thinkstep anz

Embodied carbon emissions in Australia's built environment

Climate change action at the national scale



July 2025

worldsteel LCA conference
Qingdao, China

Nicole Sullivan
Impact Director,
thinkstep-anz

Photo credit: Caleb via Unsplash

thinkstep anz

We are a **full-service sustainability firm**.
We offer **services, tools and software** that connect to meet all our client's business needs.



>18
years of experience

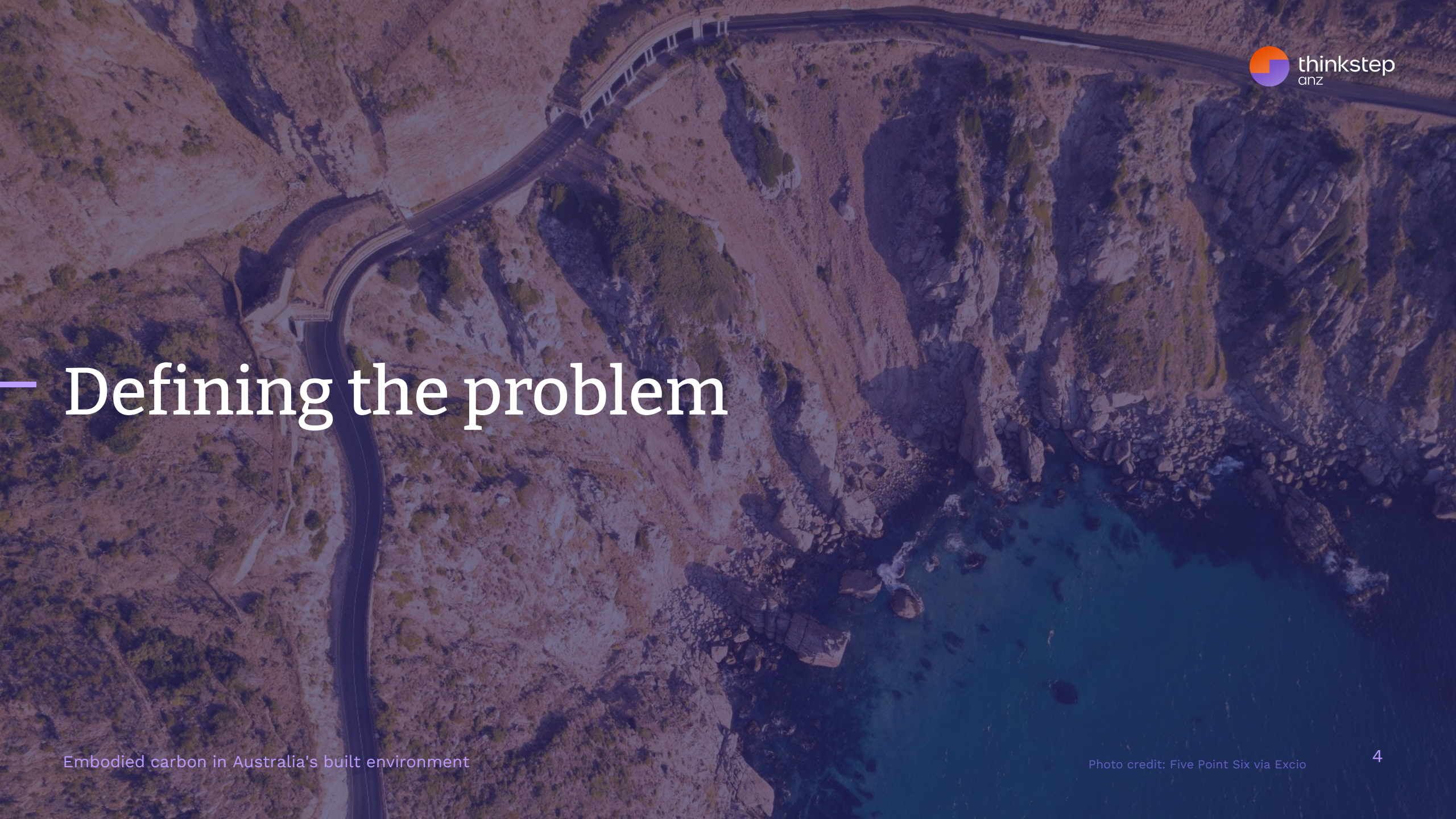
45+
sustainability experts

11
cities in Australia and New Zealand

200+
international clients

Agenda

- → Defining the problem
- → Built environment challenges
- → Finding solutions
- → The way forward
- → What’s next



Defining the problem

Photo credit: Five Point Six via Excio

World Green Building Council Report 2019

Embodied carbon is:

→ GHG emissions, as CO_2-eq.

→ Non-operational emissions

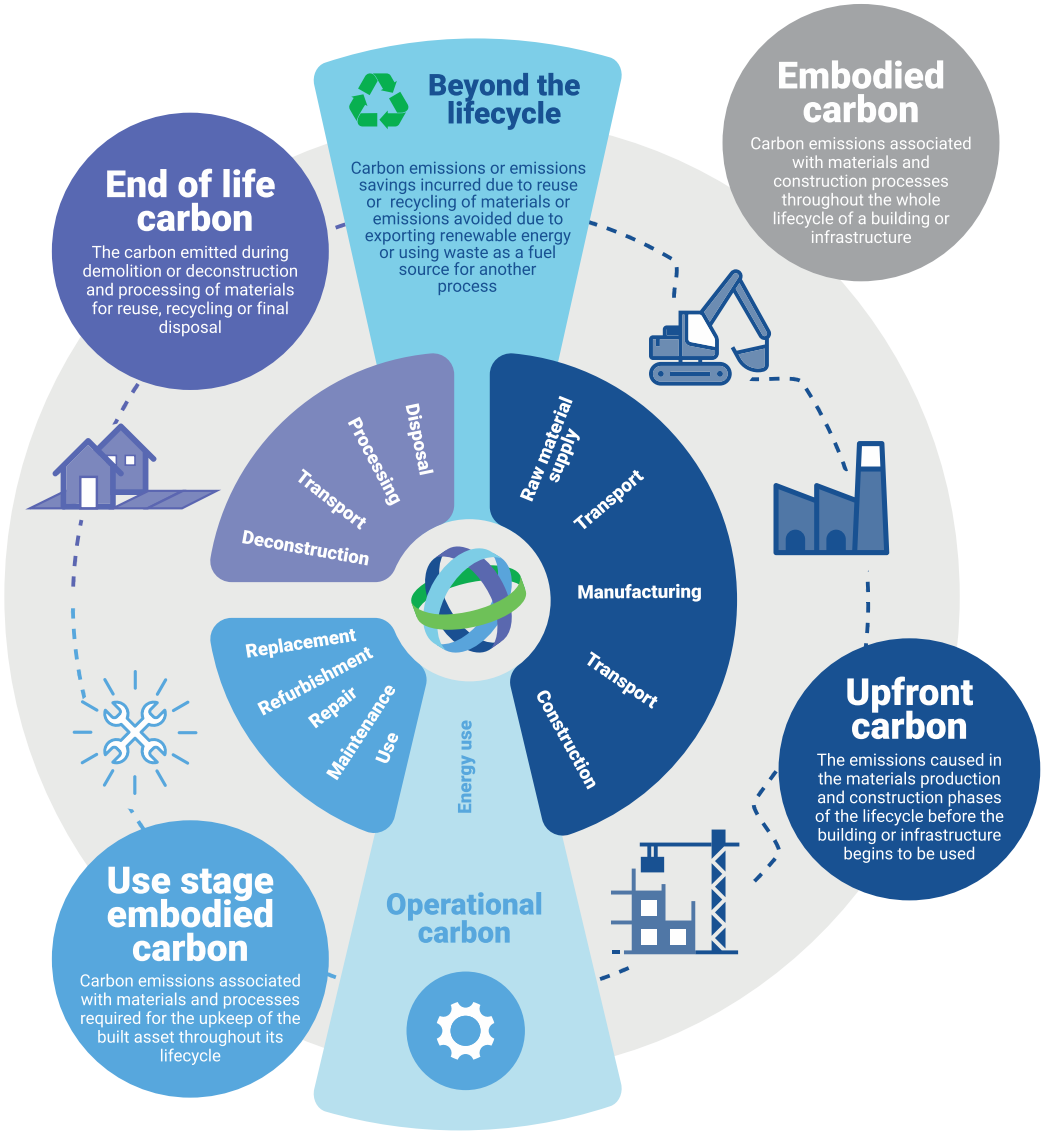
→ Within the project life cycle boundary

The sum of:

