A Carbon Positive Roadmap for the built environment

Stage 1: Commercial, institutional, and government buildings and fitouts

For discussion

June 2018

Carbon Positive Partners

green building council australia

Established in 2002, the Green Building Council of Australia is the nation's authority on sustainable buildings, communities and cities. Our vision is to create healthy, resilient and positive places for people and the natural environment. Our purpose is to lead the sustainable transformation of Australia's built environment. To do this, we:

Rate the sustainability of buildings and communities through Australia's only national, voluntary, holistic rating system – Green Star.

Educate industry and government practitioners and decision-makers, and promote green building programs, technologies, design practices and operations.

Advocate policies and programs that support our vision and purpose.

The GBCA represents over 600 individual companies with a collective annual turnover of more than $40 billion.

Our membership reflects the diversity of Australian business with over 500 small-to-medium enterprises through to 80 companies with annual turnover of more than $100 million and 24 companies now listed in the ASX200, with a combined market capitalisation of more than $620 billion. Members include major developers, professional services firms, banks, superannuation funds, product manufacturers, retailers and suppliers. We also have 40 local government, 26 state government departments and land organisations, and 18 university members.

GBCA company members alone employ more than 50,000 staff across Australia. Our professional development program boasts over 1,200 people advancing their careers and building their skills through their membership with the GBCA.

Contributors

Our thanks to Rachael McGinley, Project member; Naomi Martin, Project member; and Jorge Chapa, Project Sponsor for their contributions alongside all those organisations who were consulted and provided advice as part of this report.

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A roadmap for industry

The Green Building Council of Australia (GBCA) was established in 2002. Since that time we have developed global rating tools which are respected around the world, and we have forged strong networks and built a strong reputation within industry and government. By working collaboratively to drive the uptake of the Green Star rating system, we have encouraged leadership, transformed industry practice and created enduring value for asset owners, investors, managers and the people who live, work and play in buildings.

Last year at Green Cities we released a discussion paper reflecting our ambition to drive industry to a carbon positive future. The document outlined high-level principles and sought consensus on actions that the built environment must take to meet our climate-related commitments.

We have now developed a draft roadmap for industry feedback. The draft roadmap outlines high-level outcomes, actions, targets, advocacy positions and proposed changes to Green Star over the next decade. The targets and positions outlined in the roadmap should be considered as tentative and draft.

The roadmap is limited to commercial, institutional and government buildings and fitouts. The next release of this roadmap to be released in 2019 will also address the residential sector and the precinct scale.

We will update the roadmap every 12 to 18 months as new information is available, practices change, or other areas of opportunity are identified. While care has been taken to ensure the information in this document is accurate, it may change based on regular industry feedback.

A roadmap by industry

Thanks to our Carbon Positive Partners

We thank the following members of our Greenhouse Gas Emissions Expert Reference Panel for their direction and support in the development of this version of the roadmap.

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Appendix A outlines the participants in our workshops held in 2017.

A roadmap for leadership[1]

- Australia has signed on to the Paris Climate Change Agreement, committing to keep global warming below 1.5C to 2C. In parallel, state and territory governments have committed to targets to decarbonise their economies by 2050 or soon after.
- Australia has endorsed the 17 Sustainable Development Goals (SDGs) – a roadmap for global development efforts to 2030 and beyond. The SDGs require action to combat climate change and transition to a low carbon future.
- Industry is adopting these targets and goals to help manage risk and inform investment and development decisions. Boards are expected to report on carbon trajectories in part due to international guidelines[1]. Large investors are seeking assets that can demonstrate their contribution to helping deliver the targets in the Paris Climate Change Agreement.[2]
- The built environment should decarbonise earlier than most sectors in the economy given there are comparatively greater opportunities and lower costs for it to do so. The built environment is well placed to follow a trajectory for carbon reduction that helps keep global warming below the more stringent 1.5C target (a '1.5℃ trajectory').
- Demonstrating a commitment to keep global warming below 1.5C will become a competitive advantage for industry leaders. Government support to achieving this goal will continue to ensure Australia's competitiveness and attractiveness for investment. It will also reduce carbon related risks as they continue to come to the forefront of investment decisions and regulation.
- Whether you are a developer, owner, professional, product manufacturer, building occupant or policy maker, this roadmap will help you lead in the delivery of a more sustainable built environment.
- This is a living document, it will be updated as more information becomes available. It has been developed to provide guidance for the commercial[3], institutional and government sector. A second stage that builds on the outcomes and actions in this roadmap is in development and will cover precincts, infrastructure and the residential sector. It will be released in 2019.

What the roadmap tells us

- New buildings and fitouts[4] must have no greenhouse gas emissions from their operations by no later than 2030. Existing buildings and fitouts must have no greenhouse gas emissions from their operations by 2050 or earlier.
- Green Star will be updated[5] to provide leadership and guidance to achieve these targets sooner.
- For buildings:

  From 2020, all new buildings seeking a Green Star rating will:

  - be required to commit to a Green Star – Performance rating
  - be required to reduce their embodied carbon by 10%
  - be incentivised to select carbon neutral products and services
  - be incentivised to offset their embodied carbon and other emissions

1 Boards are increasingly aware of the importance of their companies reporting on carbon trajectories in line with international guidelines, legal opinion and good risk management. See References (11).
2 More information on these trends is contained in Appendix C.
3 Industrial facilities, data centres, and other specialty buildings have contractual engagements or use cases that make implementing some targets in this roadmap difficult. Companies in this sector are encouraged to review this roadmap and provide feedback.
4 Otherwise referred to as the 'whole building'.
5 The requirements outlined in this document may be subject to change as the development of each Green Star update proceeds. They are provided in this roadmap as best estimate of when they should become applicable to the rating system.

