

Embodied emissions

Consultation paper

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1 OVERVIEW

Embodied emissions are generated during a building's entire lifecycle - from raw materials extraction to transportation of building products, and from powering construction machinery right through to demolition and disposal. Measuring and managing emissions across such a broad scope is an enormous challenge - but one which we must tackle if Australia is to achieve its net zero emissions target by 2050.

The world's buildings are responsible for around 38% of global emissions. Operational emissions account for 29%, while the remaining 11% are estimated to be embodied emissions.¹ But as Australia's electricity grid decarbonises and more buildings are powered by 100% renewable electricity, the proportion of emissions generated upfront is expected to rise drastically.

The Green Building Council of Australia's (GBCA's) 2021 report, *Embodied Carbon and Embodied Energy in Australia's Buildings*, estimates that embodied emissions could represent up to 85% of Australia's built environment emissions by 2050 - rising from 16% in 2019.²

Australia currently has no consistent method of measurement for embodied emissions. Over 12 months, NABERS has worked in partnership with the GBCA, and collaborated with industry and governments across Australia to understand the appetite for a standard for embodied emissions, and the role of NABERS in administering that standard.

The feedback from industry told us that there is an urgent need for a national standard to measure, compare and set reduction targets for embodied emissions in buildings. Industry also expressed support for NABERS to help create and administer such a standard, as a government program with the capabilities to maintain and improve the standard over time.

This consultation paper contains 10 foundational proposals for feedback. These proposals outline how a rating tool, which we are tentatively calling the NABERS Embodied Emissions tool, would measure, verify and compare embodied emissions in new buildings and major refurbishments.

This national tool aims to allow building owners to set robust and measurable targets for reducing embodied emissions in buildings. Doing so would enhance transparency and reporting to investors, and enable organisations of all kinds to set embodied carbon targets for the buildings they will occupy. This standard also has the potential to harness the collective power of the building sector, to significantly increase demand for low-carbon design practices and construction materials. It would also help create a common language for embodied carbon emissions in Australia.

The NABERS National Steering Committee has endorsed the development of this tool. Its members are state and territory governments, the Australian Government and 14 industry bodies representing stakeholders across the building sector.

The development of this framework has been funded by the NSW Government, as part of the Accelerating Net Zero Buildings program under the NSW Net Zero Plan. NABERS acknowledges the NSW Government for its leadership in funding the development of an embodied carbon framework with national reach. NABERS also acknowledges the leadership from peak bodies across the building and industrial sectors, who repeatedly advocated for a nationally consistent approach to embodied emissions in buildings.

1 World Green Building Council, Bringing Embodied Carbon Upfront, 2019 <https://worldgbc.org/article/bringing-embodied-carbon-upfront/>

2 Green Building Council of Australia, Embodied Carbon & Embodied Energy in Australia's Buildings, 2021 <https://new.gbca.org.au/news/gbca-news/gbca-and-thinkstep-release-embodied-carbon-report/>

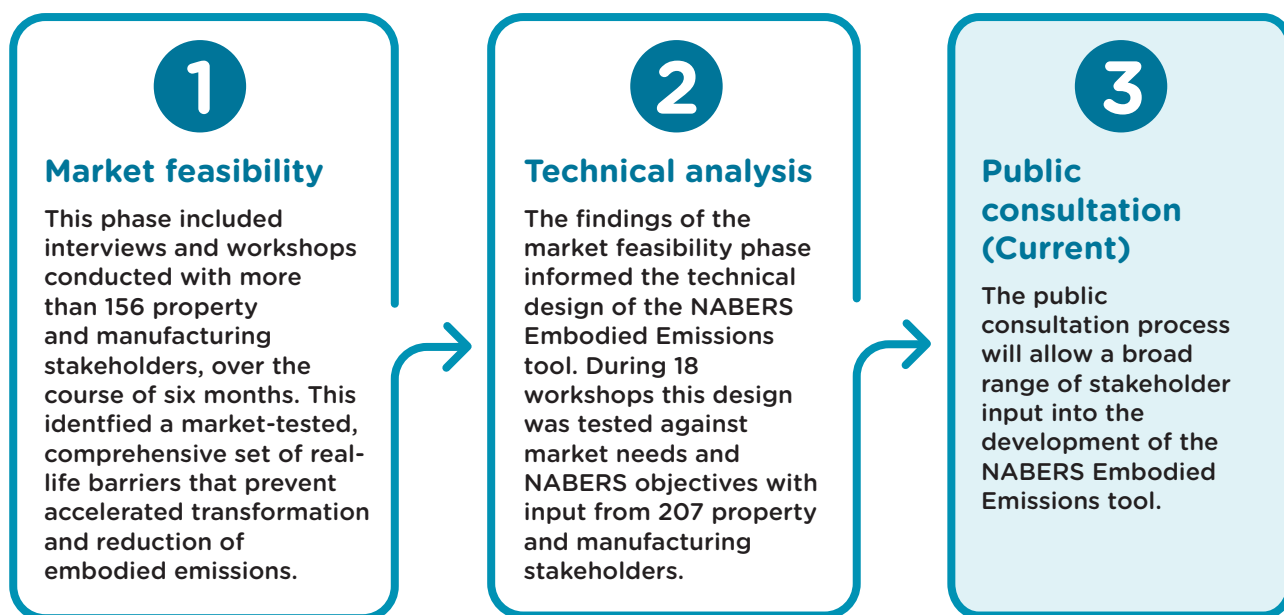


Figure 1.1: Process to develop NABERS Embodied Emissions tool

NABERS has formulated the proposals outlined in this paper based on an extensive literature review, inputs from embodied emissions experts and robust conversations with a wide range of stakeholders.

We recognise that addressing embodied emissions is a large and complex challenge that must engage building designers, construction specialists, owners and managers, product manufacturers, lifecycle analysts and more. Because of this, we also acknowledge that there may be some perspectives not yet considered. This consultation process has been designed to gather as many views and perspectives as possible.

We also acknowledge that there will be more specific and detailed questions that are not fully addressed in this consultation paper. Many of the more detailed provisions will be resolved in the rules documentation. These rules would be designed with the 10 proposals in this paper as their foundation. Once industry feedback on these proposals has been received and considered, NABERS will proceed to develop the tool including the rules.

We also recognise that there is unlikely to be a perfect solution that meets all stakeholders needs at once. The proposals in this report are designed to address many of the largest issues raised by stakeholders to date, and to provide a platform for Australia to become a world leader in embodied emissions reduction.

A roadmap for the NABERS Embodied Emissions tool has been created to allow NABERS to develop a minimum viable tool that can be scaled for impact.

For this consultation, NABERS will consider amendments and alternatives and will assess those against the objectives and market needs outlined in Section 3.

Why are embodied emissions important?

In the context of this consultation paper, ‘embodied emissions in a building’ is defined as all the greenhouse gas emissions associated with the physical parts of a building during its lifetime. This definition typically includes emissions from building materials, construction activities, refurbishments and end of life including demolition. In this document, when the term ‘carbon emissions’ is used, it is referring to greenhouse gas emissions, as defined by the Greenhouse Gas Protocol. Carbon emissions is a commonly accepted industry terminology for greenhouse gas emissions.

Research commissioned by the federal government and undertaken by the GBCA in 2021 found embodied emissions made up 16% of Australia’s built environment footprint in 2019. Without

deliberate action this could increase to 85% by 2050 as buildings become more efficient and the power grid decarbonises through increased renewables³. This is shown in figure 1.2 below.

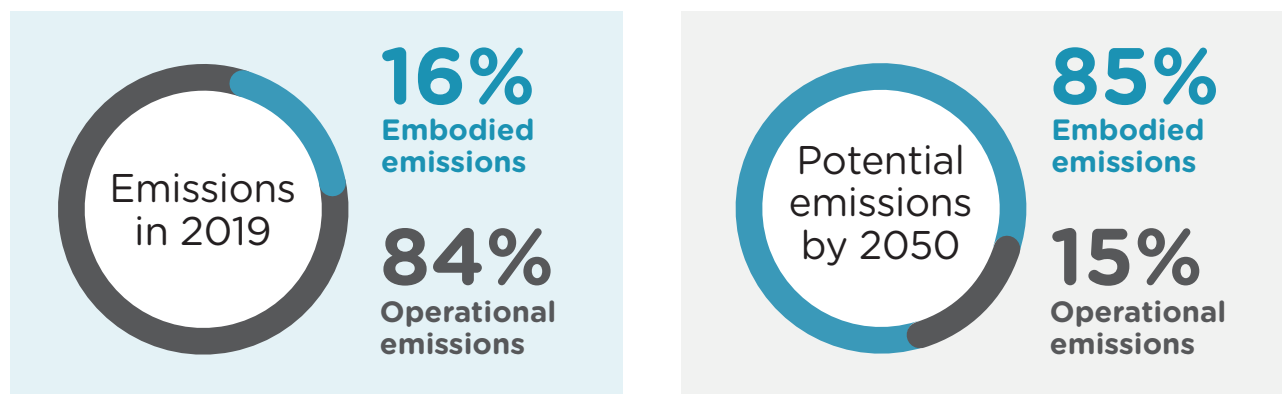


Figure 1.2: Comparison of embodied emissions and operational emissions in 2019 and forecast for 2050⁴

What is NABERS?