→ Upfront carbon

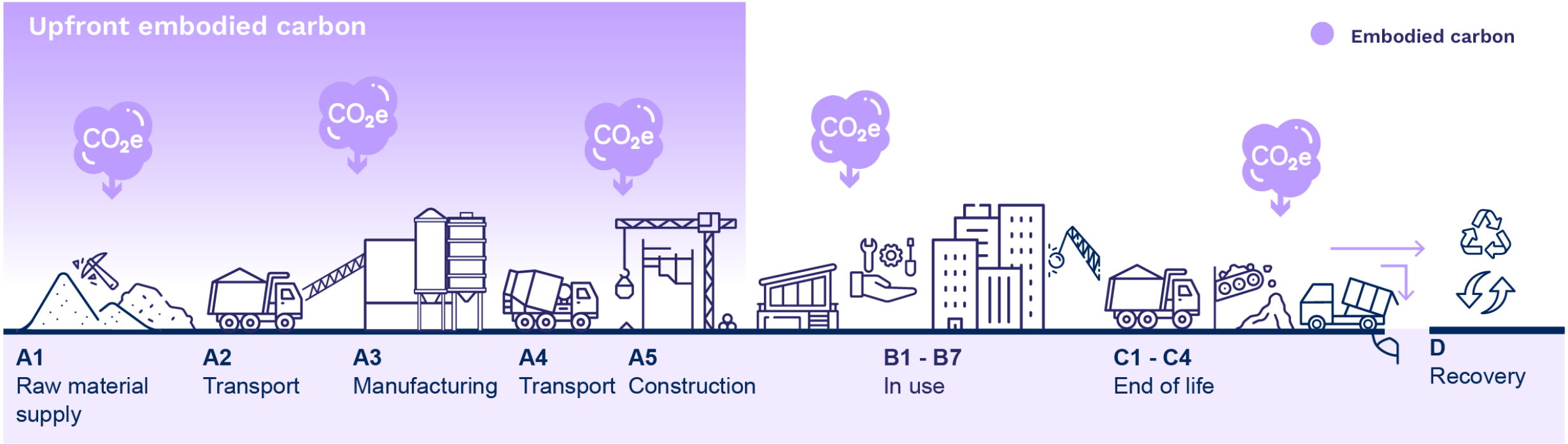
→ Use stage embodied carbon

→ End of life carbon



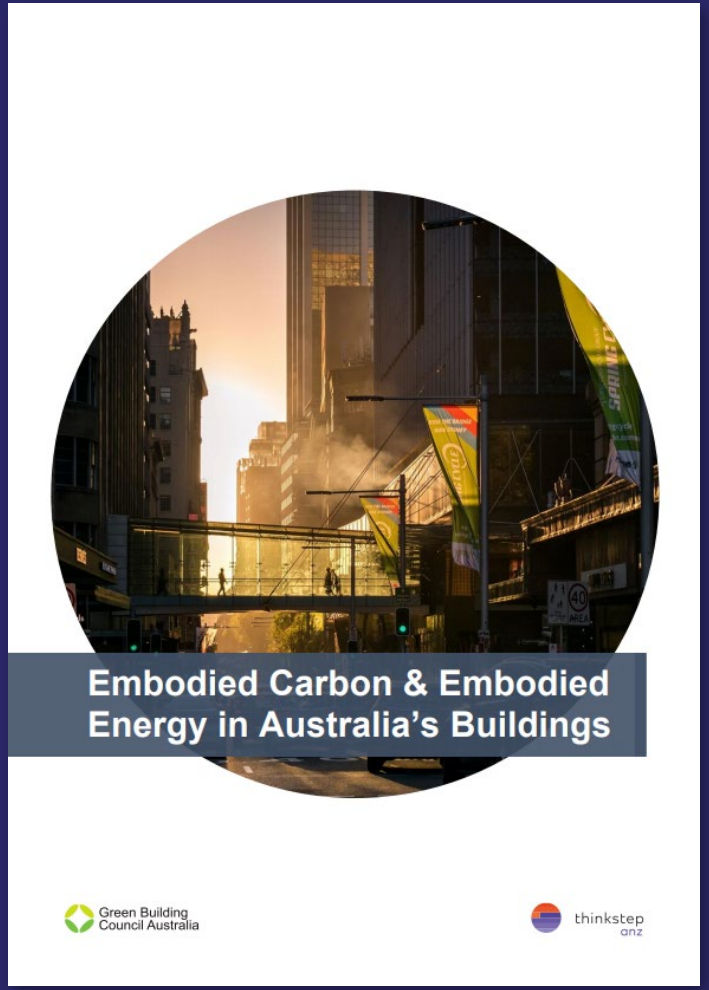
Graphic reproduced from World Green Building Council, 2019

Embodied carbon within a project life cycle

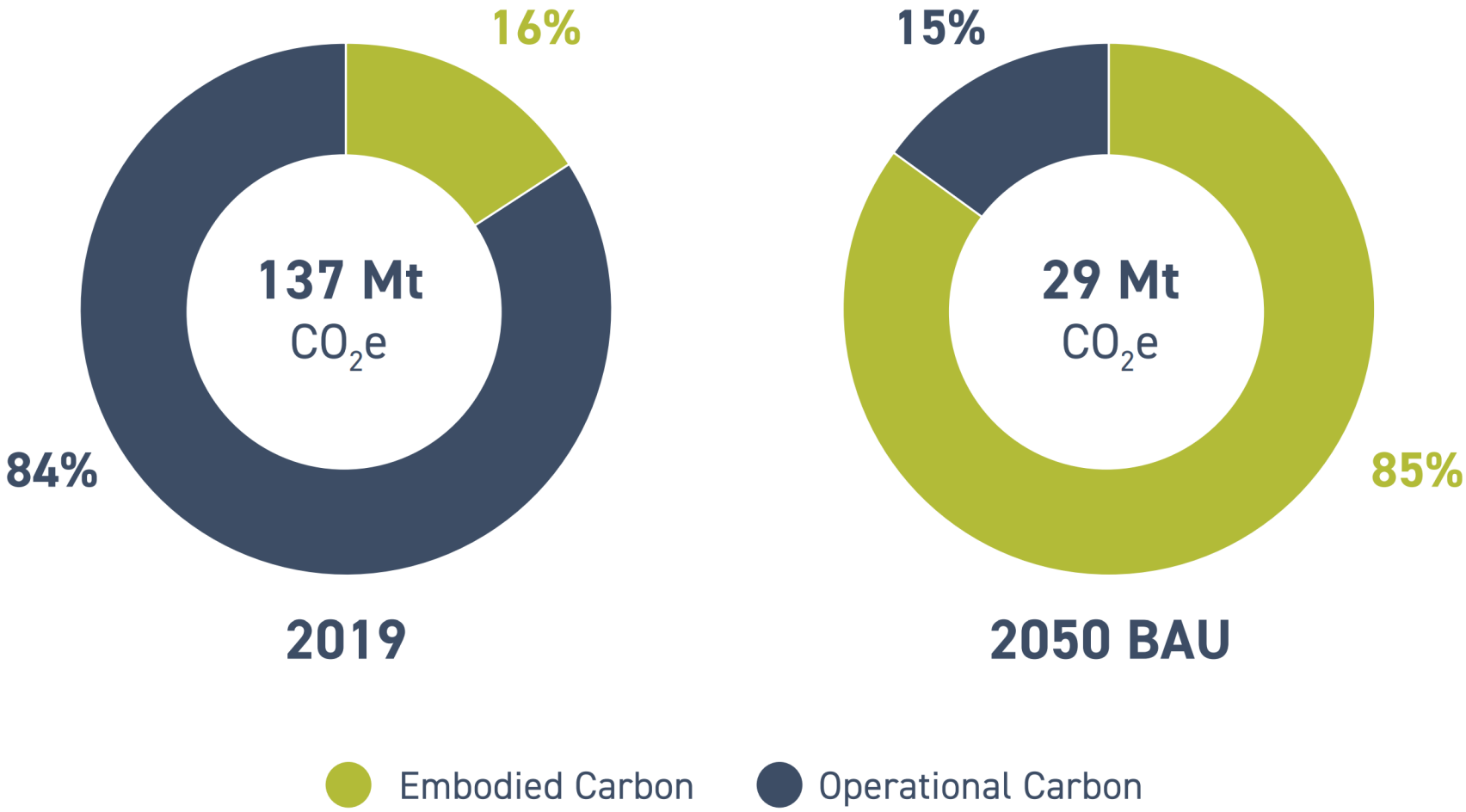


Report on **embodied and operational carbon** of all buildings across Australia.

