataset needs to be housed under an appropriate government department/agency with ongoing funding."*

Further details for each of the governance principles and technical requirements are provided in the Annex: National database principles.

Conclusion: Investing in a trusted data source will have long-term impact

A reliable national emission factors database is essential for effective embodied carbon measurement and reduction. Establishing sustainable funding, clear governance, and a technically sound system will provide the foundation for success. Ongoing updates, validation processes, and integration with industry tools will ensure its long-term relevance.

With coordinated effort and commitment, this database would become a trusted resource, supporting industry and government in making informed, data-driven decisions for a lower-carbon built environment.

3.5. Long-term investment for long-term benefit

Achieving a net zero built environment in Australia requires certainty that key foundations, enablers and investment remain in place. Investment plays a vital role in maintaining and enhancing critical components like NABERS and the national database, ensuring they are not only preserved but continuously improved and developed.

Investment is needed from government, industry and the financial sector:

- Governments must provide sustained funding and policy support to drive consistency in regulations, standards, and incentives.
- Industry leaders need to invest in skills development, research, and technology to implement low-carbon solutions at scale.
- Financial institutions must support the transition by aligning capital and financing mechanisms with net zero goals.

By securing long-term commitment from all stakeholders, we can provide the stability and confidence needed to accelerate decarbonisation and meet Australia's net zero commitments.

3.6. ASBEC's levers for change

ASBEC's Policy Roadmap identified four levers (shown in Figure 2) to achieve a reduction of 60 to 75% in embodied carbon by 2035 (Policy Roadmap Figure 3, page 18).

The four levers address planning and procurement, design and efficiency improvements, supply chain decarbonisation and fossil fuel free transport and construction. They overlap and work together to create a supporting framework for achievable change in the upfront embodied carbon impact of Australia's built environment.

The following four chapters highlight stakeholders' views and considerations for each lever that the Policy Roadmap is built on.

4. Planning and procurement

Figure 11 – Planning and procurement reforms

Stakeholders provided clear feedback that the mechanisms for change in the built environment are heavily linked to planning requirements and procurement specifications and incentives. This section summarises the feedback received.

4.1 Upfront embodied carbon measurement and reduction

While minimum NCC compliance establishes a baseline level of energy performance, there are indications that future updates to the code will make embodied carbon a key factor in building design, construction, and sustainability assessments. The likelihood that embodied carbon will be mandated through the building code highlights its importance.

Requiring embodied carbon considerations or reductions through the code will significantly impact the market. It will encourage manufacturers to develop low-carbon materials and prompt designers and builders to prioritise materials and methods that minimise environmental impact from the start. This approach could drive innovation in both building materials and construction practices.

> *"Embodied carbon regulation will incentivise the supply chain to seek out products with low levels of embodied carbon."*

Setting minimum standards for embodied carbon through the NCC and for infrastructure projects, and increasing expectations over time, creates a clear path for sector-wide decarbonisation. These standards establish expectations and encourage continuous improvement, ensuring that progress is made at a steady pace while allowing the industry to adapt to lower-carbon solutions.

Stakeholders expressed the view that Government leadership is key to establishing a "new normal" ambition for decarbonisation and scaling up the market for lower-carbon products.

Require measurement and reporting

Requirements to measure and report will signal demand and priorities for both manufacturing as well as project teams. This will help to create the business case for low-carbon products and services.

> *"Broadly assess (embodied carbon) at planning approval phase, with regard to carbon budget allocations for cities, sectors, building types."*

Stakeholders felt that setting ambitious targets within the private sector will be essential for achieving net zero in Australia. To make significant progress, companies must go beyond basic code compliance (minimum performance standards) and aim for more aggressive decarbonisation goals as part of the national plan.

Private sector leaders have already shown they can set and achieve targets by voluntarily adopting rating tools such as Green Star and Infrastructure Sustainability.

Ensuring accountability in low-carbon product use

Stakeholders emphasised the need for verification mechanisms to ensure that claims about installation of low-carbon products are accurate and not 'greenwashing'. This can be addressed by having:

- Clear implementation guidelines to help project teams specify and track low-carbon materials
- Verification processes such as audits, supply chain documentation, and third-party certifications
- Compliance measures that integrate verification into procurement, reporting, and regulatory frameworks.

> *"We highlight the challenge in specifying non-compliant products, with the specification of a product not always reflecting the installed element. We already exist in an environment where substitution is difficult to detect and indeed is often not visible."*

Establishing these safeguards will build confidence in emissions reductions and ensure that sustainability commitments translate into real-world impact.

> *"Ensure what is specified is installed."*

Set minimum standards in project contracts

Stakeholders noted that decarbonisation happens when it is required under contracts. Targets in contracts play a crucial role in decarbonisation by defining clear benchmarks that must be met. Embodied carbon targets, specifically, should identify the minimum performance level for embodied carbon that can be achieved for a given project. For targets to drive decarbonisation effectively, they must be measurable, reportable, and enforceable.

Stakeholders highlighted the need for strong government leadership to drive market transformation and accelerate the adoption of low-carbon materials. While the NCC is expected to introduce voluntary reporting in 2025 and mandates by 2028, many see an opportunity for governments to act sooner.

> *"More emphasis on government setting (embodied carbon) reduction targets in their project pipeline – that would level the playing field and change everything."*

Stakeholders emphasised that government procurement has the potential to set a precedent for industry by demonstrating what is achievable and leveraging purchasing power to scale up the availability of lower-carbon products. They suggested that mandatory targets for public projects could provide market certainty and encourage broader industry adoption.

Additionally, stakeholders stressed that government projects should require a thorough assessment of reuse and retrofit options at the early planning stages. Embedding these expectations from the outset would help drive more sustainable construction practices and reduce embodied carbon across the sector.

Update content in standards, specifications and contracts

> *"Both building and planning regulations in Australia have significant existing measures that mandate minimum material quantities often more than international practice. ... Lessons can be learned from well-regulated international markets that facilitate functional smaller footprint designs - notably Japan and continental Europe."*

Stakeholders were vocal about the need to update industry and government practices with standards, specifications and contracts. They are seeking a faster transition to newer performance-based standards and specifications that are outcomes-focused and enable flexible and more innovative solutions.

Critical updates to specifications and standards to performance-based requirements need to be progressed urgently. Funding is needed to support this change, alongside a more agile and timely process for updates.

Industry and government specifications and relevant contract clauses need to be updated to incentivise progress and ensure that they are not an impediment to decarbonisation.

On some projects, greater decarbonisation has been achieved by gaining a concession from the usual contract conditions. Where alternate pathways to compliance have been approved, these should be clearly explained and made available to future project teams and other jurisdictions, to ensure faster progress.

Support residential construction

Stakeholders noted that embodied carbon reduction in the residential sector remains limited. Maintaining affordability in residential construction is a primary concern, and many in the sector feel they lack the resources to support a low-carbon transition.

> *"Low friction, 'low-literacy' explanations and scalable processes which are ultimately connected to finance seems the only way that the residential leviathan will change its course."*

To support voluntary action to decarbonise, stakeholders highlighted the need for government support through tools, training, and education. Specifically, assistance is being sought to:

- Update tools such as NatHERS (Nationwide House Energy Rating Scheme) to include a voluntary embodied carbon module
- Provide education to builders, trades and consumers
- Provide skills training for residential designers, specifiers and construction workers.

Conclusion: Call for stronger government leadership

Stakeholders emphasised the need for stronger government leadership and clear embodied carbon targets to accelerate decarbonisation in the built environment. They highlighted minimum standards, procurement policies, and contractual requirements as key drivers of change, alongside verification mechanisms to prevent greenwashing.