- From 2020, all new buildings seeking a 6 star Green Star rating will:
  - be required to use 100% renewable electricity, either generated on-site or procured from off-site
  - be required to be 40-50% more energy efficient than today's building code requirements
  - be incentivised to put measures in place to support the decarbonisation of the grid, such as storage.
- From 2026, all new buildings seeking any Green Star rating will need to meet all the above requirements.
- By 2030, all existing buildings seeking a Green Star rating will need to meet the above requirements. For existing buildings seeking a higher rating some requirements will need to be met earlier than 2030[6].
- For fitouts:

  From 2020, all new fitouts seeking a Green Star rating will:
  - be required to commit to an operational energy rating
  - be required to reduce their embodied carbon by 10%
  - be incentivised to select carbon neutral products and services.
  - be incentivised to offset their embodied carbon and other emissions.
- From 2020, all new fitouts seeking a 6 star Green Star rating will be required to:
  - use 100% renewable electricity, either generated on-site or procured from off-site
  - be in a building with, or committed to, a Green Star – Performance rating or a high NABERS Energy rating.
- By 2030, all new fitouts seeking any Green Star rating will need to meet all the above requirements.

Buildings and tenancies

Achieving the 2030 and 2050 targets requires a whole-of-building approach. Government, education, health, and other assets where the building owner has control over the fitout's energy use already follow this approach. However, buildings where there is a contractual relationship with another party across most of the spaces that will be occupied, do not.

This roadmap acknowledges the contractual, policy, and commercial barriers that discourage joint action between building owners and tenants to address emissions. This roadmap aims to begin breaching these barriers by first incentivising, then requiring collaboration between all parties to share energy data, encourage the use of operational ratings, and drive both parties to use renewable energy. As such, the roadmap also proposes the following targets:

- For both buildings and fitouts seeking a Green Star rating:
  - From 2020 onwards, building and fitout owners will be incentivised to commit to disclose energy information, seek operational fitout ratings, use renewables, and address other emission sources.
  - From 2030 onwards, building and fitouts owners will be required to commit to achieving the above goal.

GBCA is seeking feedback on the following key issues:

- What barriers, legal, policy, or commercial, exist to achieving this goal?
- What opportunities exist within Green Star to drive this change?
- How likely is this target to be met?

Why is this roadmap important to you?

Developers, building owners, investors	Professional services, contractors, facility managers, builders	Product manufacturers, suppliers, service providers, utilities	Occupants, corporates, institutions	Government, NGOs, influencers[7]
What is your role in the built environment?				
• You build, own or finance commercial, institutional or government buildings in Australia.	• You help build, design, or manage commercial, institutional or government buildings and fitouts.	• You provide materials, goods or services for the design, construction or operation of buildings and fitouts.	• You own, occupy or lease high quality spaces in buildings.	• You set the policy, regulations and conditions that influence the design, construction and operations of buildings.
What do you gain from the Carbon Positive Roadmap?				
• A clear set of targets to follow to ensure your organisation is a leader in addressing climate change and attract like-minded customers. • A vehicle to demonstrate leadership by adopting this roadmap in your strategy. • Confidence that the assets you own, build or invest in have a lower risk profile against future carbon and energy policies.	• Clarity on requirements that your clients will be aiming to meet over time and how you can align your offering to best match your clients' needs. • Insight to ensure your organisation, and its clients are ahead of the game. • Knowledge of long-term targets to help you better manage your buildings, properties and portfolios.	• Clear goals for reducing the carbon intensity of products and services, and an ability to market to these leading organisations. • Opportunities to create new services to meet growing demand for low or zero carbon energy on and offsite. • An understanding of how the building industry intends to address carbon impacts, and the ability to provide product transparency and reporting.	• Understanding of best practice in green buildings to help you to demand quality assets in line with a 1.5°C trajectory. • Assurance that certified assets are supporting your own organisational carbon reduction targets. • The opportunity to work with building owners to drive down carbon emissions from existing buildings.	• Established targets by which the built environment and its supply chain must decarbonise. • The chance to create incentives to drive the built environment to meet a 2050 target. • Opportunities to remove barriers to renewable energy installations, purchasing and distribution.

6 Appendix F details the proposed changes to Green Star in more detail.

7 Governments should support the delivery of this roadmap through complementary policy settings that incentivise action and remove obstacles to the delivery of these goals. This roadmap outlines those key areas for government leadership to be delivered collaboratively with industry and other stakeholders to support a new market demand for change.

What does the roadmap tell you?

- The roadmap sets out five goals to drive a permanent transition to buildings and fitouts that operate with no greenhouse gas emissions; and use renewable energy for all its needs. These outcomes achieve this, while also providing high quality and resilient spaces for occupants.
- It lists ten actions that all building owners and tenants can take to achieve this transition.
- The roadmap practically addresses issues associated with:

  - total and peak energy demand
  - source of energy
  - measures to support grid decarbonisation
  - tenant and building owner relationship
  - the embodied carbon in products and services
  - the phase-out of refrigerants
  - emissions from transport, water consumption and waste
  - offsets where relevant[8].

- The roadmap identifies targets for both Green Star rated and all other buildings and fitouts. It sets both leadership targets and the maximum dates by which all buildings and fitouts must deliver these targets[9].
- To support the transition of the rest of the built environment, the roadmap proposes a range of policy positions for industry to support. It calls for:

  - a forward trajectory of upgrades to energy efficiency requirements in the national construction code
  - an expansion of requirements for the mandatory disclosure of energy efficiency in buildings and fitouts
  - for broader reforms in the energy sector
  - for practical incentives to support building upgrades and retrofits
  - and for the development of carbon neutral products and services.[10]

8 Appendix B addresses the emission scopes and provides additional discussion on offsets.
9 Appendix D details the role of Green Star in transforming the built environment.
10 Appendix G details the policy actions proposed.

How was the roadmap developed?