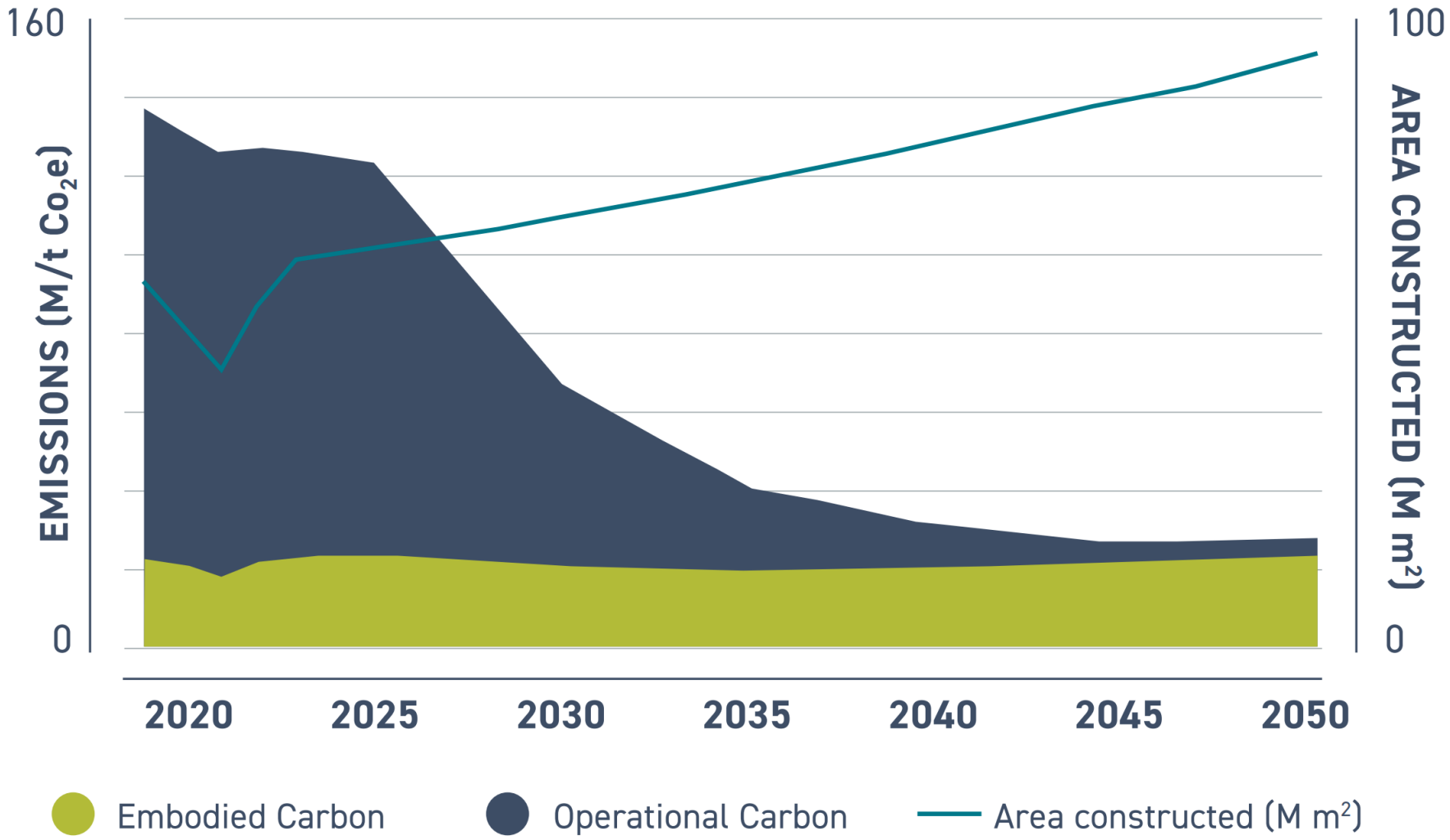
- → The share of embodied carbon in buildings is small but growing
- → Embodied emissions will exceed operational well before 2050
- → Tackling embodied carbon requires action on process heat and chemical process emissions



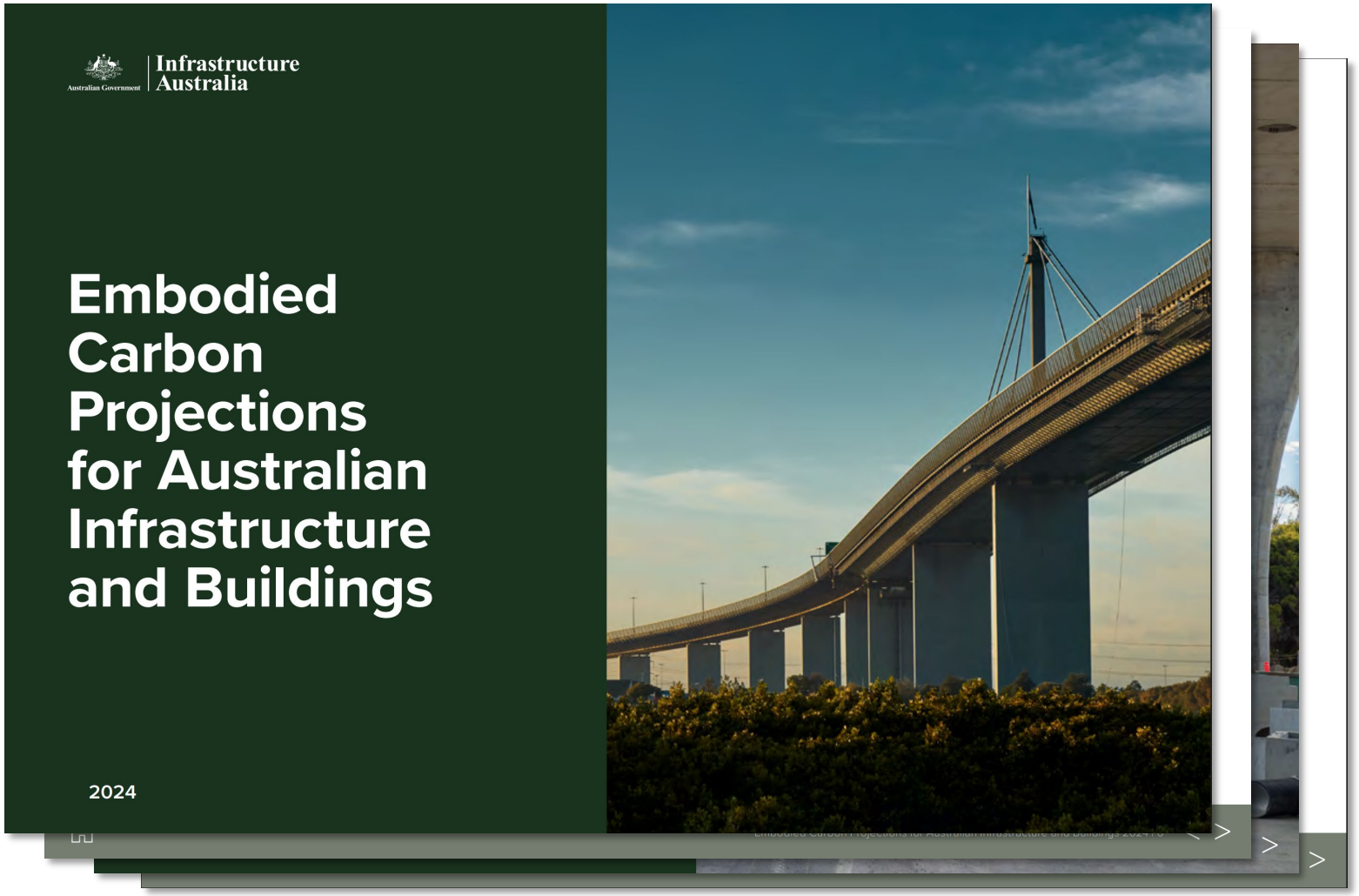
Share of embodied carbon in national emissions