Updating standards, specifications, and approval processes was seen as essential to support industry-wide adoption of low-carbon materials. Government procurement can play a pivotal role in demonstrating feasibility and scaling up market capacity.

In the residential sector, cost constraints limit action. Stakeholders called for government support through tools, training, and education, including updating NatHERS, educating builders, and investing in skills training.

Aligning policy, regulation, and industry support will be key to achieving cost-effective embodied carbon reductions.

4.2 Building less

Prioritise avoidance of construction

> *"Special attention should be given to better building code support for retrofit and adaptive reuse of existing structures."*

Stakeholders pointed to the importance of embedding emissions avoidance into planning and regulatory standards. Prioritising reuse and retrofit on an 'if not, why not?' basis has significant potential for emissions reductions compared to today's 'demolish and rebuild' cycles. It saves cost in new materials and avoids the generation of waste as an added economic benefit.

> *"A new 3-storey tower should be questioned and constrained if necessary at earliest planning approval phase. As Global ABC (2022) highlighted in its report, the challenge is to constrain growth in floor area, especially in wealthier (countries)."*

The City of London was cited as a leading example of prioritising reuse and retrofit practices.

It was suggested that planning applications should assess reuse and low-build options for brownfield and urban infill developments.

> *"Reward those who opt to build less and use alternate options to deliver services."*

Reduce unnecessary fitouts

Stakeholders highlighted that frequent fitout updates in buildings contribute significantly to embodied carbon. Ensuring that fitouts are updated only when necessary is a key way to minimise impacts.

Where an organisation has control over a significant number of fitouts, refreshing them can be achieved by using a rotation approach[1] rather than to strip out and buy new.

[1] *Rotating fitout content between multiple locations can be used to maximise the lifetime of individual assets (chairs, planters, artworks, etc) while regularly generating a 'fresh' feel within each fitout.*

Applying circular economy principles, such as reuse, refurbishment, and remanufacturing, can cut both emissions and costs, making fitouts more sustainable and efficient.

Conclusion: Prioritise reuse and retrofit

Stakeholders stressed the need to prioritise reuse and retrofit in planning and regulations to reduce embodied carbon and costs. Avoiding unnecessary construction and fitout replacements—through smarter planning, phased rotations, and circular economy principles—can significantly cut emissions and waste. Embedding these strategies into policy will drive a more sustainable built environment.

4.3 Procurement

> *Straight out government mandating carbon measurement and reduction on all projects. Use of a carbon price in government projects = there is a financial reward for reducing carbon. Could apply to private sector as well."*

Use minimum standards for government funding, tender and procurement to show government leadership

Stakeholders expressed that government leadership is key to establishing a 'new normal' ambition for decarbonisation and developing the necessary scale of market for lower-carbon products.

The Infrastructure and Transport Ministers' Meeting (ITMM) has agreed to a nationally consistent approach for valuing embodied carbon for transport infrastructure project decision making. Pathways like this to include carbon pricing in decision-making are well-supported by stakeholders.

Use the collective purchasing power of government

> *A price on carbon ... would solve everything."*

Projects by all levels of government make up a significant portion of the construction market in Australia. A commitment across federal, state/territory and local governments to support embodied carbon reduction for projects could create a critical mass of action to drive change. When combined with the efforts of industry leaders, it would drive the capability and capacity building needed across the construction sector and provide the rationale for investment in low-carbon product transformation in manufacturing.

Stakeholders noted that uncertainty around performance and suitability is a major barrier to adopting new low-carbon products. They highlighted the need for funding flagship projects to test and validate these products in real-world applications. Publishing case studies on successful implementation was seen as a key strategy to build industry confidence and drive wider market adoption.

Require EPDs

> *The most important action, I believe, will be to have EPDs for as many products as possible to allow transparent comparison."*

Many major building products have EPDs, which are Type III ecolabels according to ISO 14025. Stakeholders were clear that EPDs are viewed as the 'gold standard' of product impact transparency on an internationally standardised basis.

However, developing robust, credible claims can be complex and costly. While larger companies can meet these challenges, many SMEs and start-ups are struggling to compete.

Investment can play a crucial role in both accelerating the market entry of low-carbon products and ensuring the credibility of their low-carbon attributes. The rise of 'green claims' has made the industry wary of trusting environmental impact statements that are not third-party verified or calculated using established standards. Support by government and industry for companies to develop EPDs will create fair play in the competition for reduced embodied carbon emissions for building products.

> *Fund development of EPD tools for specific sectors and fabricators."*

Simplify EPD data communication

There is no question from stakeholders that EPDs provide the necessary credibility and transparency of impacts that users can trust. However, users often find these declarations overwhelming and difficult to navigate when looking for essential data, due to the amount of technical information they contain. Despite their credibility in providing high-quality embodied carbon information, EPDs are not user-friendly, creating a barrier for procurement decisions.

This lack of clarity hampers procurement efforts, as the embodied carbon credentials of certain building products may not be obvious. Without accessible data, making informed, low-carbon choices is difficult. Stakeholders are seeking development of a simpler format to communicate this credible data.

Align requirements to accelerate the transition

Currently, conflicting demands are creating barriers to a faster transition. Differences between levels and jurisdictions of government, departments and agencies, and enthusiasm to lead by individual entities have resulted in a confusing range of requests to manufacturers.

> *Establish tendering criteria that evaluate, reward, and drive low carbon product/material selection."*

Manufacturers have indicated that different requirements and specifications make it more difficult to 'pick a winner' in the level of expectation that they should seek to match with product specifications. A lack of agreement on what 'low-carbon' could look like, especially for hard-to-abate sectors, results in a piecemeal approach that rarely stacks up in a business case.

Consistency in procurement clauses across jurisdictions would contribute to more consistent requirements for specific products. Where the same requirement is repeated by many projects, it can create economies of scale for manufacturers who need to invest in better plants and equipment as well as product innovation.

Use incentives to drive 20 to 40 to 60% reduction over time

Hard-to-abate products need technology shifts that are often slow to implement and expensive to develop. Investing in the development of lower-carbon alternatives in these sectors will accelerate progress. They can benefit from funding, incentives and market certainty, which can establish long-term project pipelines and drive faster change.

Increasing expectations of embodied carbon reductions by projects will be fundamental to drive the change needed.

Assist procurement using practical guidance

Procurement professionals have indicated support for the concept of embodied carbon reduction requirements as part of procurement activities. However, they have also indicated that there is a lack of guidance on how to implement these requirements in a cost-effective manner.

Procurement teams need assistance to build confidence in specifying lower-carbon products. Tools that can help include a consistent specification model across projects, which can attract conforming products at a greater scale, and model clauses for tenders to support low-carbon requests.

> *"All recycled materials going into a building or an upgrade, need to have full traceability information on their content and manufacturer of origin."*

Practical guidance is being sought to support a cost-effective transition in procurement practices. A national library of model clauses was suggested as helpful for any project team. These clauses should be tested for feasibility and economic impact as part of their development and approval process.

Conclusion: Government leadership needed as a catalyst for change

Stakeholders stressed that government leadership is key to speeding up embodied carbon reduction. Setting minimum standards in funding, tenders, and procurement will create market certainty and drive investment in low-carbon products. Collective purchasing power can further scale capacity and innovation.

> *"Reward early adopters or those doing the harder thing."*

To support this transition, stakeholders called for funding flagship projects, better EPD accessibility, and aligned procurement requirements to reduce complexity for manufacturers. Incentives and phased reduction targets (20–40–60%) will help drive progress, especially in hard-to-abate sectors. Procurement teams need practical guidance and standardised clauses to implement embodied carbon goals effectively.