NABERS stands for the National Australian Built Environment Rating System. It is a national program that provides simple, reliable and comparable sustainability measurements across building sectors like offices, hotels, shopping centres, apartments, data centres, warehouses and more. NABERS covers energy, water, waste and indoor environment quality.

Over the last 20 years NABERS has proven that measurement leads to better management. Buildings that have obtained NABERS ratings for a decade achieve energy savings of 30-40% on average. For this reason, most stakeholders consulted to date have expressed strong support for NABERS to play a leading role in helping tackle the challenge of measuring, verifying and comparing embodied emissions in buildings.

NABERS and the Green Building Council of Australia partnership

NABERS and the GBCA recognise that addressing embodied emissions is a complex challenge that can only be achieved through collective action. In response, NABERS and the GBCA have partnered to develop this consultation paper, which will be followed up with guidance documentation which will be released in the coming months.

Additionally, the GBCA will recognise the NABERS Embodied Emissions tool as a verification pathway in the current 'Upfront carbon emissions' credit of future versions of the Green Star Buildings rating tool. While the two rating tools may have some variation in scope and methodology, they will remain aligned in principle and NABERS and GBCA will continue to partner to ensure ongoing alignment.

Contact details

If you have questions you can contact:

Ivana Brown (Sector Lead - Accelerating Net Zero Buildings)
nabers@environment.nsw.gov.au

This public consultation process aims to reach as many stakeholders as possible. We encourage everyone to share this paper with any interested parties. For more information about how you can respond to this paper see Section 4.2.

^{3,4} Green Building Council of Australia, Embodied Carbon & Embodied Energy in Australia's Buildings, 2021
<https://new.gbca.org.au/news/gbca-news/gbca-and-thinkstep-release-embodied-carbon-report/>

2 MARKET FEASIBILITY

2.1 General

The market feasibility phase was undertaken over six months to understand the state of the market, the key challenges, and the role NABERS could play in accelerating reductions in embodied emissions in buildings in Australia. Insights were used to define the objectives (Section 2.3) and market needs (Section 2.4) which informed the principles against which the proposals were designed. Figure 2.1.1 shows what was included in the market feasibility phase.



Figure 2.1.1: Steps in the market feasibility phase

Each stage was informed by stakeholder input through a series of workshops. Stakeholder input was extensive and included 207 individuals from 139 organisations, as shown in Figure 2.1.2.

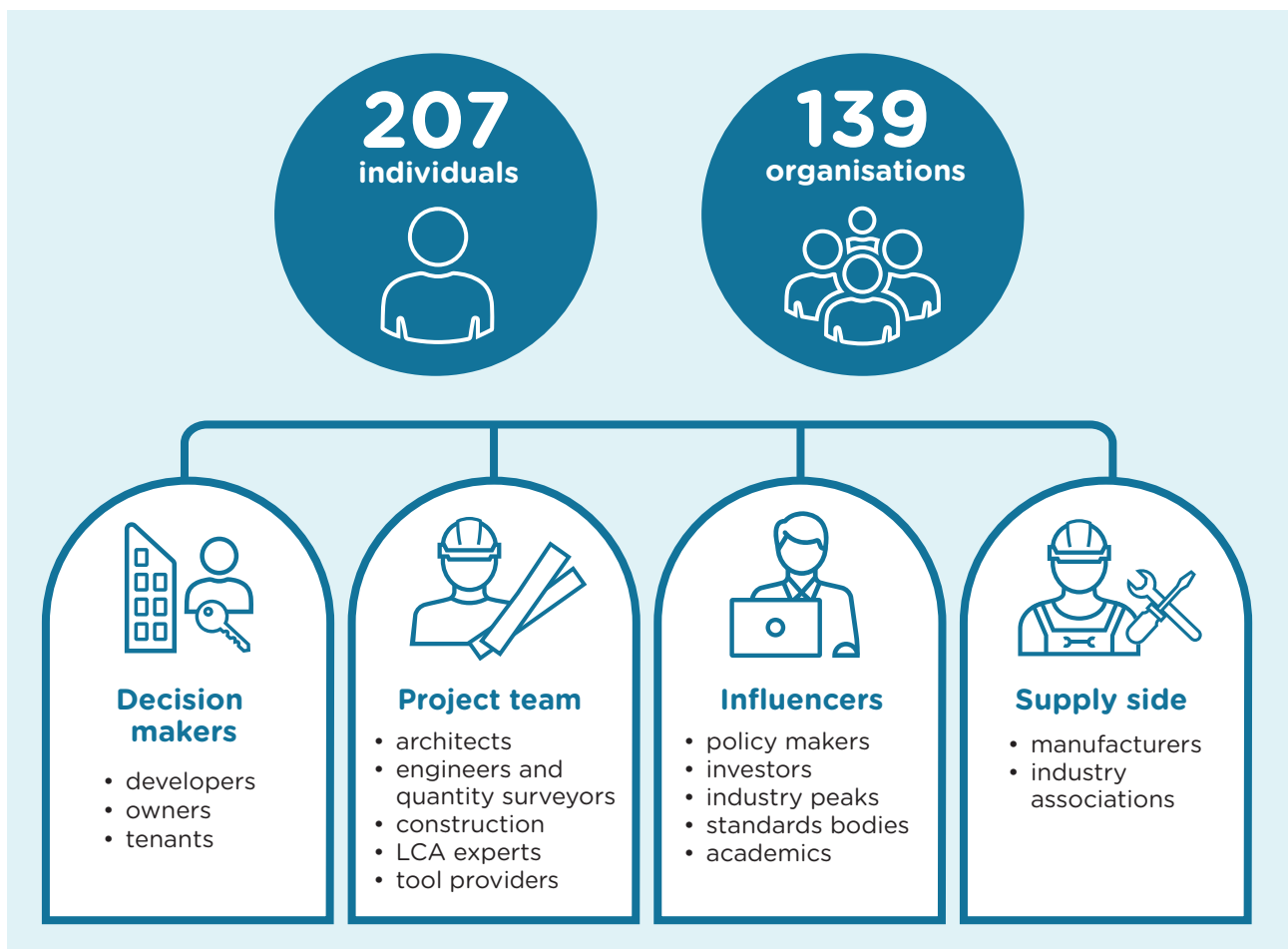


Figure 2.1.2: Extent of stakeholder engagement in the project

2.2 Problem analysis

The problem analysis phase sought to understand the state of the market and key challenges encountered by the property sector when reducing embodied emissions.

We began with discussions with Australian and International embodied emissions software providers and consultants to understand what is and isn't working well from their perspectives, and to identify opportunities for a NABERS tool. Many stakeholders raised issues that make assessing embodied emissions harder, slower and more costly than it could be.

Stakeholders also told us that a lack of a clear framework to define the measurement of embodied emissions made buildings almost impossible to compare. This last issue was identified as particularly problematic, as comparing carbon footprints is the basis of many drivers to reduce emissions in buildings. From investor pressure, to building codes, to government procurement - all rely on the ability to compare a building's carbon footprint against others. In this context, most stakeholders expressed a strong desire for a NABERS Embodied Emissions tool that would measure, verify and compare emissions of buildings in Australia. Stakeholders said this would create a standardised approach and overcome many of the immediate challenges faced by the property sector in addressing embodied emissions in buildings.