- The roadmap was developed as a response to GBCA's vision of healthy, resilient and positive places for people and the natural environment.
- The roadmap is the result of industry and government consultation and engagement. A discussion paper was released in March 2017, followed by five workshops with over 150 participants providing advice and feedback across five major cities.
- It builds on previous work undertaken by ClimateWorks[11], ASBEC[12], WorldGBC[13], and the Global Alliance for Building and Construction[14]. It also relies on published analysis from the International Energy Agency[15] and the International Panel on Climate Change[16].
- EY carried out further engagement workshops and one-on-one sessions on behalf of GBCA. EY also undertook a detailed analysis of domestic and international carbon reduction strategies, trajectories and the emissions reduction potential of the Australian property sector. EY's report of principles and recommendations is available on GBCA's website.
- AECOM were engaged to deliver four case studies showing whether buildings could achieve the outcomes of the roadmap. Their recommendations were incorporated into this discussion paper.
- This work was then refined with the assistance of GBCA members with relevant expertise. The roadmap follows a set of principles developed with the assistance of EY and included in Appendix E.
- The roadmap was developed with the assistance of our Technical Advisory Group, our Industry Advisory Group, Green Star Steering Committee, and our Greenhouse Gas Emissions Expert Reference Panel.

11 "Pathways to deep decarbonisation", Climateworks, 2014
12 "Low carbon, high performance", ASBEC, 2016
13 "Advancing Net Zero", WorldGBC, 2017
14 "Towards low-ghg and resilient buildings", GABC, 2016
15 "Market Report Series: Energy Efficiency 2017", IEA, 2017
16 "2014: Buildings. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change", IPCC, 2014

Measures to support the decarbonisation of the electricity grid

The interaction between the built environment and the grid is an aspect that will need to be explored over the next few years.

This roadmap expects that buildings will become dynamic and responsive components of local, regional, and national energy systems. The roadmap aims to have buildings use clean energy and to consider the state of the grid when consuming it. In other words, we expect buildings to be more aware of how clean, or dirty, the grid is and manage appropriately.

Based on the recent experiences in places with a high degree of renewable energy in the grid, such as California, the role of energy storage and smart grid interactions are arguably more important at the building level than on-site generating solutions. Therefore, simply generating energy and exporting energy to a 'net' value would not necessarily suffice to meet the targets in this document.

Within this document, the interaction with the grid is referred to as 'measures to support the decarbonisation of the grid'. Specific examples of these measures include a mix of on-site or offsite procurement of renewable electricity combined with demand response systems, energy storage, smart peak management controls, and other similar solutions.

Details of how these will be resolved are not covered by this document. These will be the subject of additional revisions to the roadmap over the next few years. We are seeking your feedback on:

- What is a building's role in decarbonising the grid?
- Are there standards that should be implemented?
- What is the level of performance that should be expected in a world-leading building?

What are the next steps?

The targets and actions in this document are being presented to industry for discussion.

Feedback on this document should be provided to GBCA by the end of August 2018. Feedback can be provided via email to greenstar@gbca.org.au.

We are seeking your seeking feedback on the following key issues:

- Does this document present a feasible set of actions for reducing carbon in buildings and fitouts?
- Are the targets for the distinct Green Star ratings technically achievable?
- Are the targets for the distinct Green Star ratings commercially viable? Will they work in all sectors?
- How will the interaction between the grid and the built environment impact the possibility of these goals being met?
- What challenges do you foresee in the implementation of this roadmap, and how would you propose to address these?
- Are there any other aspects that you would like to comment on?

A carbon positive roadmap for buildings and fitouts

The built environment needs to adopt a 1.5℃ target as outlined in the Paris Climate Change Agreement. This means:

New buildings and fitouts must have no carbon emissions from their operations by 2030. Existing buildings and fitouts must have no carbon emissions from their operations by 2050 or earlier.

We can achieve these targets by facilitating a transition to buildings and fitouts that are built, refurbished and operated with no greenhouse gas emissions. To do so, we must collectively:

- commit to a permanent transition to buildings and fitouts with no greenhouse gas emissions
- switch to, install, or procure renewable energy and support the decarbonisation of the grid
- build, operate, or occupy low energy intensive buildings and fitouts
- adopt net zero carbon products, materials and services
- support the transition to electric vehicles.

To achieve this ambitious vision and the goals outlined in this roadmap, building and fitout owners should adopt the following actions:

1. Adopt a vision for a zero emissions built environment by 2050.
2. Measure, disclose, collaborate on, and improve, the ongoing performance of building and fitouts.
3. Power buildings and fitouts with 100% renewable electricity, and switch away from fossil fuel use.
4. Increase the use of on-site, or near site, renewables, and measures to support the decarbonisation of the grid.
5. Reduce building and fitout energy demand by prioritising passive design, demand control, and efficient systems.
6. Stimulate markets for carbon neutral products and services.
7. Phase down refrigerants with a high global warming potential.
8. Support high quality offsets for remaining emissions as a transition strategy.
9. Increase access to active transport facilities and public transport.
10. Support the adoption of electric vehicles.

Leading with GBCA & Green Star

To help deliver our vision and support industry in the delivery of these actions, GBCA will:

- Set leading targets through Green Star to ensure all new and existing rated assets from 2020 onwards have no greenhouse gas emissions from their operations by 2030.
- Transform the rest of the built environment by promoting policies to retrofit existing buildings, improve new buildings, increase the supply of renewable energy, and phase out fossil fuel use.
- Support, train and build capacity for sustainable building design, construction and operation.
- Seek commitments and create a market from occupants and institutions to occupy buildings within this trajectory.
- Research, monitor and report on progress against the goals set out in the roadmap.