By committing to clear, consistent policies, government can provide the certainty, tools, and incentives needed to scale low-carbon solutions and accelerate the net zero transition.

> *"Government projects make up a vast proportion of the (Australian) project pipeline – consistently requiring them to meet reducing carbon budgets will drive entire industry change. As would a price on carbon."*

5. Building design and material efficiency

Reduce demand for carbon-intensive materials by **improving building design and material efficiency**

Figure 12 – Design and efficiency improvements

The responses to ASBEC's Issues Paper strongly supported the importance of design decisions for decarbonisation. Early interventions in projects were noted as particularly important to ensure that options to build less, reuse and retrofit are carefully considered.

5.1. Better design to drive decarbonisation

ASBEC's Issues Paper attracted strong and universal agreement that improving design is essential for decarbonisation. Stakeholders identified design as a critical process for applying the decarbonisation hierarchy and reducing emissions from the outset of a project (Figure 13).

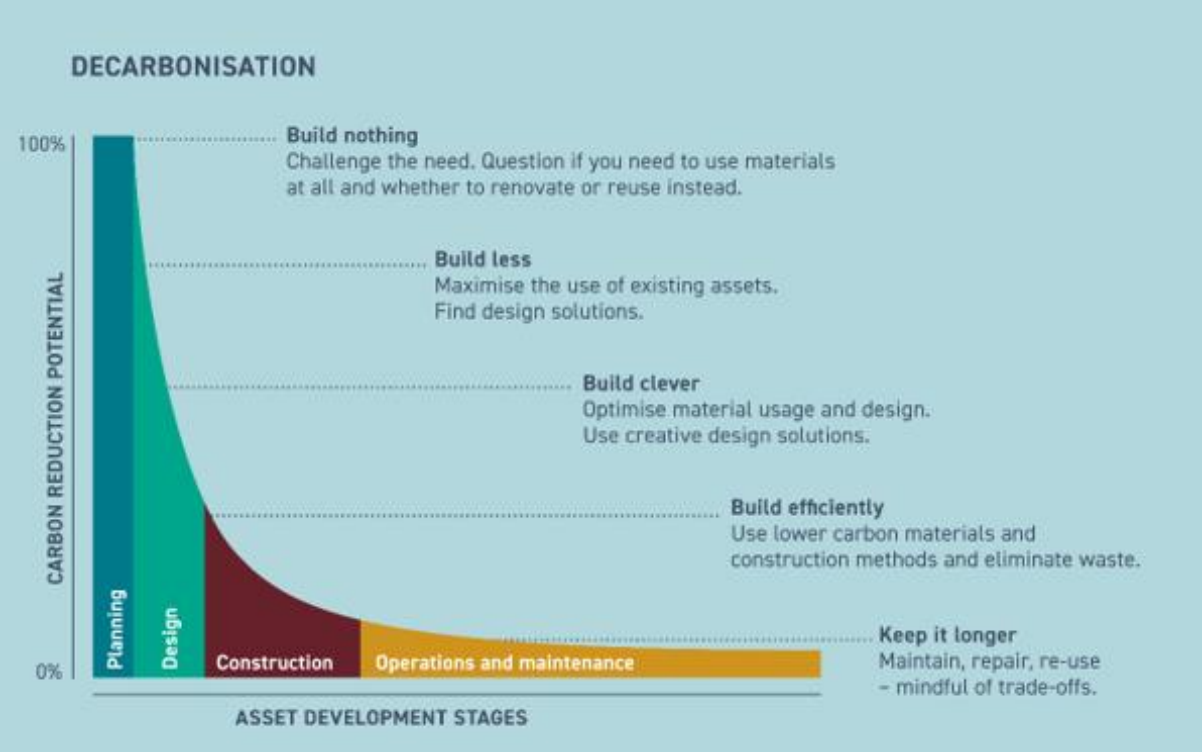

Figure 13 – Opportunities to reduce embodied carbon from stage in project cycle. Source: Adapted from HM Treasury Carbon Review (2013)

Many responses stressed the need to design out carbon at the project level rather than focusing solely on low-carbon materials. This means optimising designs to reduce emissions, prioritising durable and efficient materials, and integrating whole-life carbon assessments and circularity into construction planning.

> *"Savvy asset owners and developers have the most to gain from early-stage, lower-carbon design optimisations."*

Stakeholders noted that better design from the concept stage can significantly reduce carbon impacts before material selection even begins. Early-stage decisions should include assessing reuse and retrofit options, questioning whether new construction is necessary, and exploring ways to build less.

> *"Reducing embodied carbon through design will reap the greatest savings."*

Deferring decarbonisation considerations until the product selection stage can lead to increased resource consumption (and often cost) as well as unnecessary embodied carbon impacts.

> *"A new model of value engineering can take out the risk of losing important low-carbon options."*

A narrow focus on using material substitution to achieve lower embodied carbon emissions can also lead to perverse outcomes, such as decreasing durability or increasing maintenance costs due to selection of inferior materials.

Key options that should be considered in early design decisions include:

- **Design solutions before product choices**: focusing on design solutions first, prior to selecting products to gain every advantage for low-carbon construction.
- **Target setting**: defining targets and goals for architects and builders to encourage early consideration of design options.
- **Smarter, more flexible building designs**: designing buildings with long-term use and adaptability in mind.
- **Carbon management**: including a carbon management plan as part of early project planning, as described in the Infrastructure Technical Guidance.
- **Circular economy**: identifying high-benefit measures such as building less, reuse, retrofit, recycling, and design for efficient deconstruction.
- **Material efficiency**: reducing the demand for materials in the first place, e.g. using less material; reducing floor space and the size of buildings.
- **Transparency and traceability:** implementing material passports or traceability systems to enable reuse and cut carbon in future projects. Collaborate across the value chain.

> *"A fundamental design approach is using materials to their highest purpose."*

Additional actions to facilitate better early design thinking include:

- **Better tools**: providing early design tools, such as templates for team collaboration and design excellence checklists, to better integrate sustainability into project workflows.
- **Supporting through regulation**: mandating low-carbon design and construction practices from the early stages of planning and design, including minimum requirements for embodied carbon in planning policies and building codes.
- **Support for renovation of existing buildings**: encouraging the renovation of buildings with low-carbon solutions rather than rebuilding.

Stakeholders also noted the need to "balance low-carbon designs with aesthetics and functionality to avoid creating uninspiring environments".

Support design innovation with skills and guidance

Many professionals want to engage more deeply in decarbonisation but feel they lack the necessary skills. Stakeholders expressed the need for more training to improve their understanding of embodied carbon and available design options. Practical guidance, along with knowledge sharing through case studies and real-world examples, was seen as the most effective way to accelerate progress.

> *"Need a combination of micro-credentials and CPD courses as well as guides and tools and case studies."*

> *"There are solutions to some of these problems out there. Industry needs to see what solutions look like, so there is something tangible to engage with and the business opportunities can be discovered."*

A significant gap was identified in resources for decarbonising residential construction. Stakeholders asked for case studies and examples of low-carbon designs and highlighted the need for smaller, more efficient homes as a direct way to reduce material use and emissions.

There was a suggestion that peak bodies and industry associations could provide training to support design for decarbonisation, although stakeholders noted that this would depend on securing a suitable funding model.