The key findings from the problem analysis are outlined below:

a. Embodied emissions are becoming increasingly important

Stakeholders recognised that, as the grid becomes less reliant on fossil fuels, operational emissions will fall and this will elevate the issue of embodied emissions. The GBCA's introduction of embodied emissions credits into Green Star in 2020 further emphasised their growing importance.

b. The industry is starting to mobilise

Stakeholders acknowledged that interest in measuring and reducing embodied emissions is increasing across all segments of the property sector, driven by influencers such as investors, developers, builders, suppliers and policy makers. Furthermore, some projects and design teams are already delivering projects that incorporate strategies to reduce embodied emissions. The GBCA is documenting some of these through case studies in its practical guide to upfront carbon emissions, due to be published soon. NABERS notes there was limited interest from commercial tenants at the time of this research, though interest is mounting and their interest may have since grown.

c. The industry is highly fragmented, making comparisons between buildings problematic

There is no single accepted approach to calculating embodied emissions from buildings in Australia or globally. As a result, project teams use many different methods that draw on varying data sources and that incorporate various lifecycle stages and parts of the building. This fragmented state of play has led to embodied emissions data that cannot be compared across projects in a meaningful way. Individual project teams also identified difficulties in setting targets and developing calculation methodologies. These findings are further supported by the GBCA when its team conducted a review of embodied emissions calculations for Green Star submissions.

d. The need for guidance

Embodied emissions are an emerging focus for the property sector. Stakeholders believe there are varied levels of understanding of the issues, and limited experience in delivering embodied emissions reductions among many built environment stakeholders in Australia. Many stakeholders wanted more guidance to help the property sector understand the opportunities and practicalities of reducing embodied emissions in buildings. NABERS is working with the GBCA to release guidance documentation on embodied emissions in buildings to address this need.

e. Balancing the need to act now, with the need to evolve over time

Accelerating the reduction of embodied emissions in the property sector is a complex challenge, with layers that are expected to unfold significantly over time. In this context, many stakeholders cautioned NABERS that a tool is unlikely to solve all problems of embodied emissions in perpetuity. Rather, they asked NABERS to focus on the large and well-defined barriers which require urgent solutions. They argued that the NABERS Embodied Emissions tool should prioritise these major issues and that other issues in embodied emissions should be addressed over time.

2.3 Objectives

To guide the development of a NABERS Embodied Emissions tool, we set objectives in consultation with the NABERS National Steering Committee. This committee includes representation from states, territories, Australian Government and industry associations. The objectives were influenced by the findings of the problem analysis and informed the design of a NABERS Embodied Emissions tool during the technical analysis (see Section 3). These objectives are:

a. Support behaviour change to urgently reduce embodied emissions

This builds on the existing objectives of NABERS which support behaviour change by allowing the property sector to fairly compare the performance of buildings. This influences investment, design and procurement decisions. For embodied emissions, this would incentivise strategies such as re-use, designing with less and selecting lower-emissions building products. By influencing the procurement process of building products, NABERS intends to encourage measurement and disclosure of building products embodied emissions. This would support project teams to procure low emissions building products and drive innovation among manufacturers.

b. Focus primarily on measurement, verification, comparing and disclosure

This ensures alignment with the existing capabilities and NABERS suite of tools, but leaves room for NABERS to collaborate with others working on aligned solutions (including policy, guidance and funding to support innovation).

c. Start by solving targeted problems now, rather than waiting to solve all problems in embodied emissions

This objective creates impetus and early impact, while leaving room to scale the tool over time. This is aligned with the findings of the problem analysis above.

2.4 Market needs

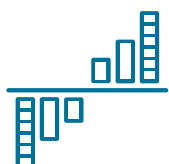
To achieve widespread adoption, the NABERS Embodied Emissions tool must address the needs of the market, from owners, developers and builders to investors, policy makers, designers and suppliers. These needs were identified in stakeholder workshops and are articulated below (in Table 2.4). These market needs formed the design principles around which the technical analysis was designed - ultimately resulting in the recommendations presented in this consultation paper.

Table 2.4: Market needs



Impactful

To be impactful the tool should help drive behaviour change that leads to a real reduction in embodied emissions.



Consistent

To produce reliable outputs the tool should use a consistent approach, including assumptions, system boundaries, calculation methodology and data sources.



Collaborative

To avoid market confusion and ensure widespread adoption, the tool should align with existing tools and systems where this helps NABERS achieve its objectives. This includes the suite of NABERS tools, other green rating tools and schemes like Green Star and Climate Active, and international systems, where relevant.



Streamlined

The tool should be streamlined to minimise effort and costs and to expand NABERS' reach.



Trusted

To build trust in the market, the tool must offer a robust, transparent process with third party-verified results.



Meaningful

The outputs of the NABERS tool must be easy to understand and create fair comparisons between buildings.

3 TECHNICAL ANALYSIS

The purpose of the technical analysis phase was to develop the proposals in this consultation paper. Combined, these proposals outline a methodology for measurement, verification and benchmarking of embodied emissions for buildings.

The proposals are informed by extensive research, stakeholder input and expert panel review, and address the objectives and market needs outlined in the market feasibility (see Section 2). More information about the research undertaken by thinkstep-anz to inform the proposals is provided in the accompanying technical report. Figure 3 outlines the process followed as part of the technical analysis.

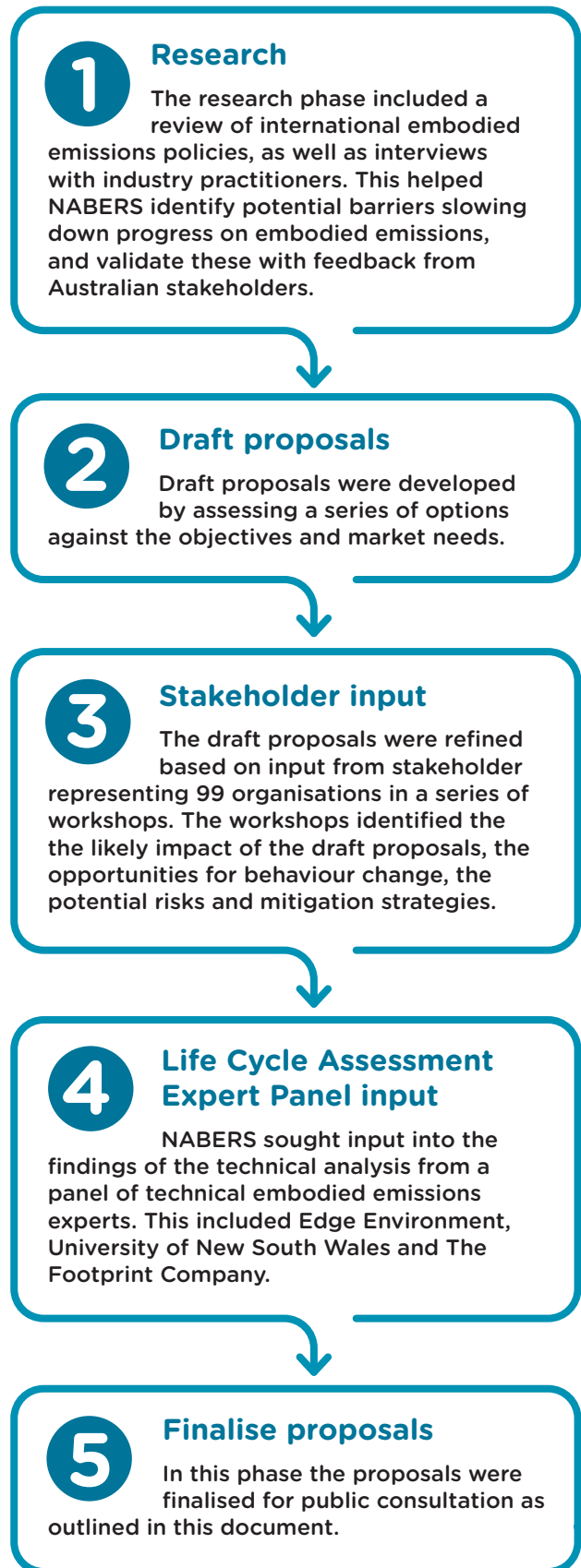


Figure 3: Technical analysis process

4 NABERS EMBODIED EMISSIONS TOOL PROPOSALS

4.1 General

This section of the consultation paper outlines the proposals that will underpin the design of the NABERS Embodied Emissions tool. A summary of the proposals is provided in Table 4.1. This is followed by further detail on each section of the tool. For each proposal the following is provided:

- a. Context
- b. Proposal
- c. A brief rationale.

The proposals in this consultation paper outline the first iteration of a NABERS Embodied Emissions tool which would address targeted problems now. In proposal 10, NABERS outlines how it would revisit some of the proposals in this consultation paper to expand the tool's scope over time.