A carbon positive roadmap for commercial*, institutional, and government buildings

Outcome	Action	Green Star **Buildings registering from this date will be encouraged to:**	2020	2023	2026	2028	2030	2035	2040	2050	Advocacy
Commit to a permanent transition to buildings and fitouts with no greenhouse gas emissions	Adopt a vision for a zero emissions built environment	(All) work with tenants to disclose[1] energy information, seek operational fitout ratings[2], use renewables, and address other emission sources	All ratings		All ratings		All buildings				In consultation with industry, establish a national plan towards 2050 zero carbon buildings and establish responsibilities at the ministry level. Expand mandatory disclosure to new sectors, with a priority focus on tenancies & fitouts.
	Measure, disclose, collaborate on, and improve, the ongoing performance of building and fitouts	(Existing) be fitted out with smart meters.	6 star	5 star	4 star		All buildings				Improve access to energy consumption data requiring energy metering and sub-metering for all buildings by 2030. Introduce requirements in the NCC for all new buildings to be commissioned and tuned from 2025 onwards.
		(New) be commission and tuned	All ratings				All buildings				
		(New) continue to use Green Star – Performance[3].	All ratings				All buildings				
Switch to, install, or procure renewable energy, and support the decarbonisation of the grid	Power buildings and fitouts with 100% renewable electricity and switch away from fossil fuel use	(New) be fully powered by renewables once they are built	6 star	5 star	4 star					All buildings	Reform policy and markets as necessary to: increase the uptake of storage and renewable energy; facilitate district-based utilities; address energy market barriers; ensure and provide fair tariff structures and value for distributed solutions; and improve access to networks. National energy policy delivers long-term certainty, incentivises investment in storage and renewables, and provides clarity on the attributes of any certificates or tracking mechanism used for renewable energy distribution. Incentivise the replacement of non-electric appliances including natural gas, and avoid incentivising installation of non-electric appliances. Require on-site storage and on-site renewable energy as part of upgrades to the NCC in 2025.
		(New) be fossil fuel free[4]	6 star	5 star	4 star					All buildings	
		(Existing) be fully powered by renewables and have a plan to transition away from fossil fuels	6 star	5 star	4 star					All buildings	
	Increase the use of on-site, or near site, renewables, and measures to support the decarbonisation of the grid[5]	(All) have on-site, or access to near-site, renewables[5], install battery storage systems, or technologies that promote grid decarbonisation.	All ratings		All buildings					All buildings	
Build, operate, or occupy low energy intensive buildings and fitouts	Reduce building and fitout energy demand by prioritising passive design, demand control, and energy efficient systems	(New) have 40 to 50% reduction in total energy demand compared to the 2016 NCC[6]	6 star	5 star	4 star		All buildings				Support the upgrade of the National Construction Code's energy performance standards and trajectory consistent with ASBEC's proposal. Introduce ambitious targets and incentives to achieve energy demand reductions of 20 to 30% for all buildings by 2035.
		(Existing) have 40 to 50% reduction in energy consumption over an average building[6]			6 star		5 star	4 star		All buildings	
Adopt zero carbon materials, products, and services	Stimulate markets for carbon neutral products and services	(New) reduce by 10% their embodied carbon against a reference building[7]	6 star	5 star	4 star		All buildings				Expand the reach of the National Carbon Offset Standard to cover a larger share of building products and materials In collaboration with industry lead a review of opportunities to reduce embodied carbon in building products and through the supply chain. Incentivise the phase-down of high-Global Warming Potential (GWP) refrigerants, e.g. in HVAC systems. Lead a review of the availability and market for domestic carbon offsets in Australia, and to identify opportunities to use offsets as part of an incentivise mechanism to encourage building upgrades.
		(New) reduce by 20% their embodied carbon against a reference building[7]	6 star	5 star	4 star			All buildings			
		(All) select carbon neutral products and services	All ratings								
	Increase the use of low-GWP refrigerants	(All) phase down high-GWP refrigerants in existing buildings	6 star	5 star	4 star	All ratings		All buildings	All buildings		
	Support high quality offsets for remaining emissions as a transition strategy	(New) offset total remaining embodied carbon emissions from construction.	6 star	5 star	4 star					All buildings	
		(Existing) offset total remaining carbon emissions from building operations	6 star	5 star	4 star					All buildings	
Support the transition to electric vehicles	Increase access to active transport facilities and public transport	(All) increase access to active transport facilities, and advocate for the improvement of local cycling infrastructure.	6 star	5 & 4 star	All ratings		All buildings				Support better governance for improved decisions, ongoing investment, long-term integrated planning and sustainable development across our major cities and urban growth areas. Prioritise policies that incentivise and better value active transport infrastructure consistent with the broader social, economic, and environmental benefits it provides. Support mechanisms designed to reduce the use of private fossil fuel vehicles (e.g. congestion pricing) and incentivise the increasing adoption of electric vehicles (e.g. charging infrastructure).
	Support the adoption of electric vehicles	(New) provide or pre-install electric vehicle charging infrastructure	6 star	5 & 4 star			All buildings				
		(Existing) provide electric vehicle charging infrastructure			6 star		5 star	4 star		All buildings	

New rated. Registration date · New all. DA Approval · Existing rated. Certification date · All buildings. Target met

Engagement & Support

Create demand

- Set NABERS Energy or Green Star - Performance targets for all government owned buildings and fitouts.
- Seek pledges and commitments from corporate and institutional partners to set Green Star (for new and existing) targets for all owned or leased buildings
- Agree with ASBEC and other partners to support the roadmap
- Distribute roadmap to regional and international partners

Develop skills to deliver the future

- Facilitate knowledge transfer of existing proven technology and practices through case studies and
- Partner with stakeholder to deliver a training program focused on delivering a carbon positive future
- Deliver critical training through our courses, events, and forums on driving change in line with this roadmap.

Communicate a vision and progress

- Create a targeted communications campaign around the aspirations of the roadmap.
- Collect and capture data to be used as evidence.
- Writing regular reports - including demonstrating the business case and value
- Regular review of the carbon positive roadmap, and review against targets.

Appendix I provides two versions of this roadmap, one for new buildings, and one for existing buildings.

Notes

* Industrial facilities, data centres, and other specialty buildings have contractual engagements or use cases that make implementing some targets in this roadmap difficult.

[1] Or other commitment forms, such green leasing clauses, operational manuals, fitouts guides, etc.

[2] Where available.

[3] This will required of new buildings seeking a Green Star rating registering under Future Focus.

[4] With some minor exceptions allowed. Any minor fossil fuel must be offset

[5] On-site renewables will be required where appropriate access for sufficient generation is available on site. Rules will be created as part of the development process.

[6] Equivalent to 5.5 star NABERS Energy in commercial buildings, 5 star NABERS energy in retail centres, or similar.

[7] The reference building will not include operational energy in its embodied carbon calculation. See 'Responsible Carbon Impacts' Innovation Challenge for more information.