5.2 More efficient use of materials

Stakeholders highlighted that material efficiency in construction can significantly reduce resource use. More efficient designs—such as avoiding cantilevers and spires, optimising column grids, and using bespoke structural elements—can lower embodied carbon while maintaining functionality.

A key request from stakeholders was greater clarity on currently available decarbonisation options. In 2024, Infrastructure Australia assessed the feasibility of like-for-like material substitutions for buildings and infrastructure. This involved consulting material suppliers and builders to identify low-carbon options that are both practical and market-ready.

> *(Risk of) too great a focus on material substitution, not enough on reducing consumption."*

The decarbonisation potential of these materials was mapped against their cost of implementation using a Marginal Abatement Cost Curve, providing a clear comparison of cost-effective pathways for reducing embodied carbon (see Figure 10).

The project only examined like-for-like material substitutions that are available on the market at scale today and did not include forecasted innovations that are not yet available.

The measures reported with the most carbon abatement opportunities available today are:

- Recycled crushed concrete to replace aggregates in concrete and pavement sub-base
- Reclaimed asphalt pavement to replace asphalt in base course and wearing course
- Hydrated lime replaced by functional substitutes in asphalt
- Structural steel lightweighting
- Reinforcing steel lightweighting
- Aluminium made with 100% renewable electricity
- Steel made in an electric arc furnace with 100% renewable electricity
- Supplementary cementitious materials to replace cement
- Renewable electricity in construction
- Steel fibre reinforcing to replace steel mesh/bar reinforcing
- Biodiesel in construction.

Due to scope limitations, the Infrastructure Australia report did not consider improvements to embodied carbon that could be achieved through:

- No-build or building less than planned
- Reuse and retrofitting
- Improved design and materials efficiency
- Substitution with different types of materials.

When adding these considerations, decarbonisation well in excess of the 23% average reported by Infrastructure Australia should be possible for much of the construction happening today.

Beware perverse outcomes

Several stakeholders were vocal in their warning that a singular focus on upfront embodied carbon emissions could lead to perverse outcomes. Any decisions relating to decarbonisation should always consider trade-offs with traditional factors like time, cost and quality, as well as whole-of-life carbon emissions, circularity and social sustainability considerations.

> *Make sure this is just the first step as it needs to move as quickly as possible to full life cycle. We need buildings that last longer and use less operational energy."*

Conclusion: Embed low-carbon design and material efficiency

Stakeholders emphasised the need to prioritise design and material efficiency to reduce embodied carbon. Early planning must consider building less, reuse, and retrofit, as well as optimising designs for material efficiency. This will maximise carbon savings before material selection even begins.

Regulation and procurement are key to driving demand for low-carbon solutions. To support this shift, the industry needs skills development, practical guidance, and early-stage tools to embed sustainability into design workflows.

While material substitutions offer immediate carbon savings, a broader approach - including better design, efficiency measures, and circular economy principles - can achieve even greater emissions reductions. A balanced, whole-of-life perspective is essential to avoid perverse outcomes and ensure sustainable, high-quality construction.

6. Supply chain decarbonisation

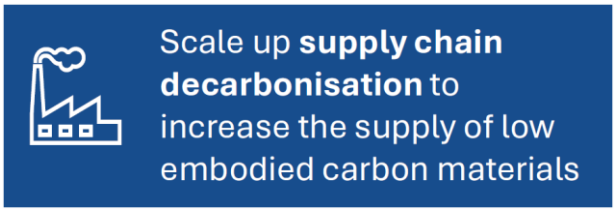

Figure 14 – Supply chain decarbonisation

Production of materials accounts for the largest share of embodied carbon in the built environment, while construction activities contribute a smaller but still significant portion.

Stakeholders emphasised that reducing emissions in the supply chain requires clear market signals, standardised requirements, technological innovation, and financial support. This chapter explores three key areas: establishing consistent policies and expectations, improving industry capability, and strengthening government and industry collaboration to support low-carbon manufacturing and procurement.

6.1 Establishing clear and consistent market signals

Stakeholders emphasised the importance of clear standards and performance metrics to support the business case for low-carbon materials in the supply chain. Standardised carbon requirements and low-carbon specification guidelines, developed through collaboration between government and industry, were seen as essential. While initiatives such as MECLA have made progress in this space, further work is required to create a nationally coordinated approach.

> *"So long as everyone on the demand side is united in calling for better products then hopefully suppliers can feel confident to meet that demand. But if some companies just pay lip service and are happy to have a cheaper/simpler but higher-carbon product then it will slow the transition down."*

A consistent approach to decarbonisation standards at the asset level rather than for individual products was identified as important. This method allows project teams greater flexibility in meeting emissions reduction goals across an entire development rather than being restricted by product-specific requirements. Time-based targets should also align with international commitments, including milestones for 2030 and 2050, to ensure policy consistency and support long-term industry planning.

> *"Implement star rating on material and product packages reflecting embodied carbon. Similarly mandate display in design."*

Stakeholders raised concerns about the clarity of embodied carbon data. While EPDs are widely used and trusted, they are often complex and difficult to navigate, making procurement decisions more challenging.

Many supported introducing a national product transparency framework that includes a simplified carbon content label based on the rigour of EPD data. This would allow industry to compare materials more easily.

> *"Could the MEPS/appliance rating website model work?"*

> *How do we have confidence that internationally sourced products will be held to the same standard demanded of Australian industry? We support like for like comparisons, so how will this be enforced?"*

Ensuring imported products meet the same carbon verification standards as domestic materials was also identified as a priority. There were several suggestions that a Carbon Border Adjustment Mechanism (CBAM) could ensure fair competition and prevent carbon leakage into Australia from high-carbon imported products.

> *Products are often imported, think of regulation or tax related to that."*

6.2 Building industry capability for low-carbon manufacturing

> *Allow manufacturers to use more recycled and waste materials."*

The transition to lower-carbon materials and construction methods is hindered by gaps in industry knowledge, skills, and access to necessary technology. Stakeholders emphasised the need for targeted training programs to upskill manufacturers, suppliers, and designers on emissions reduction strategies. Expanding knowledge-sharing initiatives and publishing case studies on real-world applications of best practice low-carbon solutions would help accelerate their uptake.

> *Long term funding may be key for the hard-to-abate sectors – how can they amortise costs over much longer periods without having to solely rely on demand?"*

Investment in new technology is critical to scaling up low-carbon manufacturing. Grants and subsidies were identified as essential to encourage manufacturers to invest in cleaner production processes, while longer-term procurement agreements would provide greater financial certainty for businesses making this transition.

Government support for product trials and validation was also highlighted as a key mechanism for testing emerging technologies before wider adoption. Stakeholders stressed that both successful and unsuccessful trials should be documented and shared, allowing the entire sector to learn from real-world experiences.

For hard-to-abate sectors, the transition to renewable energy and low-carbon fuels was outlined by stakeholders as a critical challenge. Many industries rely on fossil fuels for electricity and process heat, particularly in heavy manufacturing. Increased investment in renewable energy infrastructure would help support industrial electrification.

> *Support to deliver sufficient renewable electricity to enable (manufacturing) to access adequate amounts of reliable & cost competitive electricity..."*

> *Support to find solutions to the emissions associated with our use of natural gas."*

Research and economic support for low-carbon liquid fuels and other alternative energy sources was also requested, particularly for applications where electrification is not yet feasible.

To ensure that low-carbon alternatives remain competitive with fossil fuels, policy mechanisms need to address cost barriers that currently slow adoption.