Table 4.1: A summary of the proposals for the tool in its first iteration

Section 1: Scope of the NABERS Embodied Emissions tool	
Eligible projects	Proposal 1 - Only new buildings and major refurbishments will be eligible to certify.
The life cycle stages included	Proposal 2 - Only upfront emissions will be included (A1-A5).
Treatment of demolitions	Proposal 3 - Emissions from demolitions are excluded.
The elements of the building construction included	Proposal 4 - Cold shell is the default building scope.
The environmental indicators included	Proposal 5 - Only carbon emissions will be included.
Section 2: Calculation method	
The allowable emissions data	Proposal 6 - NABERS will encourage verified product-specific emissions data and will apply conservative defaults where no emissions data is available.
Treatment of building products with stored carbon or carbon neutral certification	Proposal 7 - Stored carbon and carbon neutral products will be disclosed on NABERS Rating Certificates via a Carbon Removal Indicator. They will not be recognised within the star rating on the certificate.
Section 3: Benchmarking	
Benchmarking methodology	Proposal 8 - A statistical analysis of Bill of Quantities data is the preferred approach to creating whole-of-building benchmarks.
Section 4: Certification process	
How projects progress to certification	Proposal 9 - Projects receive certification following practical completion with some options to review progress along the way.
Section 5: Future development	
Roadmap for Future Development	Proposal 10 - A Roadmap for Future Development of the tool, providing visibility over proposals that are likely to increase in scope, to increase the impact of the tool over time.

4.2 Responding to this paper

NABERS seeks feedback from stakeholders on 10 proposals that are outlined in this consultation paper. NABERS is not seeking feedback on the name of the tool at this time as this will be decided during the development phase. The NABERS Embodied Emissions tool is the working title.

The proposals in this paper have been developed by the NABERS team in consultation with industry and government stakeholders. Stakeholder feedback is sought to inform the final proposals that will be brought to the NABERS National Steering Committee for endorsement in 2023. NABERS will publish the outcomes of the public consultation process, outlining the final outcomes for the NABERS Embodied Emissions tool.

To submit your feedback, NABERS is asking you to consider the questions below:

a. How likely is your organisation to use or promote the use of a NABERS Embodied Emissions tool as outlined by the proposals in this consultation paper?

The following questions are the same for each section of the NABERS Embodied Emissions tool, and in some sections will cover multiple proposals which are to be considered together. These questions are:

b. What is working well in the proposals and should be retained in the final tool?

NABERS wants to understand what you like, what works and how the recommended approach aligns with the tool's objectives and market needs. It's important we know what is working well so we can know which elements should be retained.

c. Are there any risks to the proposed approach and what would help to overcome them?

NABERS wants to understand any potential risks to the objectives and market needs. How might NABERS mitigate these risks if we proceed with the proposals in this paper?

d. What should we consider in finalising this approach?

Please note why these considerations are important in achieving the objectives and market needs.

For the NABERS Embodied Emissions tool as a whole, please consider:

e. General feedback

Feedback can be provided to NABERS using the survey form. This can be found on the NABERS website [here](#). Please **submit feedback by close of business 16 February 2023**.

Responses will not be published by NABERS but may be subject to public requests for access to information under the Government Information (Public Access) Act. NABERS may use anonymised quotes from submitted responses to this paper to support future work. NABERS will collect contact details to allow us to contact respondents if required. This may include clarifying your responses or to inform you of the outcomes of the consultation process.

4.3 Scope of the NABERS Embodied Emissions tool

4.3.1 Eligible projects

Context

Consideration needs to be given to the types of projects eligible to certify to ensure fair comparison between projects assessed against the NABERS Embodied Emissions tool.

Proposal 1 - Only new buildings and major refurbishments will be eligible to certify

Only new buildings and major refurbishments will be eligible to certify. A major refurbishment involves a major change to at least one element of the cold shell (e.g. replacement of the curtain wall), where cold shell is defined in 4.3.4 *The included elements of the building construction* below.

Rationale

Including major refurbishments in the tool incentivises as much re-use of existing building elements as possible. This means buildings that avoid demolition and use part of the existing building structure will be recognised with a higher NABERS rating.

Defining major refurbishments in this way ensures fair comparison between buildings by avoiding situations where a developer could make relatively minor adjustments to a building (meaning the total emissions from a project is relatively low) to achieve a high NABERS rating.

Further, NABERS intends to review all buildings which receive multiple ratings within a ten-year period to ensure any improved ratings are not based on minor works that create an unfair comparison. This is to ensure minor adjustments are not being made to achieve a new rating. If necessary, consideration will be given to adjusting the rules to ensure fair comparison is maintained.

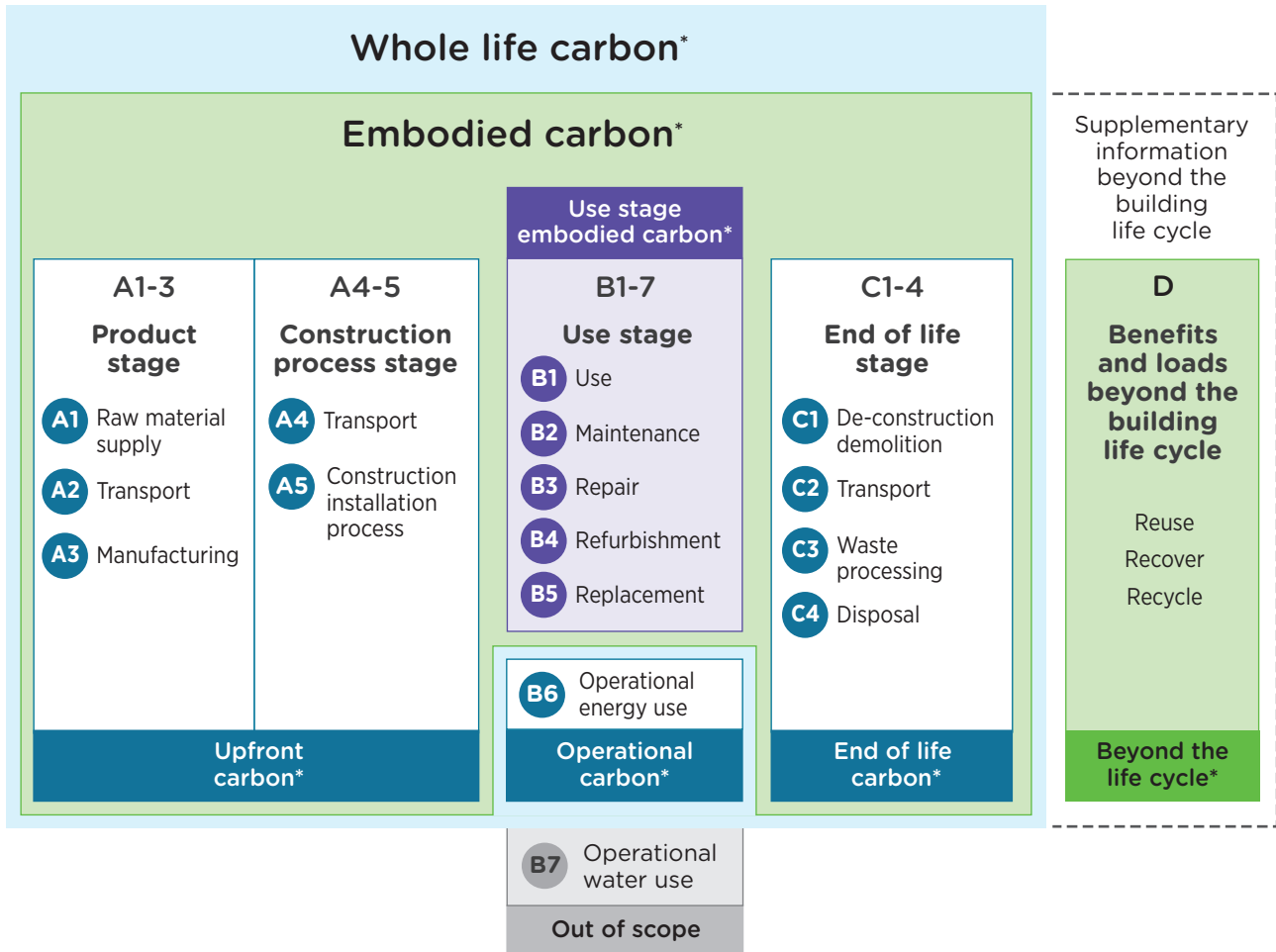
NABERS is developing a Roadmap for Future Development (see Section 4.7). This roadmap outlines considerations to expand the tool to cover additional emissions sources not addressed in the first release. This includes emissions from fitouts, maintenance and upgrades occurring during a building's lifecycle.