A carbon positive roadmap for commercial, institutional, and government fitouts

	Action	Green Star	Fitouts registering from: 2020 2023 2026 2028 2030 2035 2040 2050	Advocacy
Commit to a permanent transition to buildings and fitouts with no greenhouse gas emissions	Adopt a vision for a zero emissions built environment	Agree to requirements[2] that: • encourage all parties to share energy consumption information and reduce energy consumption of base building • introduce limits on waste stream contamination from occupants. • introduce water use consideration, including from active transport facilities.	6 star 5 star 4 star — All fitouts	In consultation with industry, establish a national plan towards 2050 zero carbon buildings and establish responsibilities at the ministry level. Improve access to energy consumption data requiring energy metering and sub-metering for all buildings by 2030. Introduce requirements in the NCC for all new fitouts to be commissioned and tuned from 2025 onwards. Expand mandatory disclosure to new sectors, with a priority focus on tenancies & fitouts.
	Measure, improve, and disclose the ongoing performance of whole buildings	Fitouts smart metering and monitoring solutions	All ratings — All fitouts	
		Fitouts are commissioned and tuned and work with the base building to address any outstanding issues.	All ratings — All fitouts	
		Seek, obtain and disclose an operational fitout energy or holistic rating[3]	All ratings — All fitouts	
Switch to, install, or procure renewable energy, and support the decarbonisation of the grid	Power buildings with 100% renewable electricity and switch away from fossil fuel use.	Fitouts registering from this date will need to be fully powered by renewables	6 star 5 star 4 star — All fitouts	Reform policy and markets as necessary to: increase the uptake of renewable energy; facilitate district-based utilities; address energy market barriers; ensure and provide fair tariff structures and value for distributed solutions; and improve access to networks. National energy policy delivers long-term certainty, incentivises investment in storage and renewables, and provides clarity on the attributes of any certificates or tracking mechanism used for renewable energy distribution. Incentivise the replacement of non-electric appliances including natural gas, and avoid incentivising installation of non-electric appliances.
		Fitouts registering from this date are in buildings fully powered by renewables	6 star 5 star 4 star — All fitouts	
		Fitout, and backup, generators are replaced with non-fossil fuel solutions.	6 star 5 star 4 star — All fitouts	
		Fossil fuel use from cooking or other uses is eliminated within the fitout space or offset.	6 star 5 star 4 star — All fitouts	
Build, operate, or occupy low energy intensive buildings and fitouts	Reduce building total and peak energy demand by prioritising passive design, demand control, and energy efficient systems	Select buildings with a low base building energy use and are certified with a Green Star – Performance rating[1].	6 star 5 star 4 star — All fitouts	Expand, strengthen and accelerate future improvement in minimum equipment and appliance standards.
		Install energy efficient equipment, computers, lighting, and appliances.	6 star 5 star 4 star — All fitouts	
Zero carbon materials, products, and services	Stimulate markets for carbon neutral products and services	Reduction of 10% embodied carbon emissions against a reference fitout[4]	6 star 5 star 4 star — All fitouts	Expand the reach of the National Carbon Offset Standard for products to cover a larger share of building products and materials. In collaboration with industry lead a review of opportunities to reduce embodied carbon in building products and through the supply chain. Incentivise the phase-down of high-Global Warming Potential (GWP) refrigerants, e.g. in HVAC systems. Lead a review of the availability and market for domestic carbon offsets in Australia, and to identify opportunities to use offsets as part of an incentivise mechanism
		Selection of carbon neutral products and services credit introduced in 2019.	All ratings	
	Increase the use of low-GWP refrigerants	Install supplementary systems with low-GWP refrigerants	6 star 5 star 4 star — All fitouts	
	Support high quality offsets for remaining emissions as a transition strategy	Offset total remaining carbon emissions from fitout construction and operations	6 star 5 star 4 star — All fitouts	
		Offset total remaining carbon emissions from organisation activities.	6 star 5 star 4 star — All fitouts	
Support the transition to electric vehicles	Increase access to active transport facilities and public transport	Select buildings with active transport facilities	6 star 5 star 4 star — All fitouts	
		Limit use of car parking spaces[2] in buildings.	6 star 5 star 4 star — All fitouts	
	Promote the electrification of vehicles	A proportion of leased car parking spaces should be electric vehicle ready.	6 star 5 star 4 star — All fitouts	

New rated. Registration date · New all. DA Approval · Existing rated. Certification date · All buildings. Target met

Engagement & Support

Create demand

- Set NABERS Energy or Green Star - Performance targets for all government owned buildings and fitouts.
- Seek pledges and commitments from corporate and institutional partners to set Green Star (for new and existing) targets for all owned or leased buildings
- Agree with ASBEC and other partners to support the roadmap
- Distribute roadmap to regional and international partners

Develop skills to deliver the future

- Facilitate knowledge transfer of existing proven technology and practices through case studies and
- Partner with stakeholder to deliver a training program focused on delivering a carbon positive future
- Deliver critical training through our courses, events, and forums on driving change in line with this roadmap.

Communicate a vision and progress

- Create a targeted communications campaign around the aspirations of the roadmap.
- Collect and capture data to be used as evidence.
- Writing regular reports - including demonstrating the business case and value
- Regular review of the carbon positive roadmap, and review against targets.

Notes

[1] Or that are on that trajectory to achieve a 5.5 NABERS Energy rating within 5 years

[2] This may take shape of green lease clauses, fitout guides, or other similar documents.

[3] Where available.

[4] The reference fitout will not include operational energy in its embodied carbon calculation. See 'Responsible Carbon Impacts' Innovation Challenge for more information.

A Global Commitment for Net Zero Carbon Buildings

To support the goals in the Paris Agreement, the World Green Building Council, C40, and the Climate Group, as part of the We Mean Business Coalition, will launch a global commitment for net zero carbon buildings in September 2018.

GBCA is proud to support this global commitment for net zero buildings.

The commitment calls on building owners, occupants, cities, states, and their associated entities to globally commit to delivering a built environment that is energy efficient, powered by renewables, and supports the decarbonisation of the grid.