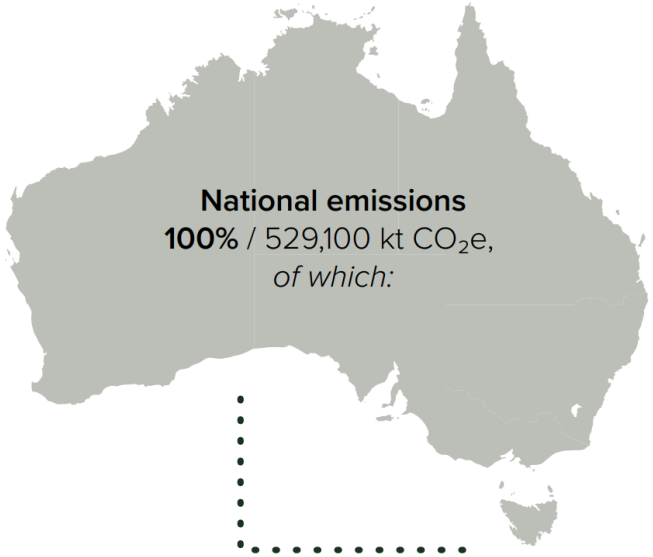


Building emissions in Australia

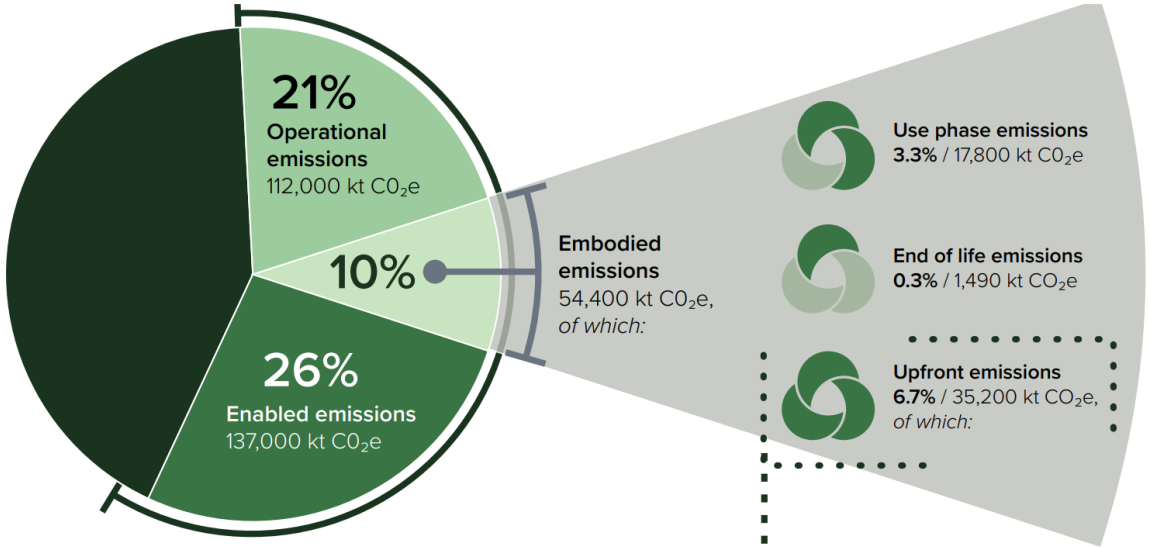


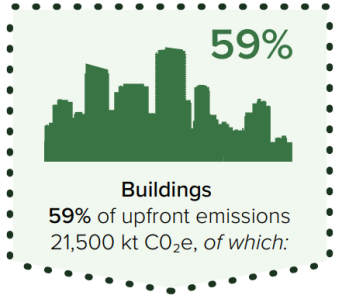
Infrastructure Australia report 2024

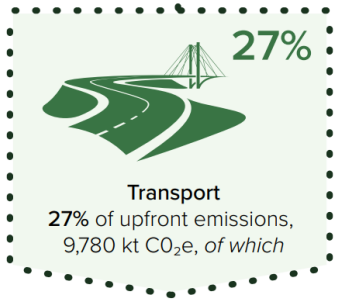


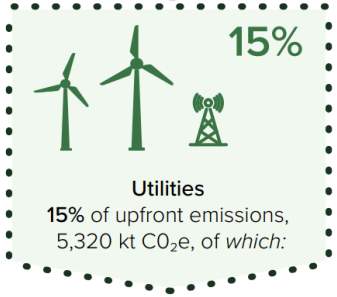














78% Materials manufacture
16,700 kt CO_2e



64% Materials manufacture
6,220 kt CO_2e



86% Materials manufacture
4,570 kt CO_2e



17% Construction
3,720 kt CO_2e



31% Construction
3,060 kt CO_2e



12% Construction
630 kt CO_2e



5% Transport to site
1,060 kt CO_2e

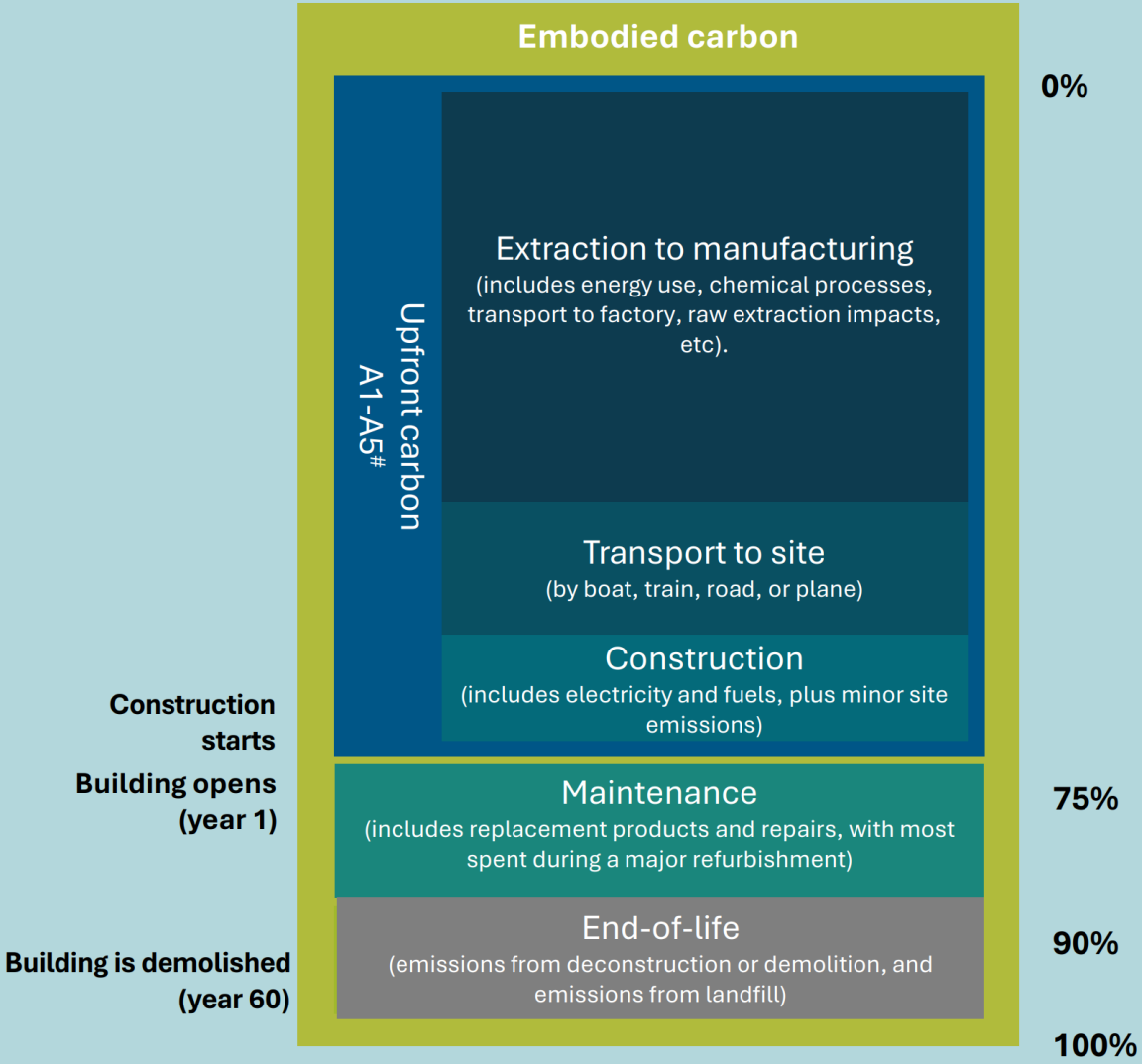


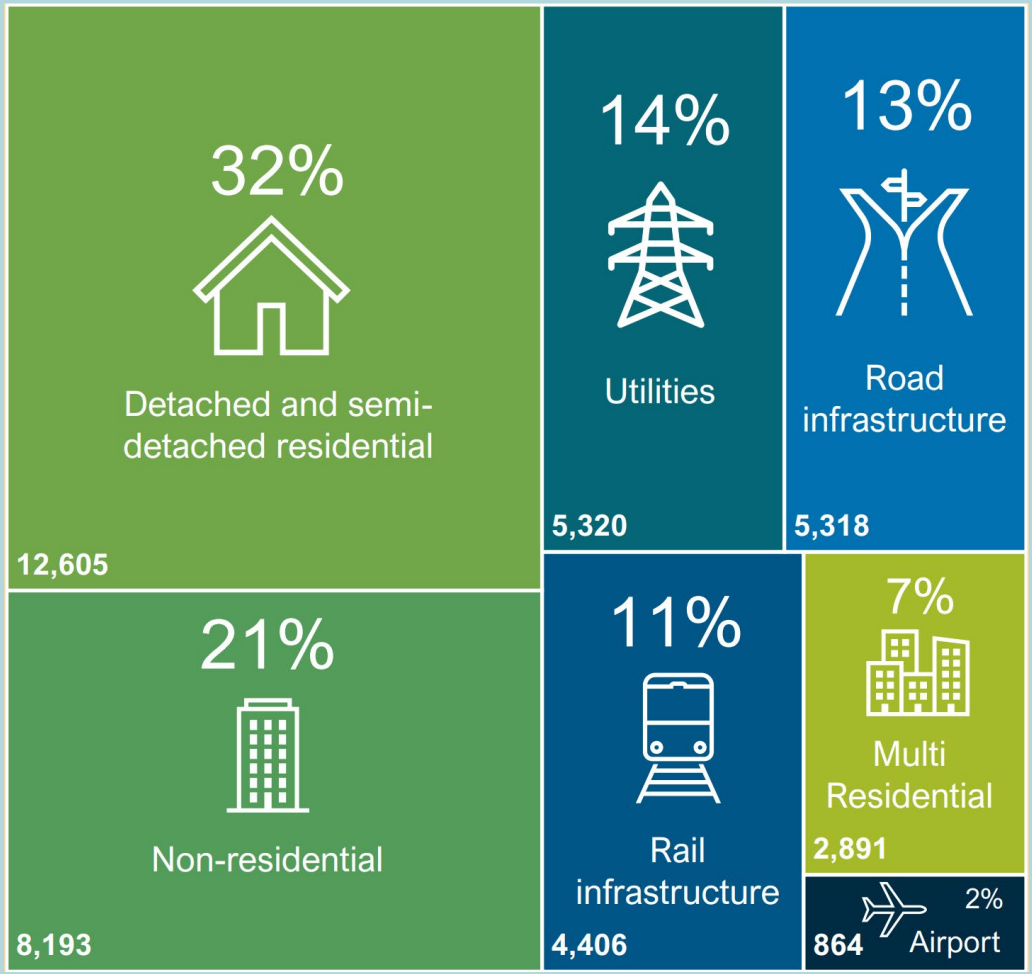
5% Transport to site
500 kt CO_2e



2% Transport to site
123 kt CO_2e

Sources of embodied carbon and sectors