6.3 Strengthening government and industry collaboration

Government leadership is essential to accelerate supply chain decarbonisation. Policies must provide long-term certainty for businesses making the transition to lower-carbon alternatives. Stakeholders recommended embedding low embodied carbon principles into government procurement to drive demand for low-carbon design and materials and developing a national embodied carbon reporting framework to establish clear benchmarks.

Aligning Australia's embodied carbon policies with international best practices, particularly those adopted by the European Union and global rating tools, would help maintain consistency and support industry participation in global markets.

International research highlights the importance of industry collaboration in scaling up decarbonisation efforts. The European Union's Country Twinning initiative has successfully helped less mature markets learn from experienced jurisdictions. Stakeholders suggested that Australia could adopt a similar knowledge-sharing approach at the national, state, and city levels to ensure that best practices are implemented consistently across different regions.

Supply chain complexity was also identified as a challenge requiring greater coordination between manufacturers, designers and contractors. Engaging the supply chain early in project planning would allow decarbonisation strategies to be built into projects from the outset, rather than being considered late in the process when change is too difficult and expensive.

Conclusion: Creating a strong foundation for supply chain decarbonisation

Reducing emissions in the supply chain requires a combination of clear policy signals, investment in industry capability, and strong government leadership. Stakeholders emphasised that standardised carbon reporting, robust procurement policies, and financial support are essential for scaling up low-carbon manufacturing. Addressing knowledge gaps and supply chain complexity will also be critical to ensuring a smooth transition.

> *Some manufacturing cannot be electrified so alternative fuels to replace fossil fuels need to be developed and available"*

By aligning national policies with international best practices, creating stable market expectations, and strengthening collaboration across sectors, Australia can accelerate supply chain decarbonisation and drive meaningful emissions reductions in the built environment.

7. Fossil fuel free transport & construction

Figure 15 – Fossil fuel free transport and construction

Reducing emissions from transport and construction is essential to achieving a low-carbon built environment. Stakeholders highlighted the need for clear emissions disclosure, investment in fossil fuel free (FFF) technologies, supportive government policies, and greater industry awareness to accelerate this transition. Addressing emissions in both construction processes and supply chain transport will require consistent reporting, technological innovation, policy reform, and workforce capacity-building.

7.1 Improving emissions disclosure and reporting

A major challenge in decarbonising transport and construction is the lack of consistent and transparent emissions reporting. Stakeholders indicated the importance of EPDs (or data with similar credibility) for transport and construction, similar to those already used for materials. Establishing clear, standardised methodologies for measuring emissions from transport and construction activities would enable better benchmarking and tracking of progress.

Improving public disclosure of emissions data would create accountability, inform decision-making, and strengthen demand for low-carbon alternatives. Without reliable emissions data, it is difficult to set meaningful targets and assess the effectiveness of emissions reduction measures. Standardising reporting frameworks across jurisdictions and industry would ensure comparability and alignment with international best practices.

7.2 Scaling up fossil fuel free construction and transport

The adoption of fossil fuel free construction equipment is an important step in reducing emissions. While some zero-emission machinery is already available, stakeholders noted that uptake has been slow due to high costs, infrastructure limitations, and the need for further technological development. They called for greater investment in research and innovation to expand the range of FFF equipment and scaling up the use of existing electric and hydrogen-powered machinery.

Electrification should be prioritised wherever possible to reduce reliance on fossil fuels. However, businesses require strong demand signals and policy certainty to justify investment in these technologies. Stakeholders recommended incorporating FFF requirements into government procurement and project contracts to accelerate market adoption.

Lendlease has published guidance on fossil fuel free construction as an excellent resource to support both the practicalities and business case for this change.

Addressing emissions in transport is also critical. Shifting freight transport from road to rail or shipping would significantly lower emissions, and stakeholders encouraged greater investment in low-emission freight networks and electrified transport fleets. Encouraging the local sourcing of materials and/or circular options where possible could further reduce transport-related emissions.

7.3 Strengthening industry policies and workforce capability

Stakeholders called for stronger contractual requirements that include transport and construction emissions alongside materials. Implementing an 'if not, why not?' approach would encourage project teams to justify the continued use of fossil fuel-dependent equipment and explore alternatives. Early engagement with builders and suppliers was seen as critical to ensuring clear expectations, practical procurement timelines, and a smooth transition to FFF construction.

Beyond direct emissions reductions, improving testing, commissioning, and site operations would help lower overall energy consumption. Optimising commissioning processes and expanding access to renewable electricity for temporary site power would support sustainability goals while reducing operational construction emissions. Prefabrication and modular construction methods were also identified as key strategies to reduce the reliance on heavy construction equipment, provided offsite manufacturing is also decarbonised.

A lack of awareness, knowledge, and technical expertise was seen as a key barrier to the transition. Stakeholders recommended increased training programs for industry professionals, knowledge-sharing through case studies, and government-led awareness initiatives to support the adoption of fossil fuel free construction.

7.4 Supporting alternative fuels and government leadership

While electrification remains the preferred pathway for decarbonisation, stakeholders acknowledged that some applications—such as long-distance heavy transport—are difficult to electrify. For these sectors, investment in low-carbon liquid fuels, such as biofuels and renewable hydrogen, is essential.

Stakeholders noted that subsidies which support the use of traditional fossil fuels in heavy haulage are not available for biofuels. This creates an added cost barrier for biofuels, which are already more expensive than traditional fossil fuels. This is a major barrier to adoption. Without economic support and policy mechanisms, adoption will remain slow.

Government leadership is essential in accelerating the transition. Amending procurement requirements to prioritise fossil fuel free construction and transport would set new industry norms and drive investment in sustainable alternatives. Expanding infrastructure for electrification and alternative fuels, alongside financial incentives for early adopters, would help offset the initial costs of transitioning to FFF technologies. Clear policy direction and market certainty would enable businesses to make long-term investment decisions with confidence.

Conclusion: Pathway needed for fossil fuel free construction and transport

Stakeholders made it clear that transitioning to fossil fuel free transport and construction requires strong policy signals, targeted investment, and industry-wide collaboration. Standardising emissions disclosure, accelerating the adoption of FFF equipment, strengthening contractual and procurement requirements, expanding infrastructure, and increasing industry knowledge were identified as key priorities.

With clear government leadership and coordinated action across the industry, the shift to fossil fuel free construction and transport can become a practical and scalable reality, significantly reducing emissions across the built environment.

8. Lessons from global policy and research

Understanding how other countries approach embodied carbon reduction provides valuable insights for shaping Australia's policy framework. The analysis of international policy papers, industry reports, rating tools, and government frameworks revealed clear trends in how other jurisdictions set targets, regulate emissions, and support low-carbon construction.

Refer to ASBEC's Issues Paper and its Annex for our detailed international policy analysis.

Many global policies are initially voluntary but progressively move toward mandatory requirements, allowing industries to adjust while driving long-term emissions reductions. Australia could follow a similar pathway by starting with voluntary measures and gradually increasing regulatory requirements.

The Issues Paper Annex provides a detailed analysis of 250 national, state, and city regulations, policies, and action plans from over 20 countries, including a review of 104 regulatory instruments. A structured parameter set was used to extract key insights from 34 sources, guiding Australia's policy direction for government and industry. Additionally, 30 leading policies from 11 countries were examined, with findings summarised in a comprehensive issues list. The Annex also includes a summary of research findings by parameter, as well as referenced policies and international action commitments. The following is a short summary of the research findings.

8.1 Policy mechanisms and regulatory alignment

International embodied carbon policies often align with broader climate commitments such as the Paris Agreement and net zero targets. Many jurisdictions have set time-based goals for 2025, 2030, and 2050, allowing for a phased approach to emissions reductions. Australia's policies would benefit from a similar alignment, ensuring consistency with global partners and helping to maintain access to international markets.