4.3.2 Life cycle stages included

Context

According to the European standard EN 15978, buildings transition through a range of life cycle stages (see Figure 4.3.2).

Figure 4.3.2: Terminology and related life cycle stages. Reproduced from WorldGBC, 2019



Proposal 2 – Only upfront emissions will be included (A1-A5)

Only upfront emissions will be included in the emissions calculations. This includes modules A1 to A5 from Table 4.3.2 above.

Rationale

This proposal aligns with the objectives and reflects strong support from industry for NABERS to start with a simple, cost-effective tool that can be broadened in the future.

Additionally, a focus on upfront carbon:

- f. Typically captures a large proportion of embodied emissions from a building’s lifecycle. Up to 80% of whole-of-life emissions are generated upfront, according to some estimates⁵; however,

⁵ Green Building Council of Australia, An upfront conversation about upfront carbon, 2022 <https://new.gbca.org.au/news/gbca-news/upfront-conversation-about-upfront-carbon/>

there is significant variance between buildings. A focus on upfront emissions can tackle the majority of embodied emissions sources and drive cultural change and innovation required to address more challenging sources of embodied emissions.

- g.** Is relatively easy to understand and communicate.
- h.** Streamlines data collection and entry.
- i.** Empowers project teams and suppliers to make changes that reduce emissions at the time the building is being constructed.
- j.** Relies on measurable data to calculate emissions. At the time when the rating is submitted (following practical completion), Modules B, C and D are all scenarios based on future assumptions, rather than measurable data. This aligns with the second objective to focus on measurement.
- k.** Is within the control of the developer or builder seeking the rating.

While most stakeholders consulted agree with NABERS initial focus on upfront carbon, some stakeholders argued that the NABERS Embodied Emissions tool should evolve to consider whole-of-life impacts. These concerns relate to the potential to reduce upfront carbon at the expense of operational emissions, total embodied emissions, or end-of-life or circularity considerations. Guidance is currently being developed by the GBCA to inform project teams about the trade-offs between upfront embodied emissions and whole-of-life impacts.

Feedback from stakeholders was clear that future iterations of the tool should cover the sources of embodied emissions not included in the first release. This includes emissions from fitouts and equipment replacements that will occur throughout the life of a building. NABERS will include this in the Roadmap for Future Development (see Section 4.7) which outlines the expansion of the tool over time. NABERS will also consider whether there are additional ways in which potential perverse outcomes can be monitored.

See Chapter 10 of the technical report for more details.

4.3.3 Treatment of demolitions

Context

To determine the scope of this tool we explored several ways to treat emissions associated with demolitions that would support the tool's objectives while meeting market needs.

Proposal 3 - Emissions from demolitions are excluded

Emissions associated with demolitions from previous structures will be excluded from the calculation.

The system boundary between an old structure and the new building will be drawn at the point after the previous building (or parts of it) has been demolished and all rubble has been cleared.

The new building is responsible for any earthworks and all construction from this point forward.

Buildings that re-use and do not demolish existing structures will be rewarded under Proposal 6, where re-used materials are assigned zero emissions.

Rationale

Emissions from the demolition process are excluded from the rating, but re-use is still rewarded by assigning zero emissions to re-used materials. Factors influencing this decision include:

- a.** Consistency with international standards on life cycle assessment.

- b. Stakeholders expressed a desire to incentivise re-use rather than penalising demolition.
- c. There are many instances where demolition is required, and there are minimal opportunities for re-use. This can include buildings which have been damaged or are unsafe, or where planning requirements have changed and the building is no longer fit for purpose. The emissions associated with the demolition is most significantly influenced by the nature of the previous structure; this in turn limits the influence of the project team on embodied emissions reductions.

See Chapter 15 of the technical report for more details.

4.3.4 Included elements of building construction

Context

Construction generates embodied emissions from a range of elements and there are several ways to define and categorise these. Clearly defining the elements is important for consistency between ratings. The recommendations that follow outline which building elements are included in NABERS Embodied Emissions tool calculations.

A definition of “cold shell” and “warm shell” is provided below. These definitions are from the “Green Star – Design and As-Built Fitout Scope: Guidance for Cold Shell, Warm Shell and Integrated Fitouts”.⁶

Cold shell: Finishes and services are not installed. A tenancy with an unfinished interior; with no heating, ventilation and air conditioning (HVAC) services beyond the riser (or core or rigid duct); and without lighting, plumbing, ceilings, interior partitions, walls or floor finishes (or with a setback to allow for future provision of floor finishes).

Warm shell: Finishes and services are applied to common areas. Tenancies are delivered with ceilings, floor coverings and lighting systems; and ducts from air supply and return risers, electrical and hydraulic services are installed above the ceiling from the riser throughout the tenancy areas. For the purposes of Green Star, these spaces can typically demonstrate compliance as delivered by the contractor, without further lease clause or tenancy fitout documentation (for most credits).

See Chapter 9 of the technical report for more details.

Proposal 4 – Cold shell is the default building scope

For each benchmarked building type, a single minimum scope will be specified:

- a. Cold shell is the default option for most building types.
- b. Warm shell or other building scope will only be considered for a building type where cold shell cannot be applied meaningfully.

Car parks are expected to be included in addition to cold shell (or warm shell) as the default, whether internal or external to the building. However, this will need to be resolved when benchmarks are created.

Rationale

This recommendation was supported by many stakeholders during the consultation process, in that:

- a. It is easier to create consistency with a narrower scope which typically represents a majority of upfront embodied emissions in a building. From available data cold shell is estimated to account for over 80% of upfront emissions (See page 123 of the technical report for details).
- b. It enables NABERS to start with a simple, cost-effective tool that can be broadened in future. The recommendation will be reviewed as part of the Roadmap for Future Development at around the 18- to 24-months post launch. See Section 4.7 for further details.

⁶ Green Building Council of Australia, Green Star – Design and As-Built Fitout Scope, 2020 <https://www.gbca.org.au/get/resources/1277/A3B49BF31C734D110549897EA9E3D936>.

- c. There is greater availability of product-specific data in the cold shell rather than the warm shell.
- d. A cold shell delivery is generally fully managed by the building's delivery team, who has access to relevant data. In contrast, warm shell components may be installed by many different delivery teams, especially in tenanted buildings, who generally set their own fitouts. Consequently, obtaining data from warm shell finishes can be costly and difficult to obtain for many sites and the building delivery team will have less influence over the rating that is achieved.
- e. There is less opportunity to improve a building rating by doing minor works when the scope is cold shell. This is because replacing a cold shell element is a significant undertaking.
- f. External car parks are not considered as part of the cold shell or the warm shell but can have a significant contribution to the embodied emissions impact. The inclusion of car parks will be considered when designing the benchmarking methodology to ensure fair comparison between buildings with internal or external car parks.

See Chapter 9 of the technical report for more details.

4.3.5 Environmental indicators included

Context

Embodied emissions relating to buildings include the measurement of a range of environmental indicators. These include, but are not limited to, carbon and water, as well as waste and circular economy outcomes. The recommendations that follow outline which of these are in scope.

Proposal 5 - Only carbon emissions will be included

Only carbon emissions will be included in the emissions calculations.

For the purposes of this report, the term "carbon emissions" refers to greenhouse gas emissions, as defined by the Greenhouse Gas Protocol.

Rationale

There is strong support from industry for NABERS to start with a simple, cost-effective tool that could be broadened in the future. NABERS will consider expanding to other environmental indicators as part of the Roadmap for Future Development. See Section 4.7 for more details.

All stakeholders agreed that reducing embodied carbon emissions was the most urgent issue. Many stakeholders also agreed that other environmental indicators were important. However, most stakeholders saw other environmental indicators as secondary to embodied carbon emissions. Given the stakeholder feedback, the first release of the tool is focused on reducing embodied carbon emissions. The considerations for expanding this to other indicators is covered in the Roadmap for Future Development (see Section 4.7). Guidance is currently being developed by the GBCA to consider the impacts of embodied carbon emissions against other environmental factors.

See Chapter 12 of the technical report for more details.

4.4 Calculation method

4.4.1 Allowable emissions data

Context

There are many different sources of emissions data that can be used for materials and products in a building, as well as for transport and construction.

The rules for allowable emissions data influence the behaviour that is incentivised in the design and procurement process. Data availability can be an issue for some emissions sources, as not all products and services have specific data. Gaps in data require more generic assumptions to be made about the emissions associated with that product or service.