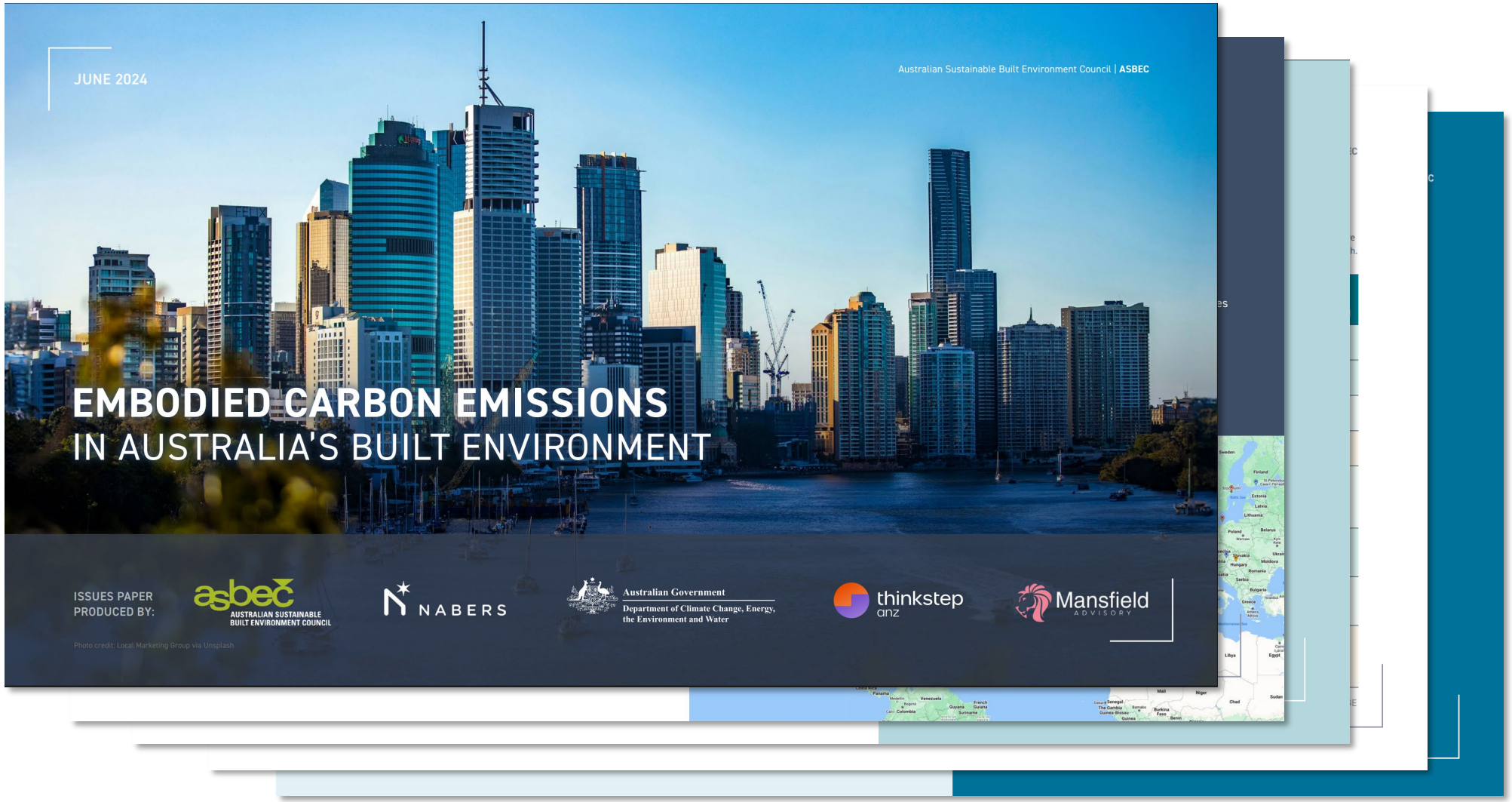




Built environment challenges

Photo credit: Occasional Climber via Excio

Collaboration building and construction industry



Seven decarbonisation dilemmas

The seven decarbonization dilemmas



1. DIRECTION

Bringing lower-carbon construction to the mainstream



2. DEVELOP

Building industry capacity to decarbonise



3. DISCLOSE

Methods, data and reporting



4. DEMAND

Clarity, consistency and confidence



5. DESIGN

The best decisions from concept to completion



6. DETAIL

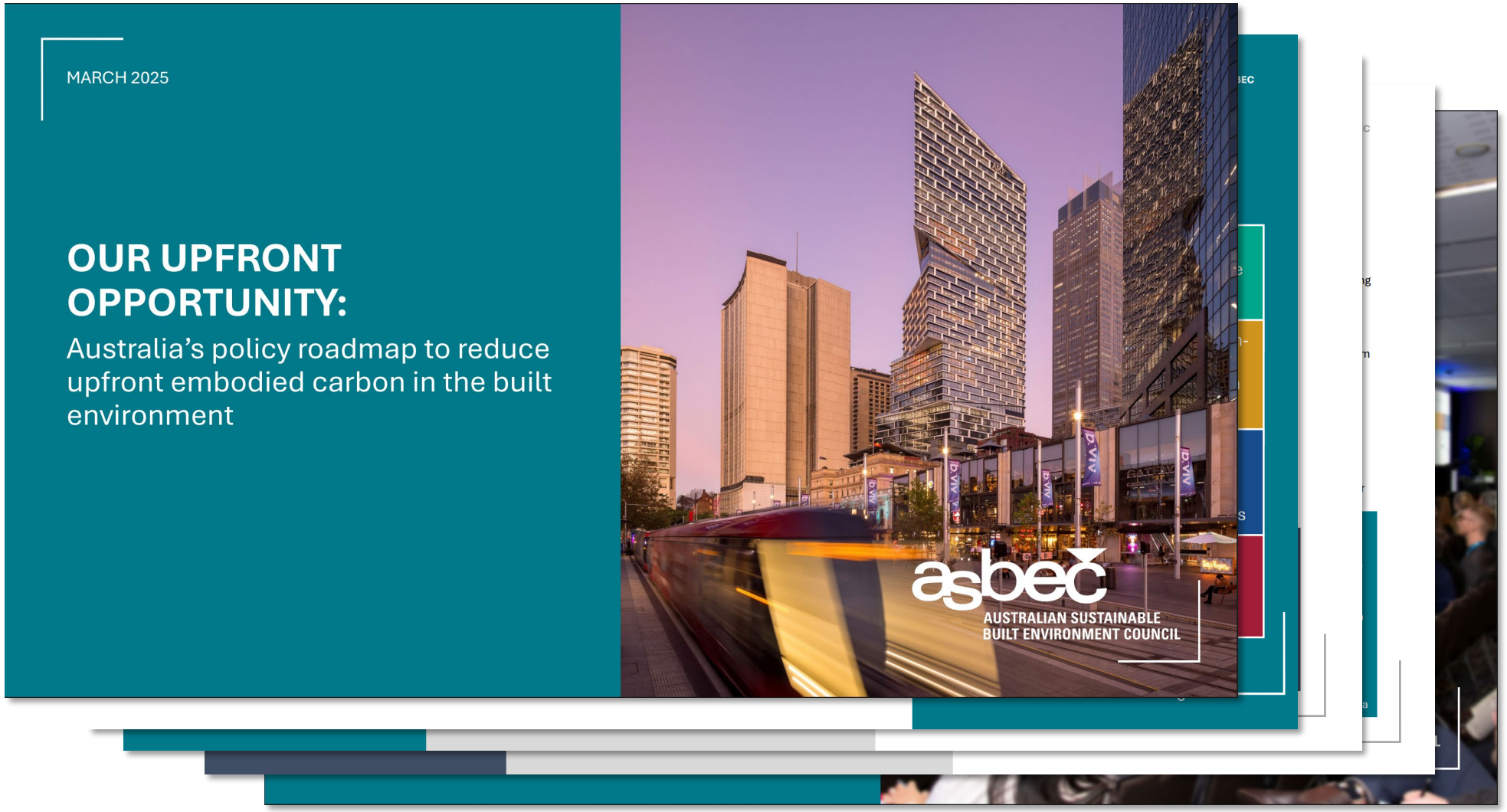
The best product options



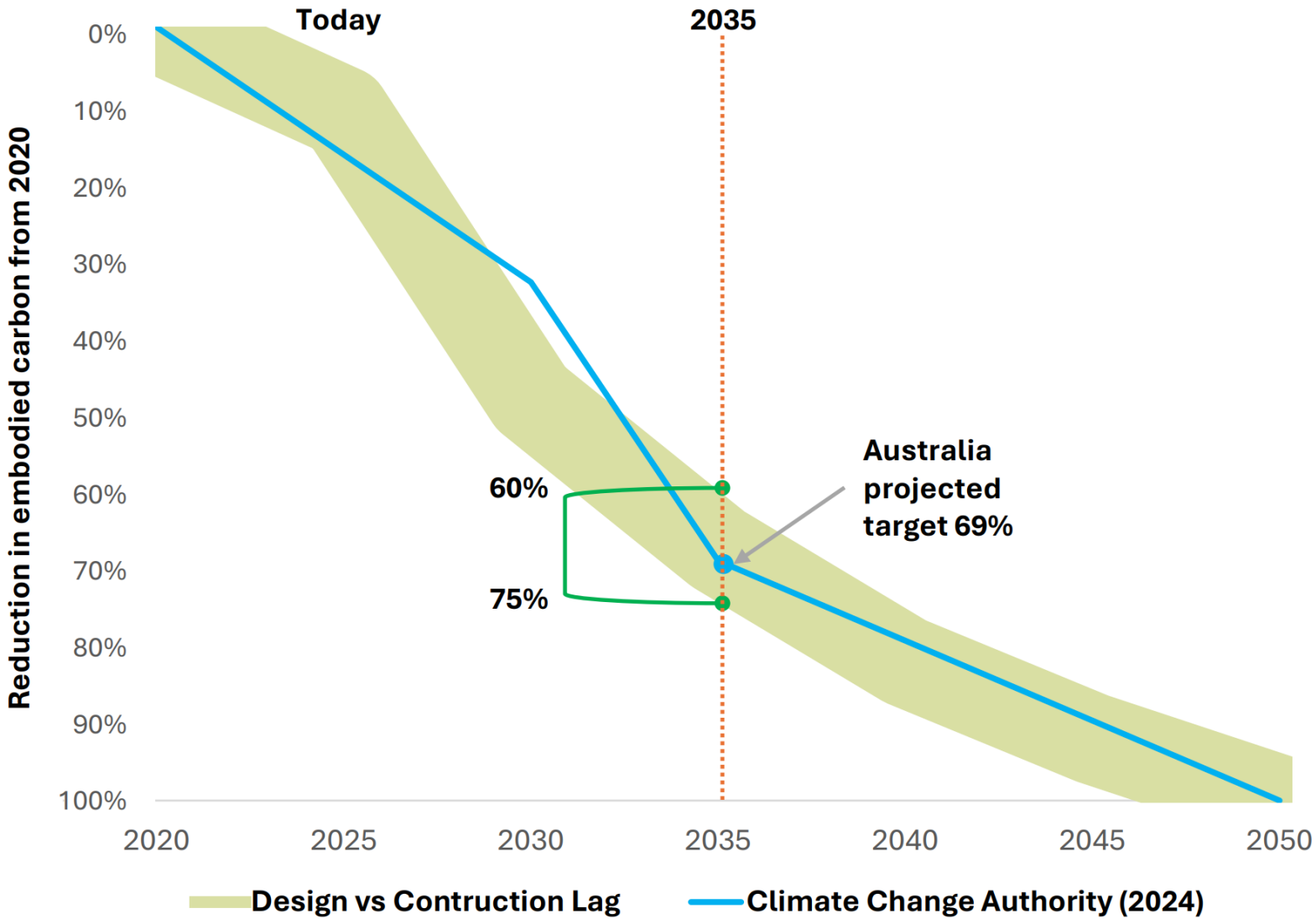
7. DELIVER

Delivering lower-carbon assets

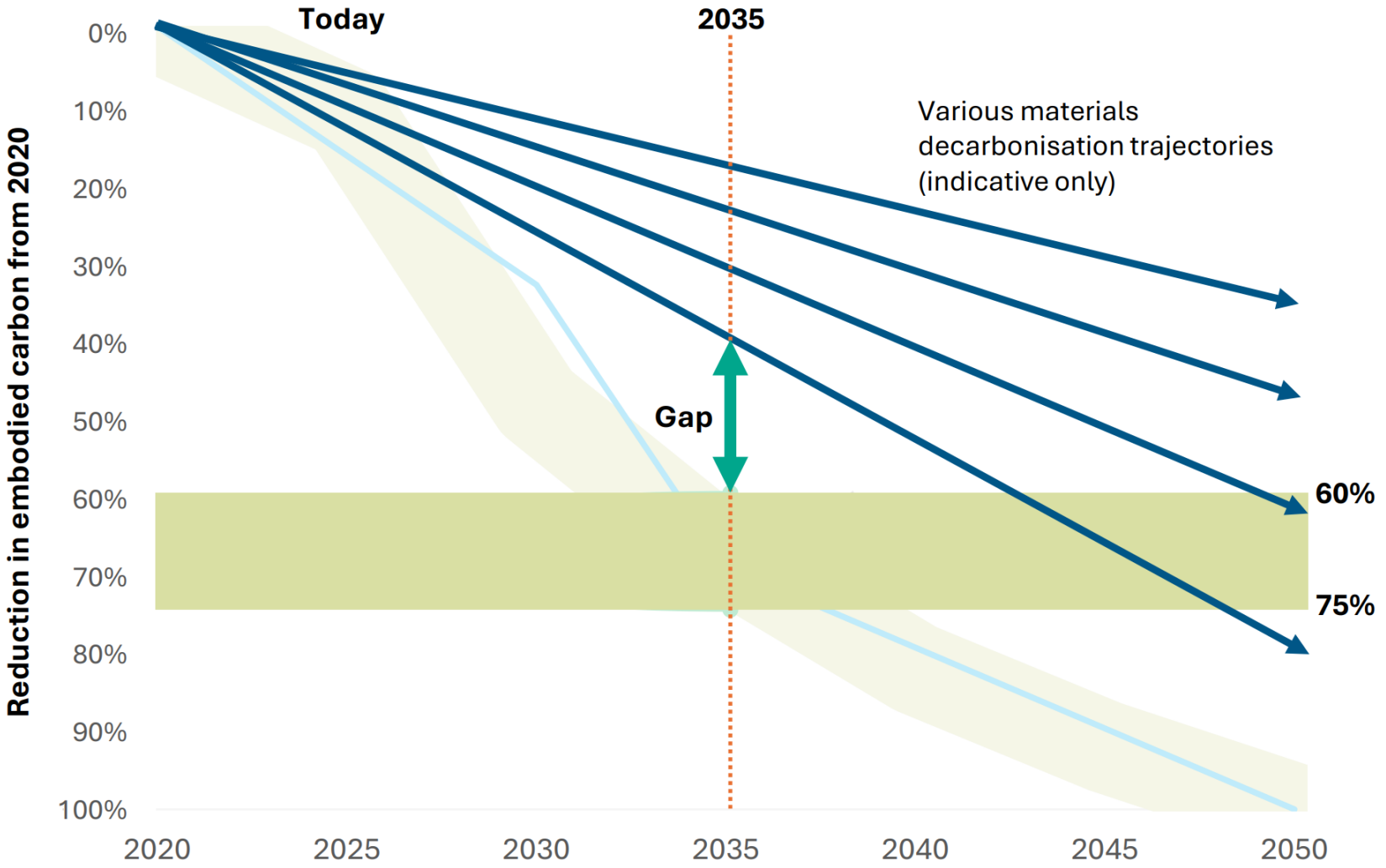
Collaboration building and construction industry



Trajectory