These policies either apply broadly across the building sector or focus on specific asset types, such as publicly owned buildings, large-scale developments, or individual construction materials. Australia is following the European model for buildings by regulating at the asset level, initially addressing emissions from foundations, structures, building envelopes and key building services. However, leading jurisdictions are expanding their policies to include more building services, interiors, and external works, an approach Australia could adopt over time.

Many policies focus on upfront carbon emissions (A1–A3[2]: raw material extraction, processing, and manufacturing), while others extend to transport and construction emissions (A4–A5). Some governments are beginning to consider whole-of-life emissions, including end-of-life and circularity factors, a move that could strengthen Australia's approach and is strongly supported by stakeholders.

[2] *Refer to Figure 3 for more detail on modules A1 to A5.*

8.2 Data standardisation and market incentives

A major challenge in international policy implementation is the lack of consistency in data reporting and verification. The European Union is developing a common embodied carbon database, integrating national datasets from member states. Australia has relied on a mix of national datasets, academic research, and industry-developed tools, making it harder to compare materials and projects. A centralised, trusted national database with all necessary data would streamline reporting and improve data transparency.

EPDs are widely used internationally, but asset-level verification requirements vary, with some jurisdictions mandating third-party verification while others rely on voluntary compliance. Establishing a standardised and robust verification system for embodied carbon data will be essential to ensure consistency and credibility in Australia.

Some international policies use financial incentives to accelerate low-carbon adoption. In the United States, the Environmental Protection Agency (EPA) is implementing the US Inflation Reduction Act (IRA)[3] which includes a label for low-carbon construction materials and mandatory procurement requirements for government-funded projects.

Australia's Low Emissions Technology Roadmap (2021) highlights the need for low-emissions building materials (LEBMs), and aligning embodied carbon policy with this roadmap could streamline incentives, drive investment, and accelerate market adoption.

8.3 Workforce capacity and supply chain integration

Early engagement with supply chains is crucial for ensuring embodied carbon reductions are embedded into project planning. International examples show that prioritising active supplier decarbonisation is more effective than relying on carbon offsets.

A skilled workforce is also essential to implementing embodied carbon policies effectively. The Swedish government has reported that skills shortages have delayed construction projects due to a lack of trained workers in low-carbon construction methods. To avoid similar challenges, Australia could integrate embodied carbon training into university programs, trade qualifications, and industry certifications. Addressing the needs of the current workforce is equally important.

Collaboration between governments, industry, and academia has been a key success factor in shaping international embodied carbon policies. The EU's Country Twinning initiative, which pairs jurisdictions at different stages of policy development, has helped share knowledge and build capacity. Australia could implement a similar approach at national, state, or city levels to accelerate progress.

[3] *At the time of writing, the IRA remains in place, but elements are reportedly being withdrawn from implementation. The full outcome of this action is not yet understood.*

Conclusion: Aligning Australia's policy with global best practices

International research highlights effective strategies for embodied carbon policy design, including phased regulatory approaches, strong data frameworks, industry collaboration, and targeted incentives. For Australia, aligning policies with global frameworks while addressing local challenges will be key.

Developing a national embodied carbon reporting framework, strengthening supply chain and workforce capacity, and setting progressive regulatory targets will help Australia transition to a low-carbon built environment. By learning from international leaders, Australia can develop a tailored, ambitious, and practical policy approach that supports both climate goals and economic growth.

8.4 Case Study: Lessons from the US Inflation Reduction Act

The IRA, enacted in August 2022, represents one of the most ambitious climate policies in the world. By studying its impact, Australia can extract valuable insights to shape its own decarbonisation efforts, particularly in low-carbon construction, procurement policies, and market incentives. Rather than replicating the IRA directly, Australia can integrate its proven strategies into existing policy structures to drive sustainable construction and reduce embodied carbon.

Decarbonising construction through federal procurement

One of the IRA's key mechanisms for reducing embodied carbon is the Buy Clean initiative, which mandates the use of low-carbon building materials in federally funded infrastructure projects. With $2.15 billion allocated for low-carbon materials in federal construction and renovation, the program leverages the US government's vast purchasing power to drive demand for low-emission alternatives. By prioritising concrete, cement, asphalt, steel, and glass with lower-carbon footprints, the initiative creates market incentives for manufacturers to decarbonise their production processes.

The Buy Clean initiative also promotes EPDs as a basis for procurement decisions. By requiring transparent emissions data, the program pushes suppliers to provide verified carbon footprints of their materials, supporting the development of a standardised approach to low-carbon procurement across the industry.

Driving industry-wide adoption

By embedding low-carbon requirements into federal procurement, the IRA effectively normalises sustainable construction practices across the US building sector. Public infrastructure projects—including highways, bridges, and government buildings—set new benchmarks for emissions reduction, which ripple into private-sector construction.

For manufacturers, these policies de-risk investment in low-carbon materials by ensuring a steady demand for sustainable products. By aligning financial incentives, emissions reporting, and procurement standards, the IRA accelerates market transformation toward a greener building industry.

Implications for Australia

The IRA's success demonstrates the power of government-led procurement and financial incentives in driving decarbonisation. Australia could adopt similar approaches by:

- Embedding Buy Clean principles into government procurement to expand the market for low-carbon materials
- Strengthening EPD requirements to standardise emissions disclosure in construction procurement
- Introducing financial incentives for low-carbon building materials and design
- Using public infrastructure projects to lead industry-wide emissions reductions.

By applying these lessons, Australia can accelerate the transition to a low-carbon built environment, aligning climate goals with industry growth and innovation.

References

ASBEC. (2024). *Issues paper: Embodied carbon emissions in Australia's built environment.* Retrieved from https://www.infrastructure.gov.au/sites/default/files/documents/embodied-carbon-measurement-for-infrastructure.pdf

ASBEC. (2025) Our Upfront Opportunity: Australia's policy roadmap to reduce upfront embodied carbon in the built environment. Retrieved from https://www.asbec.asn.au/wordpress/wp-content/uploads/2025/03/250323-ASBEC-Our-Upfront-Opportunity.pdf

Bistline, J., Blanford, G., & Brown, M. (2023). *Emissions and energy impacts of the Inflation Reduction Act. Science,* 1324–1327. doi:10.1126/science.adg3781

Bivens, J. (2023, August 14). *The Inflation Reduction Act finally gave the U.S. a real climate change policy.* Economic Policy Institute. Retrieved from https://www.epi.org/blog/the-inflation-reduction-act-finally-gave-the-u-s-a-real-climate-change-policy/

Bluegreen Alliance. (2022). *Buy Clean – A tool to create good jobs, cut pollution, and renew American manufacturing.* Retrieved from https://www.bluegreenalliance.org/wp-content/uploads/2022/09/Buy-Clean-White-Paper-22-_v3_91222.pdf

Circular Economy Ministerial Advisory Group. (2024). *The circular advantage.* Retrieved from https://www.dcceew.gov.au/sites/default/files/documents/circular-advantage-final-report-cemag.pdf

Clean Energy Finance Corporation. (2022). *Landmark buildings and the path to net zero emissions.* Retrieved from https://www.cefc.com.au/media/qpjiif3t/awof-mwof.pdf

Climate Change Authority. (2024, September). *Sector pathways review: Built environment.* Australian Government. Retrieved from https://www.climatechangeauthority.gov.au/sites/default/files/documents/2024-09/2024SectorPathwaysReviewBuilt%20Environment.pdf

