

**SUBMISSION**

Submission to Infrastructure NSW

# **Submission on Decarbonising Infrastructure Delivery**

31 January 2023

**The Australian Academy of Technological Sciences and Engineering (ATSE) is a Learned Academy of independent, non-political experts helping Australians understand and use technology to solve complex problems. Bringing together Australia’s leading thinkers in applied science, technology and engineering, ATSE provides impartial, practical and evidence-based advice on how to achieve sustainable solutions and advance prosperity.**

ATSE appreciates Infrastructure NSW has offered and welcomes the opportunity to respond to the consultation on Decarbonising Infrastructure Delivery. NSW is one of the largest investors in infrastructure in Australia with [\\$88.4 billion being spent on infrastructure in NSW](#) over the next four years. By embedding embodied carbon reduction as a key principle for infrastructure in NSW, greater reductions in emissions nationwide can be achieved. This approach will also encourage further industry investment in technologies that reduce carbon in the construction sector, leveraging the strengths of universities in NSW, home to research centres like the [Sustainable Materials Research & Technology Centre](#) at UNSW.

The proposed framework has the potential to lead the way nationally as a gold standard approach to decarbonising infrastructure and the construction sector, however some additional actions are needed. There are many matters addressed in the Discussion Paper which ATSE is supportive and ATSE has only chosen to comment on those, where we think ATSE has something to add to the discussion. ATSE recommends the inclusion of the following actions to strengthen the proposed framework:

**Recommendation 1:** Under *Principle 1 – Use consistent methods and data to measure embodied carbon* include actions to “use carbon balance sheets through all project phases, establish an open-source database for embodied carbon, include emissions from power generation for electric vehicles, and include emissions from land use changes”.

**Recommendation 2:** Under *Principle 1 – Use consistent methods and data to measure embodied carbon*, include an action for Infrastructure NSW to “support research and development projects to fill gaps in knowledge and datasets for measuring embodied carbon”.

**Recommendation 3:** Under *Principle 2 – Reduce embodied carbon from options analysis and early design stages*, include an action to “create a comprehensive, whole-of-life strategy to be used for carbon budget planning”.

**Recommendation 4:** Under *Principle 2 – Reduce embodied carbon from options analysis and early design stages*, include an action to “use a circular economy approach to planning infrastructure projects”.

**Recommendation 5:** Under *Principle 2 – Reduce embodied carbon from options analysis and early design stages*, include an action to “establish carbon balances sheets for: no changes to land proposed for infrastructure development projects, all project options, and preferred project options (to be updated at all critical phases of a project)”.

**Recommendation 6:** Under *Principle 2 – Reduce embodied carbon from options analysis and early design stages*, include an action to “utilise digital technologies, including digital twinning, to develop a standard approach to carbon modelling”.

**Recommendation 7:** Under *Principle 2 – Reduce embodied carbon from options analysis and early design stages*, account for any loss of carbon absorption capability of the natural environment and its maturity due to infrastructure development and the degree to which proposed nature-based solutions mitigate any loss in the scoping, options analysis and design phases.

**Recommendation 8:** Under *Principle 4 – Establish minimum expectations for embodied emissions reduction in tenders*, include an action to “set a total carbon budget for infrastructure projects and determining the minimum requirements accordingly”.

## Measuring embodied emissions

ATSE welcomes Infrastructure NSW’s ambition to reduce, account for, and set a value for emissions from embodied carbon in the infrastructure sector, as outlined in the [Decarbonising Infrastructure Delivery discussion paper](#). Rapidly reducing emissions in high-emitting sectors is critical to reaching the state and federal net zero targets by 2050. A greenhouse gas accounting framework, which includes embodied

emissions, is a requisite first step in quantifying emissions reductions in building and construction. A whole-of-government approach, as posited by the discussion paper, will enable calculation and comparison of embodied emissions across different infrastructure solutions and project options. The development of a standardised greenhouse gas accounting framework will also provide a signal to industry to invest in carbon-reducing innovations and technologies and apply carbon accounting frameworks to their projects.