Today
2035
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Reduction in embodied carbon from 2020
60%
75%
Australia projected target 69%
2020
2025
2030
2035
2040
2045
2050
Design vs Contruction Lag
Climate Change Authority (2024)

Material decarbonisation trajectory



Finding solutions



Photo credit: Charlotte E. Johnson via Excio

Finding solutions

250

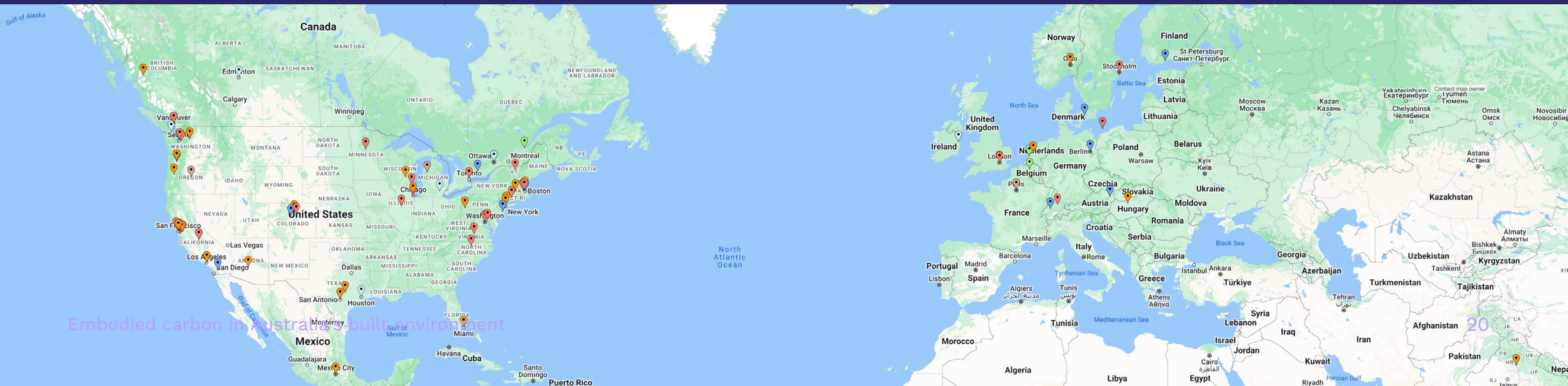
250 national, state and city regulations, policies and action plans from over 20 countries, including 104 regulatory instruments were reviewed.

34

34 sources were researched using a defined parameter set to extract critical information to inform Australia's directions for government and industry.

30

30 leading policy sources from 11 countries were analysed.