The Carbon Positive Roadmap proposes that all existing buildings and fitouts with a Green Star – Performance rating, and any future new buildings and fitouts with a Green Star rating, will be required to achieve the goals of this commitment. As such, by being in a Green Star rated asset, you can be sure you are owning, developing, or occupying buildings and fitouts that are complying with this commitment and more.

To support this commitment, GBCA is launching a Green Star Carbon Positive Pledge. This Pledge will assist stakeholders to clearly identify leaders in the space across our membership.

If you would like more information on the commitment and the pledge, contact our Market Engagement team or Public Affairs team.

The impact of following this roadmap

This roadmap represents a significant increase in performance for buildings and fitouts over the next decade due to the collective actions and targets that are being proposed. However, the built environment is taking action to address these targets. For example, 6 star Green Star rated buildings are already required to achieve an improvement of 40% over current code to achieve a rating. Most already exceed this requirement, with a typical energy reduction of 50% to 60%.

Out of the 116 6 Star ratings achieved since 2012, 30% are currently achieving this requirement in the commercial, retail, education, and public building sectors. 100% use of renewables is already taking place in many parts of the built environment, including buildings and fitouts. There are a dozen Green Star rated buildings fully powered through on-site renewables, particularly in the education sector, and a few more in the pipeline, including at least one shopping centre.

Off-site procurement of renewables is now common across Green Star rated buildings. For example, the first 6 Star Green Star – Design & As Built building, Floth offices in Brisbane, is fully powered by GreenPower. LG Super also recently achieved the 'Powered by Renewables' Innovation Challenge for their portfolio. This was achieved through their commitment to purchase GreenPower for all building operations.

There has been an increase in power purchasing agreements (PPA) in the built environment. PPA's for Sydney Metro, UNSW, and the Melbourne energy buyer's forum are examples of successful agreements that have brought the cost of renewables at parity or lower than grid electricity.

The technologies to address natural gas use in buildings already exist and are well known. For example, Monash University is undergoing an electrification exercise to move all its buildings to gas. This strategy is seen in multiple buildings in other countries, such as The EDGE in Netherlands.

The cost impacts of offsetting embodied carbon can be calculated thanks to the increase in data available through the Impact from Materials credit in Green Star. A survey of submissions for this credit indicates that assuming a high offset cost of $17 per ton, a typical commercial building will incur an extra cost of 0.1% to offset its carbon.

A review of the increases in capital costs due to the combined measures of a building in 2023 compared to a 6 star Green Star rated buildings would result in an increase of 0.2%[17].

The long-term benefits of following this roadmap will be significant as noted in the next section.

The benefits of following the roadmap

There are significant benefits of reducing carbon emissions from the built environment in a manner that can drivemore healthy, resilient and valuable buildings. These can be grouped loosely around three key areas:

	Cities	Buildings	People	Governments
1. Climate change and environment	• Resilient to heat waves • Reduced urban heat island effect	• Resilient to heat waves and infrastructure failures	• Reduced impact from climate change	• Disaster resilience • COP21 targets met • SDG met
2. Health and wellbeing	• Reduction in pollution • Reduced obesity and health costs due to better active transport infrastructure.	• Better air quality • Reduced noise	• Increased comfort • Reduced heat stress • Reduced asthma and allergies • Reduced noise	• Reduced spending on health systems
3. Value and economic impact	• Reduced energy use and energy infrastructure • Increased energy access • Attraction of investment • Resilience to heat waves • Reduced water infrastructure	• Enhanced value to buildings • Energy savings • Management of own infrastructure • Better service to occupants • Diversified business opportunities (through energy generation, embedded networks, and reliability solutions)	• Increased productivity • Increased energy security • Guarantee of amenity and service	• Increased investment and employment • Energy security and reduction in total energy demand • Increase in competitive advantage

Adapted from Table 9.7, IPCC, 2014: Buildings. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

17 "Carbon Positive Roadmap, Technical review and recommendations", AECOM, 2018

The Sustainable Development Goals and this roadmap

Target

(15.1) …ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems…

(15.2) promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally

(13.1) Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters…

(13.2) Integrate climate change measures into national policies, strategies and planning

(13.3) Improve education, awareness-raising and human and institutional capacity on climate change …

(13.a) Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change …

(1.5) Reduce exposure and vulnerability to climate-related extreme events

(3.9) …substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination…

(4.7) …all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development…

(6.4) …increase water-use efficiency across all sectors…

(7.1) …ensure universal access to affordable, reliable and modern energy services

(7.2) …increase substantially the share of renewable energy in the global energy mix

(7.3) …double the global rate of improvement in energy efficiency

(7.a) …enhance international cooperation to facilitate access to clean energy research and technology … and promote investment in energy infrastructure and clean energy technology.

(7.b) …expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries.

(8.2) Achieve higher levels of economic productivity through diversification, technological upgrading and innovation…

(8.4) …endeavour to decouple economic growth from environmental degradation…

(9.1) Develop quality, reliable, sustainable and resilient infrastructure…

(9.4) upgrade infrastructure and retrofit industries to make them sustainable…

(9.a) Facilitate sustainable and resilient infrastructure development in developing countries…

(9.b) Support domestic technology development, research and innovation in developing countries…

(11.2) By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all…

(11.6) By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

(12.1) Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns…

(12.2) achieve the sustainable management and efficient use of natural resources

(12.5) substantially reduce waste generation…

(12.7) Promote public procurement practices that are sustainable…

Let’s work together to help deliver a carbon positive built environment

- Green Star has a leading role in driving the changes required by the roadmap. Be involved as we update Green Star rating tools as required by the targets and goals.
- Help us deliver a roadmap for residential buildings and the precinct scale. Join us in workshops, by providing feedback, and sponsoring the next stage of the roadmap.
- Support GBCA’s policy platform and training programs to help drive change.
- Partner with us to deliver skills, services, and mechanisms to drive change in industry.
- Occupants and tenants must demand the standards outlined in the roadmap.
- Seek the support of government to make the necessary changes to policy and codes.
- Help us build a market for zero carbon products and services.
- Support us by becoming a carbon positive partner.