The following are definitions of key terms used within this proposal:

- a. Life cycle assessment (LCA) data** – the data from a life cycle assessment which identifies the environmental impact of a product during its lifetime. For the purposes of this consultation paper this refers to greenhouse gas emissions.
- b. Process life cycle assessment data (process data)** – calculates the greenhouse gas emissions based on the aggregation of the processes involved in creating a product. It is typically used by organisations to understand and reduce the impact of their products, making it product-specific data.
- c. Hybrid life cycle assessment data (hybrid data)** – combines process life cycle assessment data with high-level economic data to capture emissions outside of the manufacturing process, such as those from business operations like financing and insurance costs. This means that hybrid data will have a larger boundary for the types of greenhouse gas emissions included when compared to process data. Hybrid data is rarely specific to a product from a supplier and is typically calculated for a type of material representative of an economic sector (e.g. reinforcing steel within Australia).
- d. Environmental Product Declarations (EPDs)** – an independently verified and registered document that communicates environmental information about the life cycle environmental impact of a product. This includes greenhouse gas emissions and is based on process data.
- e. Carbon neutral certified products** – third party-certified products that have demonstrated that they have compensated for all the emissions associated with the product in accordance with the rules of the certification scheme.
- f. Climate Active Carbon Neutral** – An Australian Government accredited scheme that certifies that a product is carbon neutral in accordance with its rules. It provides certifications beyond products, however these are not considered within this consultation paper.

For more information about these terms please refer to Chapters 3.4, 16 and 17 of the technical report.

Proposal 6 – NABERS will encourage verified product-specific emissions data and will apply conservative defaults where no emissions data is available

A select number of emissions data sources will be allowed. Where product-specific emissions data exists (i.e. process life cycle assessment data), it should be used in preference to other emissions data. As we move down the order of material preference, emissions are likely to increase, creating an incentive to use higher order data where this is available. During the tool development phase NABERS will investigate rules which could enforce this order of preference.

The allowable data sources include, in order of preference:

- a. Third party verified product-specific process life cycle assessment data, such as from Environmental Product Declarations and carbon footprint declarations, which comply with internationally accepted standards.⁷

⁷ Complying standards: for EPDs – ISO 14025 and either EN 15804 or ISO 21930; for carbon footprints – ISO 14067 or PAS 2050, preferably aligned with the system boundary from EN 15804 or ISO 21930.

- b. Published emissions data from Climate Active Product Disclosure Statements associated with product Carbon Neutral certification.
- c. The NABERS table of emissions data, which is based on a conservative estimate from a review of available data. This will be set to ensure product manufacturers are generally better off verifying their product's carbon footprint through one of the above methods. It will preference process life cycle assessment data from EPDs where this is available (e.g. timber, concrete, steel). Hybrid data will only be considered where there is a lack of suitable process life cycle assessment data (e.g. façade assemblies, building services and some construction activities). In these cases, emissions data may be per square metre or dollar spent.

Additional data sources may be considered during tool development where they align with the intended objectives of this proposal. For example, this may include the worst-in-average calculation from industry-average EPDs.

All retained building elements and other re-used products will be assigned zero emissions in their original state. They will be entered into the calculator as zero embodied emissions, plus the emissions generated in repurposing these elements for re-use. This applies regardless of the age or source of the building element. This means buildings that avoid demolition will be rewarded with a better rating, as the reused elements of the structure will be considered emissions free.

Rationale

This proposal is intended to incentivise the use of product-specific emissions data (i.e. process life cycle assessment data). Stakeholders told us that incentivising product-specific emissions data would encourage building product manufacturers to measure and disclose the emissions intensity of their products through third party verified frameworks. Prioritising product-specific emissions data incentivises project teams to preference manufacturers with innovative low-emissions materials through their procurement decisions.

Stakeholders expressed concern that, at least initially, many products will not have third party verified emissions data. In response, NABERS will develop a table of conservative emissions data to ensure projects can achieve a NABERS rating in the absence of other data. This removes the barrier of lack of complying emissions data. The table of conservative emissions data is likely to contain more emissions than higher priority data. This will have a negative impact on a project's rating, and therefore incentivise the use of higher priority data sources.

Stakeholders would like to see all building re-use encouraged, regardless of construction age. As such, all retained building elements and re-used products will be assigned zero emissions, in their original state, to encourage re-use. This acknowledges that retaining and reusing building elements is the best way to lower embodied emissions. This is aligned with international standards.

See Chapters 15, 16 and 17 of the technical report for more details.

4.4.2 Treatment of building products with stored carbon or carbon neutral certification

Context

Stored carbon and carbon offsets are a way to remove or reduce emissions from the atmosphere to compensate for the emissions associated with the manufacture of building products. A further explanation of these is provided below:

- a. **Building products with stored carbon** – is an inherent quality of some building materials that store carbon dioxide from the atmosphere. The storing of carbon is represented as emissions removal, which is a negative number when compared to emissions produced. For example, trees absorb carbon dioxide from the atmosphere during growth and this is stored as biogenic carbon in timber materials that have been manufactured from trees. Storage of carbon in trees occurs in life cycle module A1 “Raw Material Supply” which includes the growth of the trees.

- b. **Building products with carbon neutral certification** – are an acquired quality of building materials. A building product manufacturer will purchase offsets which compensate for the emissions associated with the manufacture of that building product. These are used to certify a product as carbon neutral in certification schemes such as Climate Active Carbon Neutral in Australia.

Proposal 7 – Stored carbon and carbon neutral products will be disclosed on NABERS Rating Certificates via a Carbon Removal Indicator; they will not be recognised within the star rating on the certificate

NABERS Rating Certificates will report on building products with stored carbon and carbon neutral certification via a Carbon Removal Indicator. This indicator will sit alongside the NABERS Embodied Emissions tool's star rating.

The amount of stored carbon in products and from carbon offsets within carbon neutral certified products will be disclosed separately to the NABERS Embodied Emissions tool star rating. The star rating will include the greenhouse gas emissions from all products used but will exclude any stored carbon or carbon offsets.

An example of what the Carbon Removal Indicator could look like is illustrated below. Note that the Carbon Removal Indicator is currently an early concept, and its design, including its name, calculation methodology and visual representation of results, will be finalised later in the rating tool development phase.

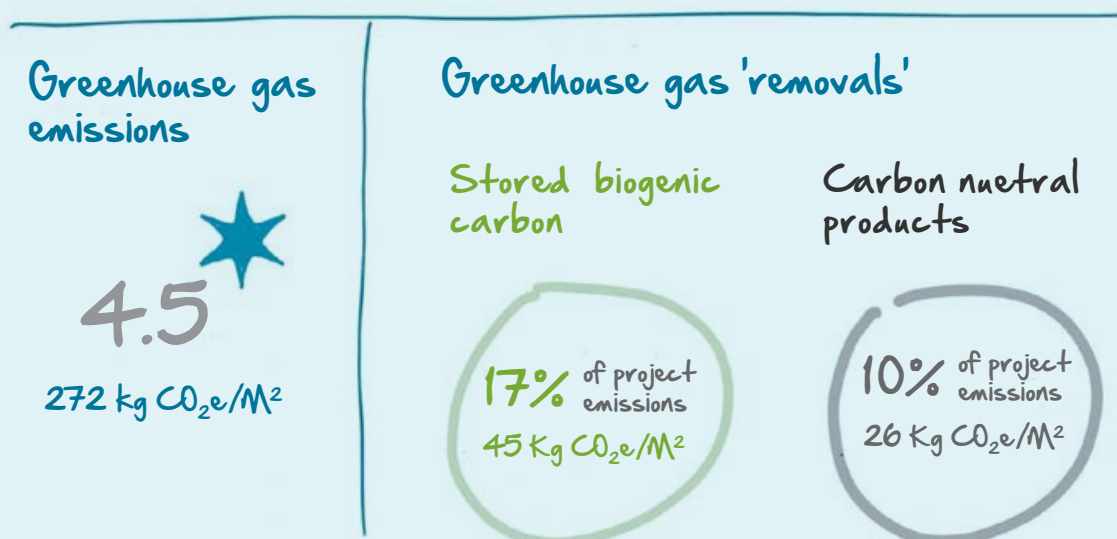


Figure 4.4.2: Example of how a Carbon Removal Indicator could look, based on the Renewable Energy Indicator

The stored carbon reported via the Carbon Removal Indicator will relate to a project's materials in relation to scope of works covered by the NABERS Embodied Emissions tool (see Section 4.3). This means that stored carbon occurring in A1–A5 is included at this time, and this includes stored biogenic carbon from timber. Cement re-carbonation is excluded from the calculation as it is outside the scope of life cycle stages considered in this tool. This will be reconsidered in conjunction with a review of life cycle stages as part of the NABERS Roadmap for Future Consideration (see Section 4.7). Stored carbon emissions reported in the Carbon Removal Indicator will be based on EPD data.