International policy overview

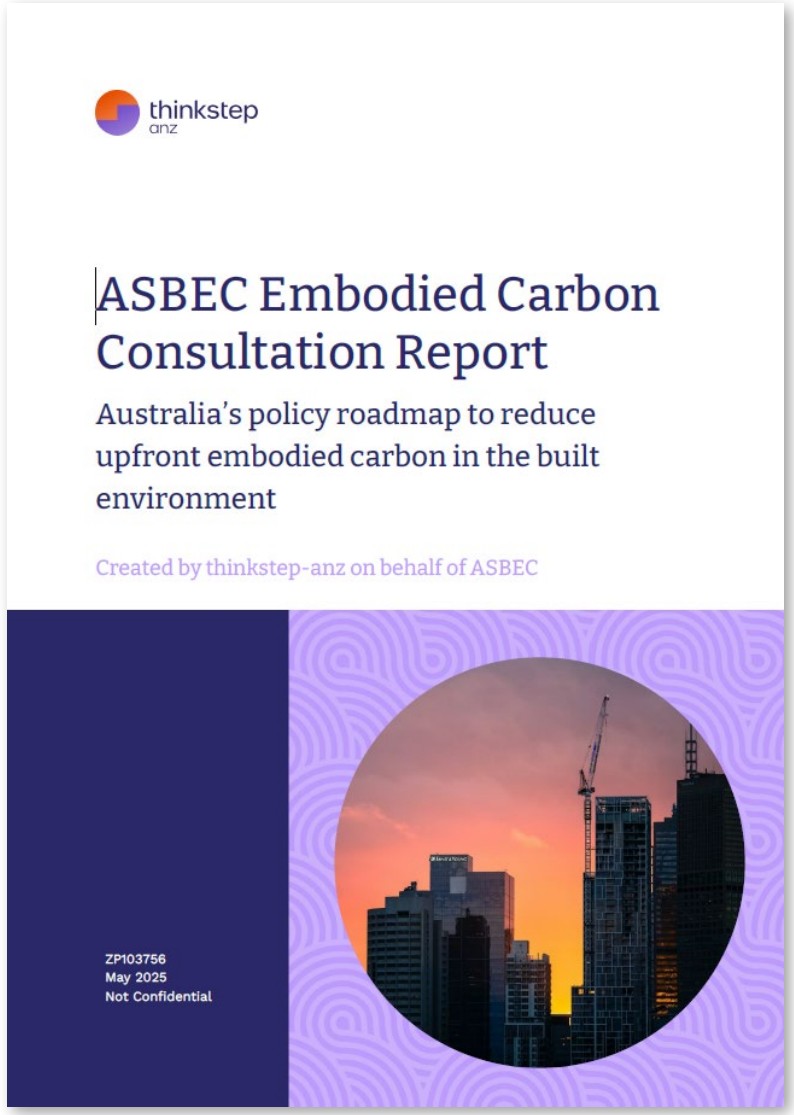
Country	Buildings / Infrastructure Requirements	Products Requirements	EPDs	Upfront A1 – A5	Use Phase Embodied B1 – B5	Operational B6	End of Life C1 – C4 (D where noted)
Canada	Major construction projects 30% reduction in embodied carbon.	Cement, ready-mix concrete, precast and prestressed concrete elements and concrete masonry block.	Y	Y	N	N	Y
China	Reduce operational emissions, report embodied carbon. Residential and public buildings.		–	Y	Y	Y	Y
Denmark	New buildings above 1000 m² must comply with the limit value of 12 kg CO_2-equivalent/m²/year.		Y	A1 – A3	B4	Y	C3, C4, D
Finland	Expected reporting and future limit values for buildings. Not yet clear.	Will be declared.	–	–	–	–	–
France	Embodied carbon is capped for new buildings and building extensions. Includes carbon storage. Expressed as kg CO_2eq/m². The entire life cycle impact for the building is calculated for information purposes.		–	Y	Y	N for cap calc Y for info only	C&D
Ireland	Carbon Management Systems for large infrastructure projects with whole lifecycle GHG assessment.	Longer-life and lower-carbon cement blends in public contracts, minimum clinker replacement of 30%. Use EPDs when directly procuring cement or concrete products.	Y concrete only	Y	Y	Y	Y
Netherlands	Measure, reduce and target (reducing the embodied carbon of major construction projects measured by 'MPG'). All new residential and office buildings over 100 m².	Suppliers of steel, iron and concrete to implement sustainable extraction and production policies. Recommends bio-based materials for reducing embodied carbon.	Y	Y	Y	N	C&D
Singapore	Green Mark rating tool incentivises embodied carbon measurement and reduction. Heavy focus on energy efficiency. Mandate for new public sector buildings over 5,000 m² air-conditioned area to use Green Mark certification.	Concrete, glass and steel.	–	Y	–	Y	–
Sweden	Mandatory LCAs for Modules A and C for buildings over 100,000 m² (exclusions apply to industrial, agricultural and some other buildings). Building's envelope, load-bearing structures, and interior walls must be included. Target to be introduced by 2027.		Y	Y	Y	N	Y
UK	Proposing upfront carbon limits to be published, still in early stages. Report carbon from all life cycle stages.		Y	Y	Y	Y	C&D

What is the solution?

- → Global alignment does not exist
- → There is no perfect answer;
  no ‘silver bullet’ that solves everything
- → Different approaches across Australia are slowing progress
- → Stakeholders are clear on what they need



ASBEC


thinkstep
anz
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
ZP103756
May 2025
Not Confidential

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."*

Keep talking to industry *as you are."*

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

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

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

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

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

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

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

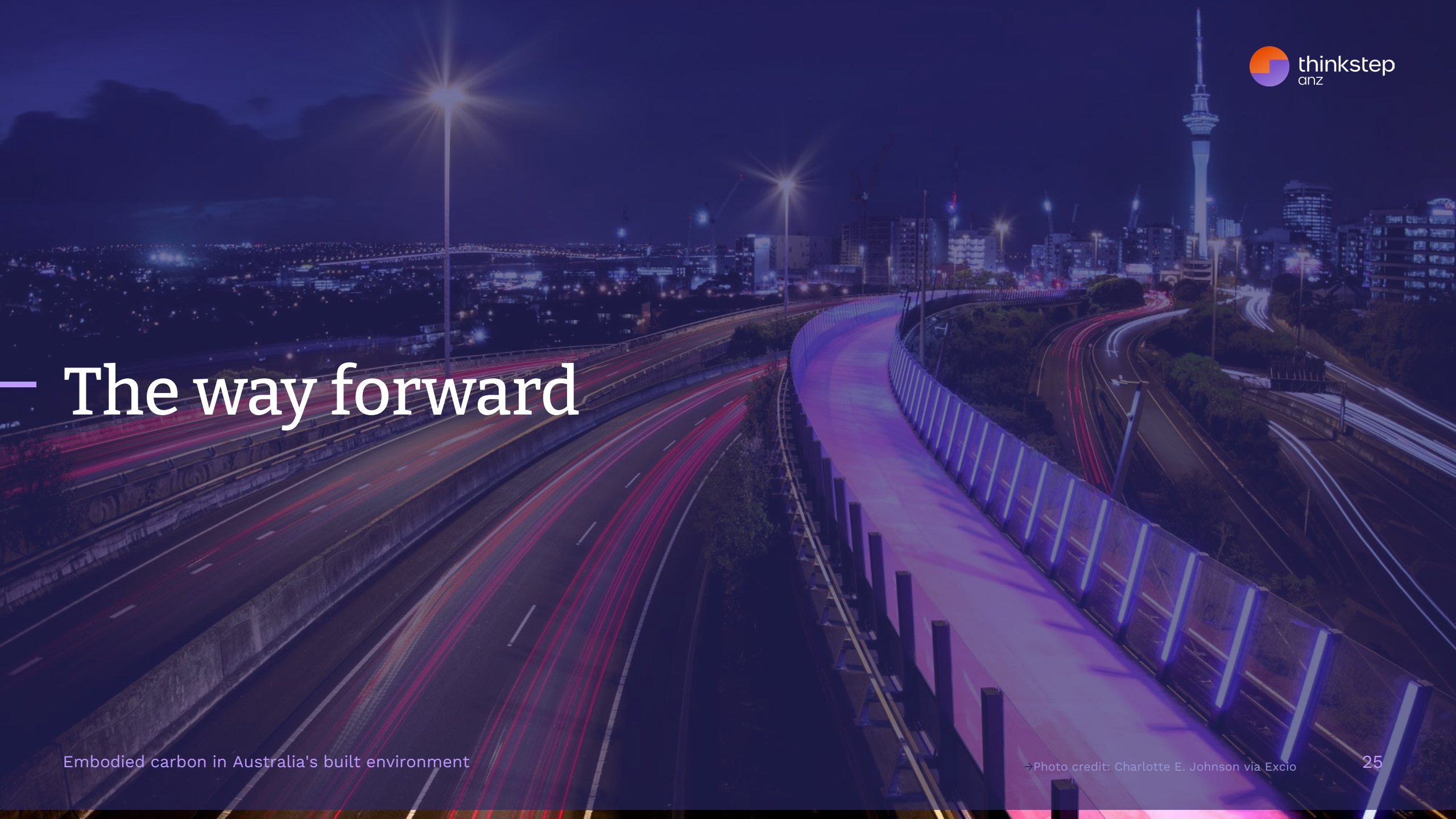
Reward those who opt to ***build less and use alternate options*** *to deliver services."*