Climate Change Authority. (2024, September). *Sector pathways review: Electricity and energy.* Australian Government. Retrieved from https://www.climatechangeauthority.gov.au/sites/default/files/documents/2024-09/2024SectorPathwaysReviewElectricityandEnergy.pdf

Climate Change Authority. (2024, September). *Sector pathways review: Industry and waste.* Australian Government. Retrieved from https://www.climatechangeauthority.gov.au/sites/default/files/documents/2024-09/2024SectorPathwaysReviewIndustryandWaste.pdf

Climate Change Authority. (2024, September). *Sector pathways review: Resources.* Australian Government. Retrieved from https://www.climatechangeauthority.gov.au/sites/default/files/documents/2024-09/2024SectorPathwaysReviewResources.pdf

Department of Climate Change, Energy, the Environment and Water. (2023). *Circular Economy Ministerial Advisory Group.* Retrieved from https://www.dcceew.gov.au/environment/protection/circular-economy/ministerial-advisory-group

Department of Climate Change, Energy, the Environment and Water. (2024). *Environmentally sustainable procurement policy.* Australian Government. Retrieved from https://www.dcceew.gov.au/environment/protection/waste/sustainable-procurement/environmentally-sustainable-procurement-policy

Department of Climate Change, Energy, the Environment and Water. (2024, June). *Environmentally sustainable procurement policy [PDF].* Australian Government. Retrieved from https://www.dcceew.gov.au/sites/default/files/documents/environmentally-sustainable-procurement-policy.pdf

Department of Industry, Science and Resources. (2024). *Future Made in Australia Bill - 09 August 2024.* Australian Government. Retrieved from https://treasury.gov.au/sites/default/files/2024-05/p2024-526942-fmia-nif.docx

Department of Industry, Science and Resources. (2024). *Future Made in Australia National Interest Framework – 14 May 2024.* Australian Government. Retrieved from https://treasury.gov.au/sites/default/files/2024-05/p2024-526942-fmia-nif.docx

Department of Industry, Science and Resources. (2024, June). *Building ministers' meeting communique – June 2024.* Australian Government. Retrieved from https://www.industry.gov.au/news/building-ministers-meeting-communique-june-2024

Department of the Treasury. (2024). *Mandatory climate-related financial disclosures – 2024.* Australian Government. Retrieved from https://treasury.gov.au/sites/default/files/2024-01/c2024-466491-policy-state.pdf

Department of the Treasury. (2024, September). *Interim report: Housing and productivity review [PDF].* Australian Government. Retrieved from https://treasury.gov.au/sites/default/files/2024-09/p2024-573125-interim-report_0.pdf

Infrastructure and Transport Ministers. (2024). *Embodied carbon measurement for infrastructure.* Retrieved from https://www.infrastructure.gov.au/sites/default/files/documents/embodied-carbon-measurement-for-infrastructure.pdf

Infrastructure Australia. (2024). *Embodied carbon projections for Australian infrastructure and buildings.* Retrieved from https://www.infrastructureaustralia.gov.au/reports/embodied-carbon-projections-australian-infrastructure-and-buildings

INSW. (2024). *Embodied carbon measurement for infrastructure: Technical guidance.* Retrieved from https://www.infrastructure.nsw.gov.au/media/ak2o0bqg/decarbonising-infrastructure-delivery-measurement-guidance.pdf

ITMM. (2024). *Embodied carbon measurement for infrastructure: Technical guidance.* Retrieved from https://www.infrastructure.gov.au/sites/default/files/documents/embodied-carbon-measurement-for-infrastructure.pdf

Jenkins, J., Mayfield, E., & Farbes, J. (2022). *Preliminary report: The climate and energy impacts of the Inflation Reduction Act of 2022.* Princeton University, Zero-carbon Energy Systems Research and Optimization Laboratory (ZERO Lab). Retrieved from https://repeatproject.org/docs/REPEAT_IRA_Prelminary_Report_2022-08-04.pdf

NABERS. (2024). *NABERS embodied carbon.* Retrieved from https://www.nabers.gov.au/ratings/our-ratings/nabers-embodied-carbon

NABERS. (2024). *NABERS embodied carbon database.* Retrieved from https://www.nabers.gov.au/publications/national-emission-factors-database

Office of the Federal Chief Sustainability Officer. (2023). *Federal Buy Clean Initiative.* Retrieved from https://www.sustainability.gov/buyclean/

Parliament of Australia. (2023). *National reconstruction fund corporation bill 2023.* Retrieved from https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r6955

Parliament of Australia. (2023). *The housing Australia future fund bill 2023.* Retrieved from https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r7177

Smedick, D., Golden, R., & Petersen, A. (2022, August 31). *The Inflation Reduction Act could transform the US buildings sector.* Rocky Mountain Institute. Retrieved from https://rmi.org/the-inflation-reduction-act-could-transform-the-us-buildings-sector/

US Environmental Protection Agency. (2023). *Getting to substantially lower embodied greenhouse gas emission construction materials.* EPA Office of Chemical Safety & Pollution Prevention. Retrieved from https://www.epa.gov/system/files/documents/2023-04/March%2022%20-%20OCSPP%20IRA%20Programs%20-%20EPD%20Assistance%20-%20final_ec.pdf

US General Services Administration. (2024). *Inflation Reduction Act.* Retrieved from https://www.gsa.gov/real-estate/gsa-properties/inflation-reduction-act

US General Services Administration. (2022). *Material requirements.* Retrieved from https://www.gsa.gov/real-estate/gsa-properties/inflation-reduction-act/lec-program-details/material-requirements

List of figures

Figure 1 – ASBEC's Policy Roadmap 3

Figure 2 - ASBEC's summary of levers for change (page 3) 4

Figure 3 – The asset life cycle and carbon emissions. Source: thinkstep-anz 9

Figure 4 – Embodied and operational carbon in Australia's buildings, with yearly area constructed (GBCA and thinkstep-anz, 2021) 10

Figure 5 – Development Process of the Issues Paper and Policy Roadmap 13

Figure 6 – The research in numbers 14

Figure 7 – Carbon Leadership Forum Embodied Carbon Policy Tracking Map 14

Figure 8 – ASBEC's Issues Paper: Embodied Carbon Emissions in Australia's Built Environment 15

Figure 9 – The 7 dilemmas presented in ASBEC's Issues Paper 15

Figure 10 - Marginal abatement cost curve 2025-26 Source: Infrastructure Australia (2024) 23

Figure 11 – Planning and procurement reforms 27

Figure 12 – Design and efficiency improvements 35

Figure 13 – Opportunities to reduce embodied carbon from stage in project cycle. Source: Adapted from HM Treasury Carbon Review (2013) 35