ATSE recommends further actions to be implemented to strengthen the framework's first principle of using consistent methods and data to measure embodied carbon. Carbon balance sheets should be adopted through all phases of a project. An open-source and cross-institutional database, such as the University of Melbourne's Environmental Performance in Construction (EPiC) database of environmental flow coefficients for construction materials, should be utilised to enable calculation of embodied carbon. Actions under the plan should also support the accounting for all relevant changes in emissions, including the power generation required to meet increasing demand for electric vehicles used in construction and operation, and all deforestation and land clearing involved in infrastructure development.

As the development of a greenhouse gas accounting framework is in its infancy, there remain gaps in knowledge and datasets that will need to be resolved to strengthen future efforts to quantify and reduce emissions from the infrastructure sector. As part of the initiative to decarbonise infrastructure delivery, ATSE recommends that Infrastructure NSW commits to supporting research and development projects to build up this knowledge.

**Recommendation 1:** Under *Principle 1 – Use consistent methods and data to measure embodied carbon*, include actions to “use carbon balance sheets through all project phases, establish an open-source database for embodied carbon, include emissions from power generation for electric vehicles, and include emissions from land use changes”.

**Recommendation 2:** Under *Principle 1 – Use consistent methods and data to measure embodied carbon*, include an action for Infrastructure NSW to “support research and development projects to fill gaps in knowledge and datasets for measuring embodied carbon”.

## Modelling and reducing emissions during design

Reducing embodied emissions is a critical near-term requirement, however, emissions from infrastructure operations must also be considered so that holistic carbon emission reductions are achieved. Principle 2 concerns reducing embodied carbon from options analysis and early design stages. The four listed actions will go some way to reducing emissions from infrastructure projects. There is scope to go further at the early design stage by requiring comprehensive modelling, adopting circular economy principles, and utilising carbon balance sheets for the evaluation of different scenarios in land use and project options to support decision making.

ATSE recommends taking a whole-of-life approach for infrastructure carbon budgets that includes the impact of from all stages of a project, including:

- Existing site land use
- Site investigations
- Planning and design
- Extractive resources
- Manufactured materials
- Off-site construction activities
- On-site construction activities
- Operational activities
- Natural project elements
- End of useful life

Analysis for each of these stages would enable more efficient and effective management of greenhouse gas emissions and promote carbon emission reduction focused scoping and innovation. Emerging technologies such as digital twinning can be used to help simulate emissions at these stages through the creation of a virtual representation projects. This emerging area can be used for modelling greenhouse gas emissions. The action could utilise digital twinning and other new digital technologies to standardise an approach to carbon modelling as well as reducing emissions from built objects. Digital twinning is increasingly being used and supplemented with augmented reality to bring project planning and design options to life. Digital twinning facilitates visualisation, operational scenario testing, construction sequencing and enables workflow process design and management. There are early signs that these modelling techniques are being adapted to incorporate carbon emissions and to support carbon balance sheets.

ATSE notes that the carbon absorption of existing land use and incorporation of nature-based solutions in infrastructure projects represent important components of our understanding and management of carbon emissions. It is vital that modelling and analysis of these capabilities throughout the life of a project should reflect the changes which occur with maturity of such environments. This modelling should include the impacts of the carbon absorption capability of nature-based solutions integrated into new infrastructure, destroying or damaging existing high performing carbon sinks for new development, and replacement of existing carbon generating land use by infrastructure. Actions to reflect the above approach can be added under Principle 2.

**Recommendation 3:** Under *Principle 2 – Reduce embodied carbon from options analysis and early design stages*, include an action to “create a comprehensive, whole-of-life strategy to be used for carbon budget planning”.

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### **Establishing an infrastructure carbon budget**

Principle 4 concerns the establishment of minimum expectations for embodied emissions reduction in tenders. ATSE recommends going further by estimating the trend in carbon emissions for the NSW Infrastructure program, determining what is required to achieve net zero emissions across the state, and setting a carbon budget on this basis. This will also illuminate if further actions are needed to achieve deeper cuts to emissions to meet 2030 and 2050 net targets.

**Recommendation 8:** Under *Principle 4 – Establish minimum expectations for embodied emissions reduction in tenders*, include an action to “set a total carbon budget for infrastructure projects and determining the minimum requirements accordingly”.