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

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

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

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



The way forward

→Photo credit: Charlotte E. Johnson via Excio

National Australian Built Environment Rating System: NABERS Embodied Carbon

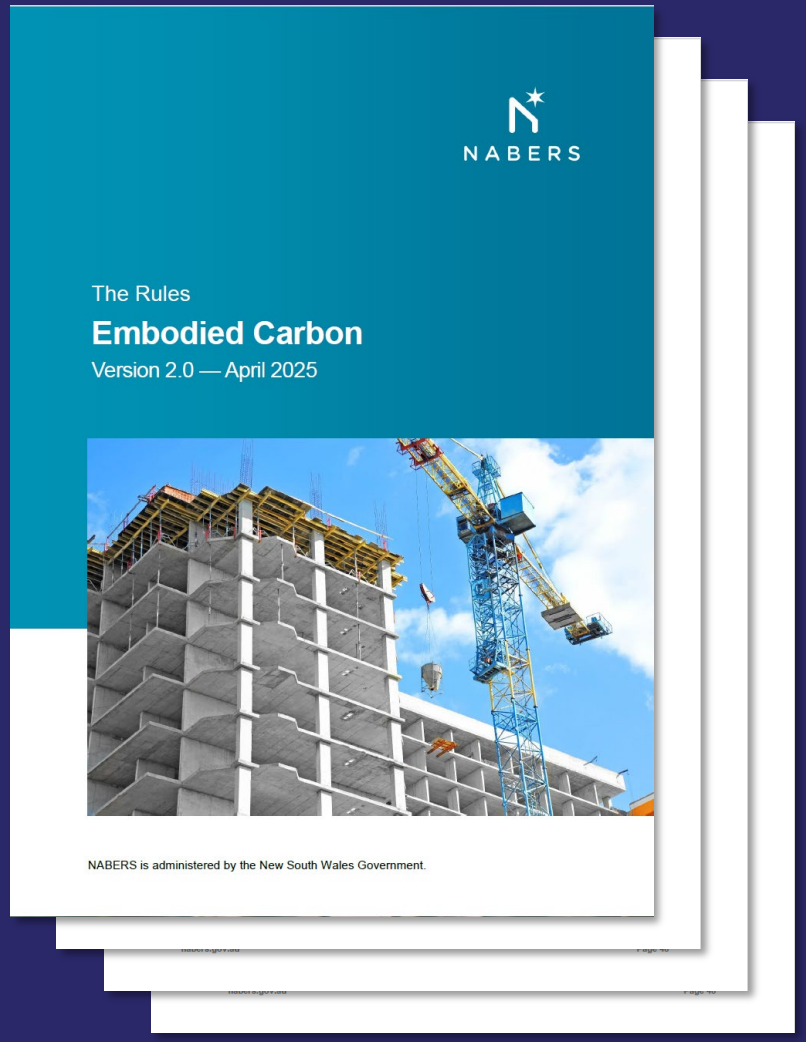
NABERS Embodied Carbon
is a rating tool for measuring upfront embodied carbon in large buildings in Australia

It uses:

→ process-based LCA

→ product-specific emission factors

→ proof of installing specified products

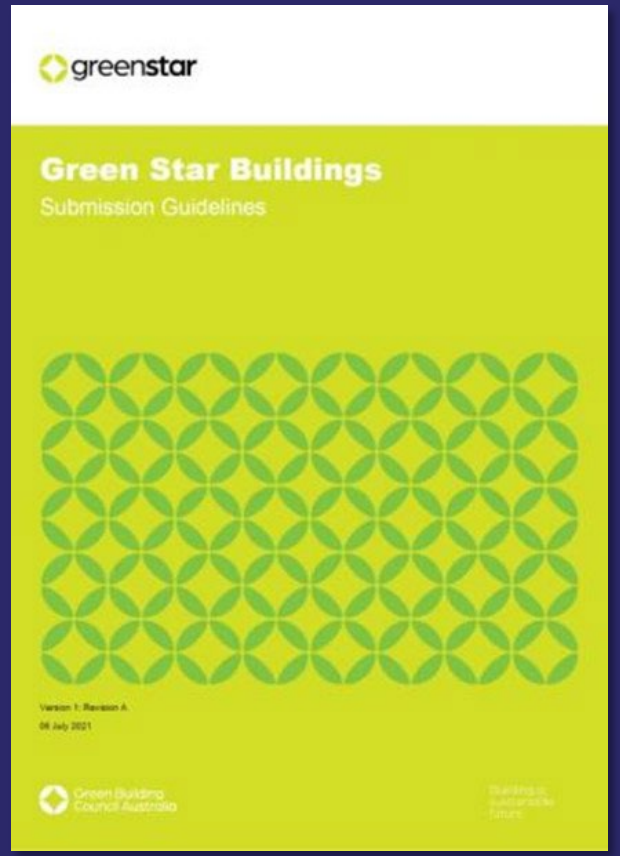


Green Star Buildings
is a rating tool for holistic sustainability for buildings in Australia, New Zealand and South Africa.

Upfront Carbon requirements since 2020

→ Minimum 10% reduction compared to national average construction

→ Higher ratings need 20% or 40% reduction



ASBEC's 4 levers



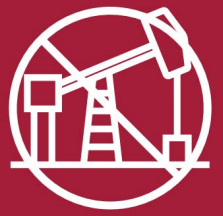
Reform **planning and procurement** to encourage low carbon projects



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

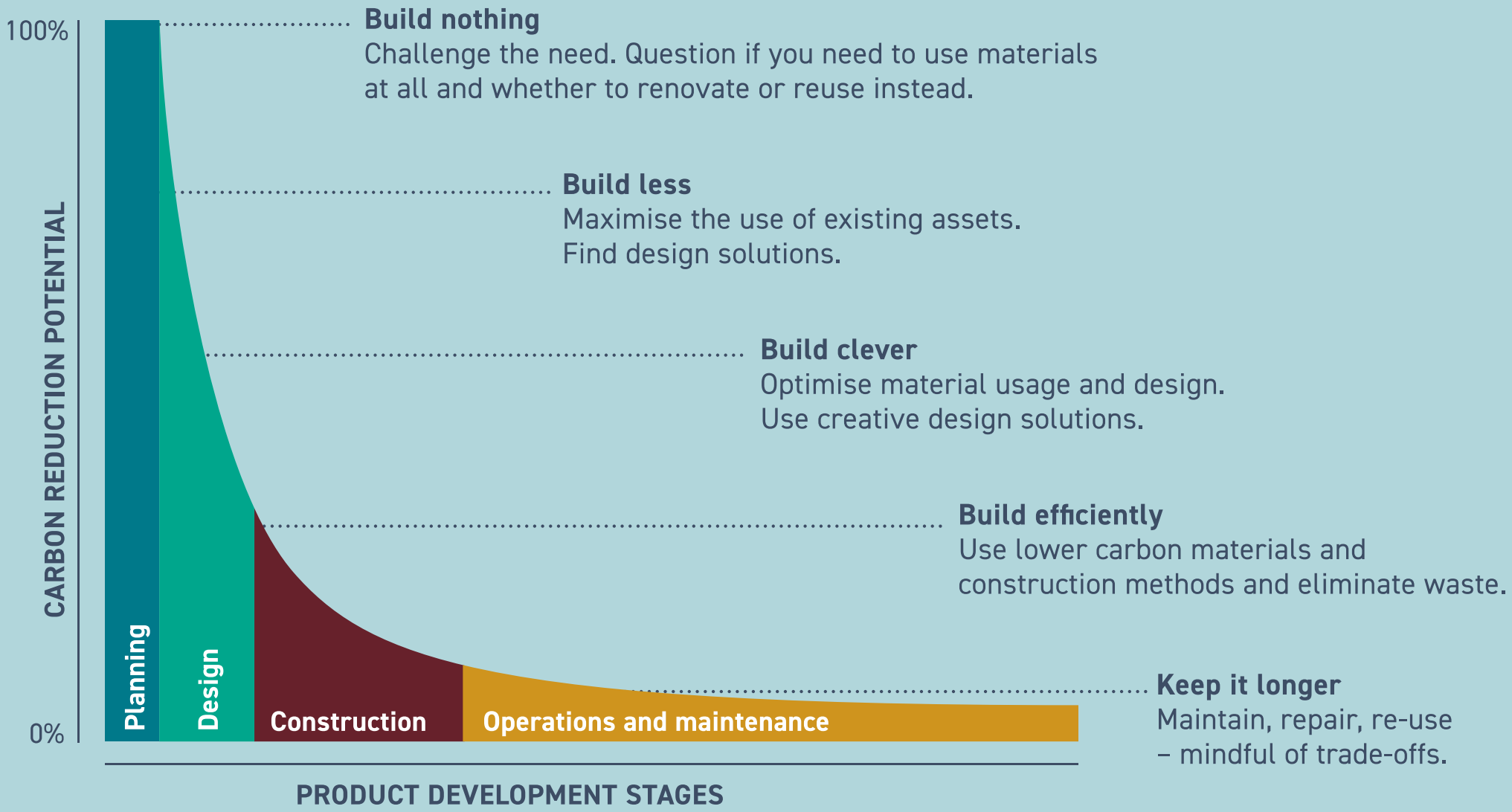


Scale up **supply chain decarbonisation** to increase the supply of low embodied carbon materials



Transition to **fossil fuel free transport and construction**

Decarbonisation hierarchy



What's next

Photo credit: Stewart Watson via Excio

Australia’s built environment priorities

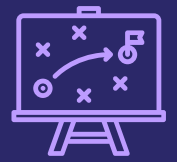


Australia’s built environment priorities:

→ Industry education

→ Government policy

→ Manufacturing transition



Steel industry must focus on:

→ Everything!

→ Large-scale technology transition

→ Incremental change

→ How the transition is communicated

thinkstep anz

Nicole Sullivan

Impact Director, thinkstep-anz

+61 419 750 083

Nicole.Sullivan@thinkstep-anz.com

Sydney | Melbourne | Perth | Canberra | Adelaide
Wellington | Auckland | Christchurch | Hamilton | Rotorua | Tauranga

Certified B Corporation

CLIMATE LEADERS COALITION
ON A MISSION TO REDUCE EMISSIONS IN NEW ZEALAND

SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

thinkstep-anz

thinkstep anz

Succeed sustainably

thinkstep-anz.com

Sydney | Melbourne | Perth | Canberra | Adelaide
Wellington | Auckland | Christchurch | Hamilton | Rotorua | Tauranga

Certified B Corporation

CLIMATE LEADERS COALITION
ON A MISSION TO REDUCE EMISSIONS IN NEW ZEALAND

SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

thinkstep-anz