Figure 14 – Supply chain decarbonisation 39

Figure 15 – Fossil fuel free transport and construction 42

List of tables

Table 1 – Examples of initiatives focused on, or linked to, embodied carbon 19

Table 2 – Knowledge and skills required for decarbonisation 21

Table 3 – Governance principles 57

Table 4 – Technical principles 58

Abbreviations and glossary

Term	Definition
ABCB	Australian Building Codes Board
ALCAS	Australian Life Cycle Assessment Society
ANZSIC	Australian and New Zealand Standard Industrial Classification
API	Application Programming Interface
ASBEC	Australian Sustainable Built Environment Council
CBD	Commercial Building Disclosure
CBAM	Carbon Border Adjustment Mechanism
CEFC	Clean Energy Finance Corporation
CO_2e	CO_2 equivalent, or carbon dioxide equivalent is calculated using the mass of a given GHG multiplied by its global warming potential
DfMAD	Design for Manufacturing, Assembly and Disassembly
DCCEEW	Department of Climate Change, Energy, the Environment and Water
EPA	Environmental Protection Authority
EPD	Environmental Product Declaration. A Type III ecolabel that provides transparent, verified information about the environmental impact of products.
FFF	Fossil fuel free (used in context of construction and transport)
GBCA	Green Building Council of Australia
GHG	Greenhouse gas For the purposes of this report, GHGs are the seven gases listed in the Kyoto Protocol. These GHGs are currently: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).
HM Treasury	Her Majesty's Treasury (UK), cited in the context of carbon management frameworks
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act (United States)
ISC	Infrastructure Sustainability Council
ITMM	Infrastructure and Transport Ministers' Meeting
LCA	Life Cycle Assessment
LCACP	Life Cycle Assessment Certified Professional
LEBMs	Low Emission Building Materials
MECLA	Materials and Embodied Carbon Leaders' Alliance

Term	Definition
Mt	Megatonne (million metric tonnes)
NABERS	National Australian Built Environment Rating System
NatHERS	Nationwide House Energy Rating Scheme
NCC	National Construction Code
NGAs	National Greenhouse Accounts
SME	Small and Medium Enterprise
UNFCCC	United Nations Framework Convention on Climate Change
Zero-carbon	A term used to describe buildings or systems that have net zero carbon emissions, usually through design, materials, and renewable energy use

Applicability and limitations

Restrictions and intended purpose

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Legal interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Annex: National database principles

Table 3 – Governance principles

Key concept	Requirement	Details
Steering Committee	→ Establish a Steering Committee to represent the needs of stakeholders and ensure that credibility and appropriate governance are upheld in accordance with these requirements.	Potential Steering Committee members include: → National Australian Built Environment Rating System (NABERS) → Infrastructure Australia → Infrastructure NSW → Green Building Council of Australia (GBCA) → Infrastructure Sustainability Council (ISC) → Australian Sustainable Built Environment Council (ASBEC) → Australian Life Cycle Assessment Society (ALCAS) → Australian Institute of Architects → Engineers Australia
Stewardship	→ Assign a data steward responsible for the database. → Implement quality assurance processes for data accuracy.	→ A government agency should appoint a data steward within its sustainability or environmental division. → The agency should engage an external Life Cycle Assessment Certified Professional (LCACP) or Certified Life Cycle Assessment Reviewer (CLAR) for annual validation checks and updates.
Operational governance	→ Maintain comprehensive documentation for the database. → Provide training for users of the database.	→ The data steward or a dedicated project manager should be responsible for maintaining documentation. → The agency's training department and/or an external provider specialising in embodied carbon should conduct the training.
Accessibility	→ Ensure the database is accessible and user-friendly. → Ensure the database meets the needs of users so that it facilitates decarbonisation of assets.	→ Conduct user testing with a sample of industry professionals or gather feedback through surveys to improve usability. → In future, make an Application Programming Interface (API) available so that the database is accessible to carbon software tools and can be updated directly from credible sources.

Table 4 – Technical principles

Key concept	Requirement	Details
Database structure	→ Organise the database in a simple format, e.g. Excel workbook or web-based database, to facilitate easy navigation and data entry. → Provide clear descriptions for each table and field in the database.	Assuming a spreadsheet is used for the initial version: → Use separate worksheets for each material type. Summarise all EPDs consulted per material in one worksheet. → Summarise all grouped and normalised emissions in one worksheet. This worksheet should show the average, minimum, and maximum emissions from EPDs together with the conservative default emission factors after uncertainty adjustment. → Include a dedicated 'Instructions' worksheet that details each worksheet and column's purpose and how to interpret the data.
Data management	→ Ensure accurate data entry and regular updates to the database. → Implement version control for the database.	→ Apply regular validation checks to any manually entered data and/or automate data entry using linked external databases or scripts. → Keep transparency of the version history on the publication website. → Ensure that older versions of the database remain publicly accessible, providing a clear audit trail.
Data integrity	→ Source data from complying EPDs.	All EPDs must: → Be registered with an EPD program that is independent of the company who produced the EPD. Examples of independent EPD programs include EPD Australasia, the Global GreenTag EPD Program, the International EPD System, IBU and UL Environment. → Comply with ISO 14025. → Comply with either EN 15804 or ISO 21930. → Be verified by an independent third-party.
Data accuracy and reliability	→ Ensure the database is accurate, reliable and up-to-date.	→ Regularly cross-reference the database with the latest EPDs and/or perform periodic reviews with industry experts to validate data accuracy.

Key concept	Requirement	Details
Data comparability	→ Group sourced emission factors into relevant material categories. → Normalise emissions per declared unit to emissions per kg of product.	→ Group data using industry-recognised material categories (e.g., 40 MPa concrete). Where needed, consult with industry to define new categories. → Use the Australian and New Zealand Standard Industrial Classification (ANZSIC) as an alternative classification. → Follow the declared unit, such as cubic metres, square metres, or tonnes, and convert it to kilograms using the conversion factors included in the EPD.
Data representativeness	→ Conduct a qualitative assessment to determine the representativeness of sourced emission factors for the calculation of default and average emission factors. → Apply uncertainty adjustments based on qualitative assessments.	→ Use the tiered data ranking system established by NABERS as part of methodology development. → Use the predetermined adjustment rates associated with each qualitative ranking tier.
Annual update mechanism	→ Establish a mechanism for annual updates to the database. → Keep track of previous emission factors. → Ensure comprehensive data collection for updates, both for existing data and adding new EPDs to the database.	→ Set a fixed annual schedule for updates. → Store the date of publication and revision of each EPD. → Ensure that emission factors are updated where the underlying EPDs have been updated since the last release. → Calculate normalised and grouped factors based on year of publication. → The agency should assign a suitably qualified data collection team or outsource this task to a specialised consultancy group. A qualified LCACP or CLAR should oversee the work.

thinkstep anz

About thinkstep-anz

We're an independent and award winning sustainability firm with offices in Australia and Aotearoa New Zealand - and a global reach.

Our team works with you to put sustainability at the heart of your business, to set you up to succeed and inspire you to keep achieving more.

We focus on what matters and use data to understand organisations and their impact. We provide practical resources and ideas that move you ahead.

We create value for organisations like yours, bringing our technical expertise and business know-how to help you tell your story. It's what we've done for the last 16 years.

Our services cover:

Product

- Life Cycle Assessment (LCA)
- Environmental Product Declarations (EPD)
- Circular Economy (CE)
- Cradle to Cradle (C2C)
- Material Circularity
- Water footprint
- Packaging

Carbon

- Carbon Footprint
- Scope 3 emissions
- Reduction strategy
- Carbon targets
- Science-based targets (SBT)
- Emission factors

Strategy

- Materiality assessment
- Green building
- Sustainable Development Goals (SDGs)
- Regenerative futures
- 3 Horizons
- Roadmaps
- Responsible procurement
- Benchmarking
- Workshops
- Business circularity

Reporting

- Climate risk (TCFD | XRB)
- Global Reporting Initiative (GRI) & Integrated reporting (<IR>)
- B Corp
- CDP

Communications

- Sustainability reports
- Case studies
- Board presentations
- Training
- Copywriting
- Infographics
- Media support

Software

- LCA for experts (GaBi)
- LCA calculator
- Material Circularity Indicator (MCI)
- Corporate sustainability (SoFi)
- MCI tool
- Excel carbon calculator

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ON A MISSION TO REDUCE EMISSIONS IN NEW ZEALAND

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