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13. Minter Ellison. Memorandum of Opinion: Climate Change and Director’s duties. 2016.

Appendix A: Workshop participants and feedback received

We would like to thank the following organisations for providing written feedback for the first discussion paper.

- Multiplex Construction
- 3ARK
- University of SA
- Frasers Property Australia
- CRC for Low Carbon Living
- WWF Australia
- Australian Forest Products Association
- Mirvac
- Lendlease
- UNSW
- University of Melbourne

We would like to thank the following organisations for attending our consultation workshops throughout Australia.

- 3ARK
- AECOM
- AIRAH
- Allens
- AMP Capital Investors
- Architectus Group Pty Ltd,
- Ark Resources
- Arup Australasia
- Aurecon Australasia Pty Ltd
- Australian Forest Products Association
- CBRE
- Centre for International Economics
- Certis Energy,
- Chaney Architecture
- City of Fremantle
- City of Marion
- City of Melbourne
- City of Perth
- CJ Arms
- Cleanaway
- ClimateWorks Australia
- Colliers International Pty Ltd
- Cooperative Research Centre (CRC) for Low Carbon Living
- CSIRO
- CSR
- Cundall
- Cushman & Wakefield
- Cybannac
- D Squared Consulting Pty Ltd
- Department of Environment, Water and Natural Resources
- Department of Finance - Building Management and Works (WA)
- Department of Housing & Public Works (QLD)
- Department of Planning, Transport and Infrastructure (SA)
- Eco3 Pty Ltd
- Edge Environment
- EMF Griffiths
- Engineered Wood Products Association of Australasia
- Floth Pty Ltd
- Frasers Property Australia Pty Ltd
- Full Circle Design Services Pty Ltd
- Good Environmental Choice Australia Ltd
- Greenbase Pty Ltd
- Grun Consulting
- Hutchinson Builders
- Investa Office Management
- ISPT
- J Goddard & Co.
- Jacobs
- JLL
- John Holland Pty Ltd
- JPE Design Studio
- Kluske Consulting
- KPMG Banarra
- LandCorp
- Lendlease
- Macquarie University,
- Mirvac
- Multiplex Construction
- Murdoch University
- NABERS
- National Australia Bank
- Net Zero Design
- Norman Disney & Young
- Pangolin Associates
- Property Council of Australia
- Point Advisory
- Queensland Government
- South Australian Government - Department of Premier and Cabinet
- South Pole Group
- Sustainability Victoria
- Sustainable Architecture Forum
- SustainSA
- Team Catalyst Pty Ltd
- The GPT Group
- The Solar Project
- The University of Melbourne
- The University of New South Wales
- ThomsonAdsett
- University of Adelaide
- Viridis Australasia Pty Ltd
- Westpac Banking Group
- Wood & Grieve Engineers
- WSP
- WT Consultancy
- WWF Australia

Appendix B: Terminology

Carbon neutral & carbon positive

The table below provides definitions the terms used in this document.

	Carbon emissions business as usual	Carbon neutral	Carbon positive
Definition	Refers to the emissions profile of buildings exhibiting improvements due to general trends in energy efficiency and distributed energy largely driven by cost effectiveness	Refers to the emissions profile of buildings that results in no net release of greenhouse gas emissions into the atmosphere. Often achieved with the assistance of offsets. This document refers to the National Carbon Offset Standard for guidance on the carbon boundaries of buildings.	Refers to the emissions profile of buildings which take the following approach to, and go beyond, carbon neutrality: • result in no net emissions of greenhouse gas emissions from operations due to the use of renewable energy • minimise all other emissions, including embodied carbon, • and responsibly offset the rest with targetted offset practices (renewable energy certificates or carbon sequestration offsets).
Outcome	At least 2°C of global warming likely	Aligned with 1.5 - 2°C of warming	Aligned with 1.5°C of warming or less

Emission sources in buildings

For purposes of this document the emissions from buildings are considered the following[18]:	
Direct emissions from buildings (scope 1)	• Fossil fuel consumption in buildings (boilers, cooking equipment, etc). • Natural and synthetic refrigerants
Indirect emissions from building energy consumption (scope 2)	• Electricity consumption by: - Heating, ventilation, and air conditioning systems - Refrigeration equipment - Lighting and other building services (pumps, lifts, etc). - Equipment and plug loads (computers, appliances, etc). • Energy from heating and cooling services provided by utilities and district plants
Indirect emissions from other sources (scope 3)	• Embodied carbon from materials in the building • Emissions from: - the transport of building users to buildings - water use and sewage treatment - waste sent to landfill

18 Adapted from table 1 emissions of GHG from real estate (4) & National Carbon Offset Standard for Buildings (Department of the Environment and Energy, 2017).

Each of these sources contribute to a building's emissions on average, as detailed below:

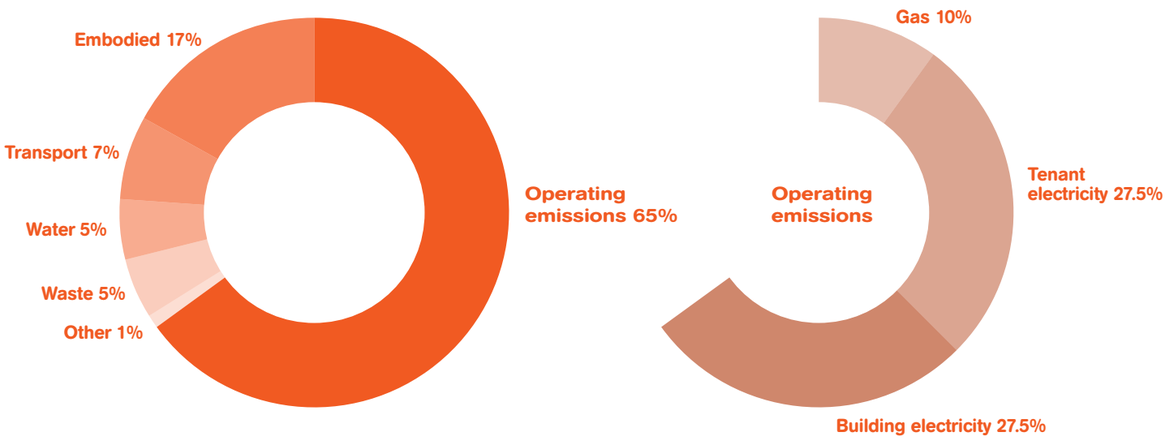


Figure 1 Breakdown of emissions in a typical commercial office building in Sydney

Emissions excluded from this definition at this stage include:

- process loads (industrial activity within a building)
- emissions from procurement activities by occupants (purchase of consumables such as paper in an office)
- emissions from food consumption and production
- emissions from land use and clearing
- emissions from construction equipment.