Carbon neutral products reported via the Carbon Reduction Indicator will relate to *building products* with carbon neutral certification, such as Climate Active Carbon Neutral. Only product level Carbon Neutral certifications are proposed to be recognised in this indicator.

Rationale

Stakeholders expressed diverse views on the treatment of stored carbon and carbon neutral certified products, and these were considered when developing this recommendation.

Stakeholders acknowledged the importance of avoided emissions ahead of carbon removal strategies such as stored carbon and carbon neutral certified products. At the same time, many stakeholders noted that stored carbon and carbon neutral certified products make an important contribution to urgent emissions reductions globally, especially where manufacturers currently face technology and equipment barriers.

This recommendation was chosen because:

- a.** It is intended to provide transparency to our stakeholders by showing how products have compensated for the building's embodied emissions separately to those emissions avoided through design, construction and low emissions materials.
- b.** Using a separate indicator allows stakeholders to set targets that consider avoided emissions, stored carbon and carbon neutral product certification in a way that aligns with their objectives.
- c.** It is aligned to the existing NABERS Energy tool which is launching a Renewable Energy Indicator alongside the NABERS Energy star rating on the certificate. Early feedback indicates an increased adoption of purchased off-site renewable energy ahead of the launch of the Renewable Energy Indicator in 2023. Previous attempts to include multiple outcomes in a single rating have led to confusion, low market uptake and limited behaviour change.
- d.** It aligns with international standards for carbon accounting, creating consistency with international markets. The standards for carbon accounting do not allow for stored carbon (Greenhouse Gas Removals) to be combined in the carbon calculation for a partial carbon footprint. This applies when lifecycle is limited to A1-A5 as outlined in Proposal 2 (see Section 4.3.2).
- e.** Carbon neutral certification, such as Climate Active Carbon Neutral certification for building products, is a third party verified program endorsed by the Australian Government. It also requires manufacturers to reduce emissions as much as possible prior to purchasing carbon offsets. The acceptance of carbon neutral certified products will be reviewed as part of the Roadmap for Future Considerations (see Section 4.7).
- f.** Some stakeholders have expressed concern that timber could be over-used in buildings beyond its functional requirements to increase the amount of stored carbon reported in the proposed Carbon Reduction Indicator. NABERS will monitor potential instances of this behaviour as one of the actions listed in the Roadmap for Future Development (see Section 4.7).
- g.** This proposal allows project teams to choose how targets are achieved. This aligns to the principles of the existing suite of NABERS tools. This means NABERS does not create an additional preference for one strategy over another.

This recommendation builds on, but differs from, the way the Upfront Carbon Emissions credit works in Green Star. In that credit, biogenic carbon and Climate Active carbon neutral products can be considered to have emissions as low as zero (but they cannot be negative). The GBCA made that decision based on feedback at the time. However, GBCA's team agrees with this recommendation and will consider alignment in a future Green Star revision, and to account for biogenic carbon and carbon neutral products in the 'Other Carbon Emissions' credit.

See Chapters 13 and 14 of the technical report for more details.

4.5 Benchmarking

4.5.1 Benchmarking methodology

Context

NABERS benchmarks are historically based on statistical sampling where data is collected from a large number of buildings to determine good, average and poor performance for an equivalent building. This allows buildings of different sizes, and with different attributes, to be compared fairly.

While many life cycle assessments to measure building embodied emissions have been conducted globally, a lack of consistency in the calculations means that they cannot to be combined to compare “like” buildings.

Collecting data from new life cycle assessments across Australia, consistent with the new NABERS Embodied Emissions tool, would take years and buildings would not be comparable until sufficient data has been collected.

Quantity surveyors have already collected data from thousands of buildings in Australia. This is done through a document called a Bill of Quantities (BOQ). A BOQ is used for tendering in the construction industry. It includes all the building elements that the NABERS Embodied Emissions tool would require to calculate embodied emissions. A BOQ updated to as-built quantities could be used to calculate benchmarks.

Proposal 8 - A statistical analysis of Bill of Quantities data is the preferred approach to creating whole-of-building benchmarks

A statistical analysis of Bill of Quantities data is the preferred approach to creating whole-of-building benchmarks.

Rationale

Bill of Quantities data already exists, and the Proposals 1 to 7 outlined could be applied to this data to create comparable, timely and statistically relevant results for meaningful benchmarking. Consideration will need to be given to ensure data is good quality and comparable. This is particularly important if using data from different quantity surveyors. While a Bill of Quantities may be used for benchmarking, a full BOQ may not be required to submit a NABERS Embodied Emissions rating. NABERS will consider sources of data for the BOQ and appropriate emissions data during tool development.

The benchmarks created may be based on building form (e.g. short or tall buildings) or by sector (e.g. National Construction Code building classifications).

The BOQ data will need to be collected and analysed to finalise the benchmarking methodology. Alternatives may need to be considered should challenges arise. These may include working with developers and builders to collect data from a smaller sample of projects.

Some concerns have been raised by stakeholders around possible underestimates of existing BOQ data, which would impact any embodied emissions calculated. This risk will be investigated to understand its potential impact on benchmarks. If necessary, risk mitigation measures will be considered. This could include adding a margin of error factor to the embodied emissions associated with BOQ data.

Normalisation factors are used in NABERS benchmarking processes. They create meaningful comparisons between buildings. For example, comparing the emissions from a large building to a small building is not meaningful. Normalising the emissions by the area of the building to compare the emissions per metre squared is a fairer comparison. In the NABERS Energy Office Base Building Rating, a building’s energy use is normalised by its hours of operation (“Rated Hours”) and size of the building (“Rated Area”). The normalisation factors will need to be informed by the benchmarking process with an objective to align with the existing NABERS benchmarking process where appropriate.

Benchmarks will be reviewed regularly as shown in the Roadmap for Future Considerations (see Section 4.7). Data from alternative sources such as the NSW State Environment Planning Policy could be used for this.

See Chapter 18 of the technical report for more details.

4.6 Certification process

4.6.1 How projects progress to certification

Context

The proposed certification process will build confidence and trust in ratings through a series of progressive checks and balances that are in line with other NABERS ratings certification processes. This includes processes that:

- a. Enable projects to verify that they are on track to meet their targets during their design phase
- b. Use a qualified NABERS Assessor to determine ratings for projects following practical completion
- c. Audit NABERS Assessor determinations, prior to final certification, ensuring ratings are in line with NABERS rules.

A definition of an Independent Design Review and a Commitment Agreement is provided below as these are used in the recommendations.

Independent Design Review: Engaging a member of the Independent Design Review Panel to conduct a review of the project’s design documentation and modelling. The Panel members will be specific to NABERS Embodied Emissions. The required expertise will be determined during tool development.

Commitment Agreement: A contract signed by a developer or owner to have a contractual obligation to design, build and commission a building to achieve a specific NABERS target.

Proposal 9 – Projects receive certification following practical completion with some options to review progress along the way

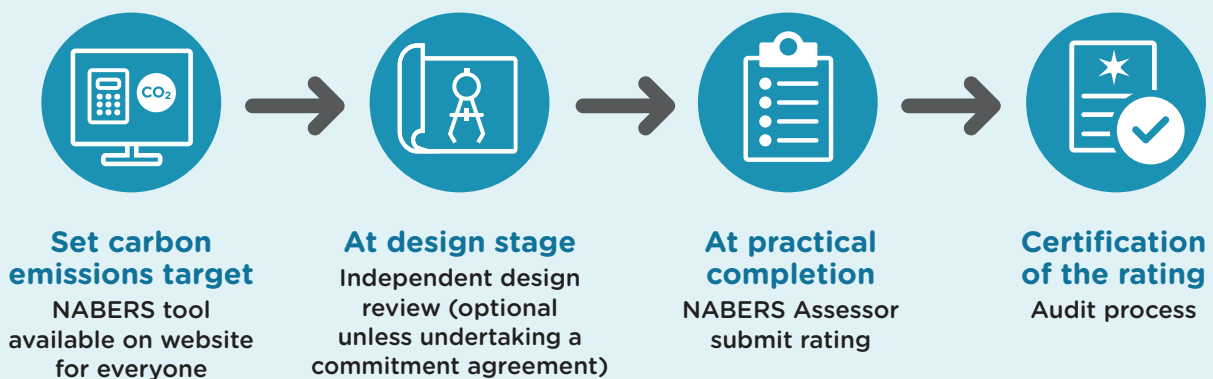


Figure 4.6.1: Technical analysis process

Projects will progress to certification through the following stages:

1. Set carbon emissions target

NABERS calculation tools for embodied emissions will be available to everyone, regardless of their intention to certify with NABERS. These tools will help projects to set embodied emissions targets and will provide data to inform decisions through to practical completion.

2. At design stage

When projects choose to sign a NABERS Commitment Agreement, an Independent Design Review will be conducted. This allows the project to advertise their intention to obtain a particular NABERS Embodied Emissions target.

For projects that choose not to sign a Commitment Agreement, an Independent Design Review will also be available, but not mandatory. These projects could use their review to understand how they are tracking in respect to their target ratings.

The Independent Design Review process will adapt the existing process used for design reviews with other NABERS tools.

3. At practical completion

After practical completion of the building, data is entered into the NABERS rating input form. NABERS Assessors for embodied emissions ratings will be responsible for submitting the rating and ensuring it is consistent with the NABERS Rules. The NABERS Assessor will be a qualified professional with the appropriate training in the NABERS Embodied Emissions tool. This could be embodied emissions experts, quantity surveyors, building sustainability professionals or other suitably-qualified individuals who have completed the NABERS Assessor training and certification process for the NABERS Embodied Emissions tool.

Ratings will be based on the materials and quantities in the actual building. All claims need to be verifiable via documentation such as schedules, invoices and EPDs. Evidence will be required for project elements which have a significant impact on embodied emissions.

4. Certification of the rating

There will be an early certifications verification process. Following the launch of the tool, submissions will have data entry and source data checked, including invoices, Bills of Materials and product disclosure statements. This will continue as a short-term measure until sufficiently low errors in data are detected. The process will then transition to the existing NABERS Level 1 (L1) and Level 2 (L2) audit processes, as outlined:

- a. **NABERS Level 1 (L1) Audit:** will be conducted by NABERS technical officers on 100% of NABERS rating applications. This is a quality assurance process undertaken to ensure that an Assessor has correctly completed the rating application, made no obvious errors in data entry, and correctly applied the NABERS Rules to the rating.
- b. **NABERS Level 2 (L2) Audit:** will be conducted by a panel of external auditors on 5% of NABERS rating applications initially. The Level 2 audit process involves re-rating the premises, using documentation provided by the Assessor who conducted the original rating. From time to time, this can lead to a NABERS rating being revised or withdrawn. Assessors can receive sanctions for unsatisfactory performance as identified through the audit process. Read more about about the audit process.

Rationale

The rationale for each of the above highlighted stages is:

1. Set carbon emissions target

Stakeholders indicated that emissions estimates generated by NABERS tools, in relation to different carbon emissions reduction strategies, will be useful in setting targets, as well as throughout construction.

NABERS will make these tools available to anyone who wishes to use them. This is because the data they generate is likely to influence future carbon emissions reductions, even when those using these tools choose not to pursue a NABERS carbon emissions rating for a given project.

2. At design stage

Stakeholders emphasised the importance of using NABERS tools to inform design decisions and early material choices that contribute to the delivery of low-embodied emissions buildings.

Conducting an Independent Design Review is not optional where a Commitment Agreement has been signed, as these require additional scrutiny to provide reassurance that the project is on track to deliver its commitment. Commitment Agreements also allow the project owner to advertise the intention to obtain a particular NABERS embodied emissions target.

Making NABERS tools available to project teams that have not entered into a Commitment Agreement provides autonomy to decide whether an Independent Design Review is necessary.

3. At practical completion

Submitting ratings after practical completion ensures assessors can access data from the completed building. This means more data can be based on measured rather than estimated data.

4. Certification of the rating

A key component of certification is a rigorous auditing program to ensure results can be trusted. Stakeholders identified a lack of expertise around measuring embodied emissions in the property sector and a need to build capacity. In response to this, NABERS will verify all ratings following the launch of the NABERS Embodied Emissions tool. This enables NABERS to provide feedback on early submissions and build capacity by ensuring rules are understood. Over time the process will move to the existing NABERS L1 and L2 auditing methods. This existing audit process has achieved a high level of trust in the marketplace for existing NABERS ratings.

See Chapters 6, 7 and 8 of the technical report for more details.

4.7 Future development

4.7.1 The Roadmap for Future Development

Context

The objectives aim to deliver urgent change by focusing on targeted problems. To support this, NABERS is developing a minimum viable tool that can be scaled for impact over time. A roadmap for the NABERS Embodied Emissions tool has been developed to show the scaling considerations.

Proposal 10 - A review of the proposals in this consultation paper will be carried out at approximately 18-24 months following launch

The following proposals would be reviewed as shown below in alignment with the objectives and market needs:

- a. Proposal 2** - Only upfront emissions will be included (A1-A5)
Expanding life cycle stages included beyond upfront emissions.
- b. Proposal 4** - Cold shell is the default building scope
Expanding the building scope beyond cold shell.
- c. Proposal 5** - Only carbon emissions will be included
Expanding environmental indicators considered beyond carbon emissions.
- d. Proposal 7** - Stored carbon and carbon neutral products will be disclosed on NABERS Rating Certificates via a Carbon Removal Indicator; they will not be recognised within the star rating on the certificate
Treatment of carbon neutral products to consider any changes to their contribution to urgent emissions reduction.
Consideration of the treatment of stored carbon to align with outcomes of review of life cycle stages (Proposal 2).
- e. Proposal 8** - A statistical analysis of Bill of Quantities data is the preferred approach to creating whole-of-building benchmarks
Consideration of timelines to regularly update benchmarking taking into account data availability.

Rationale

The proposals identified in the roadmap address stakeholder feedback that NABERS should consider a wider scope of embodied emissions sources than is outlined by the proposals in this paper. To align with the third objective - which is to focus on targeted problems now - the proposals in this paper do not consider all embodied emissions associated with a building. This allows NABERS to facilitate urgent behaviour change and overcome the most pressing current challenges of reducing embodied emissions. Creating a roadmap is intended to signal to stakeholders how the scope of the tool is likely to change over time. Stakeholders identified that this would foster a collective focus on the future challenges associated with an expanded tool, and would give market leaders time to prepare for changes anticipated with updates.

5 APPENDIX A: TECHNICAL REPORT WAYFINDING

The structure of the technical report by thinkstep-anz is framed around ‘problem statements’ which were resolved during the technical analysis. In finalising the proposals in this consultation paper, the structure of the recommendations has shifted. The table below outlines how the proposals in this consultation paper aligns with the research and recommendations of the technical report.

Table 1: Mapping between NABERS proposals and guiding questions

NABERS proposal	Guiding question	Technical report page
1 Only new buildings and major refurbishments are eligible to certify.	Chapter 15 – Should the tool cover major refurbishments and demolition?	79
2 Cold shell is the default building scope.	Chapter 9 – Which parts of the building are included?	42
3 Emissions from demolitions are excluded.	Chapter 15 – Should the tool cover major refurbishments and demolition?	79
4 Include only upfront emissions (A1-A5).	Chapter 10 – Which life cycle stages will be included?	48
5 Only carbon emissions will be included.	Chapter 12 – Will it assess carbon only or full LCA?	61
6 NABERS will encourage verified product specific emissions data and will apply conservative defaults where no emissions data is available.	Chapter 16 – Will it cover process LCA, hybrid LCA or both?	85
	Chapter 17 – Should the tool use a hierarchy of preferred data?	91
	Chapter 15 – Should the tool cover major refurbishments and demolition?	79
7 Stored carbon and carbon neutral products will be disclosed on NABERS Rating Certificates via a Carbon Removal Indicator. They will not be recognised within the star rating on the certificate.	Chapter 13 – Will stored biogenic carbon be considered?	65
	Chapter 14 – Will carbon offsets be considered?	72
8 A statistical analysis of Bill of Quantities data is the preferred approach to creating whole of building benchmarks.	Chapter 18 – How will we set benchmarks?	97
	Chapter 11 – Which functional or declared unit will be used?	54

NABERS proposal	Guiding question	Technical report page
9 Projects receive certification following practical completion with some options to review progress along the way.	Chapter 6 - Who submits the rating to NABERS?	28
	Chapter 7 - When does certification occur?	33
	Chapter 8 - How is auditing managed?	37
10 A Roadmap for Future Development of the tool, providing visibility over proposals that are likely to increase in scope, to increase the impact of the tool over time.	N/A	



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