Offsets and offset units

Offset units are defined by the National Carbon Offset Standard for Buildings as units representing: 'reductions of greenhouse gases or removals of greenhouse gases from the atmosphere by sinks, relative to a business-as usual baseline. Offset units are tradeable and can be used to negate (or offset) all or part of another entity's emissions'.

The question of offsets is a key area of concern for many stakeholders in the built environment. Concerns continue to be raised about the quality of offsets, with differing opinions on the quality of domestic compared to international offsets. Most stakeholders argued that domestic offsets had a higher chance of being additional; however, it was also noted that the Australian offset market is illiquid, meaning international offsets provided cost and accessibility benefits.

The other key point of contention is that offsets can be used to offset electricity emissions with non-domestic carbon reduction mechanisms. While it provides a low-cost mechanism to abate carbon, it was noted that this will not drive advancements in the decarbonisation rate of the Australian grid.

While electricity emissions should be 'offset' through the consumption of renewable electricity either onsite or offsite using PPAs or retiring RECs, some non-electricity based emissions will remain. This is particularly the case for existing buildings where there is use of gas, existing refrigerants or other fuel sources (such as diesel). For these emissions, offsets may be required to ensure a building is aligned with the 1.5–2°C trajectory.

The use of offsets as a transition and development mechanism is valuable, particularly for actions where the carbon generating activity is not directly managed by the asset owner. For example, as manufacturing continues to occur overseas, offsetting those impacts through offsets can be justified. However, the use of offsets must match and align with the organisations business strategy. That is, the location, types, and benefits sought must be relevant to the goals sought at a strategic level.

It is noted that offsets can have additional co-benefits in line with the sustainable development goals. Offsets from land use have co-benefits such as preserving natural ecosystems. They can also serve as a development mechanism to transform infrastructure in developing countries. These are examples of co-benefits available by using offsets[19].

19 https://www.ehp.qld.gov.au/assets/documents/climate/global-offset-markets-analysis-report.pdf

Appendix C: The built environment & climate change[20]

International context for action

The Paris agreement sets a target of 2°C minimum with an expectation that countries will aim to curb emissions on a 1.5°C trajectory. Achieving this goal means that global reductions must be net zero between 2050 and 2100. Such a rate of decarbonisation is a significant change from our current path. This is demonstrated by Figure 3 below that compares three International Energy Agency (IEA) scenarios:

1. Reference Technology Scenario (RTS) which models current climate change commitments and is consistent with a change of approximately 2.7°C by 2100
2. 2°C Scenario (2DS) which models a pathway consistent with 50% chance of limiting climate change to 2°C
3. Beyond 2°C Scenario (B2DS) which modes a pathway consistent with 50% chance of limiting climate change to 1.75°C.

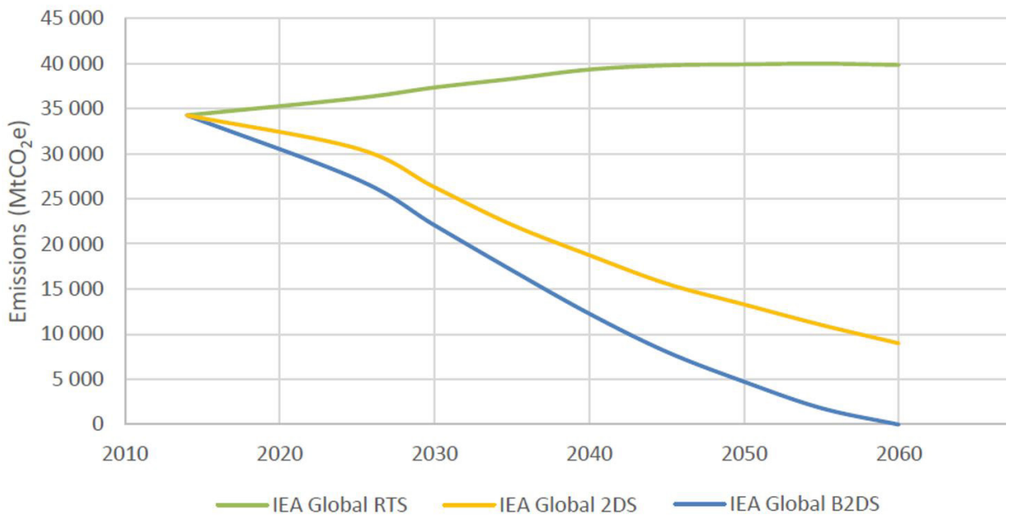


Figure 2 Global science based trajectories

Despite the agreed trajectories and the targets set in the Paris agreements, action to date falls well short of what is required to achieve even a 2°C target. A review of all expected emissions target contributions shows that unless changes occur, global temperatures are likely to be 2.6 to 3.1°C higher than pre-industrial levels[21]. The effects of such a temperature raise would be catastrophic to Australia. Even a 2°C scenario would have dire impacts compared to a 1.5°C scenario[22].

Other countries are taking a leadership action, particularly in Europe. European regions have aligned minimum energy efficiency requirements to long-term GHG emissions targets, such as carbon neutrality by a particular year[23].

In line with this context that action from the civil and corporate sector is taking place. As the effects of climate change become more apparent government and civil organisations and finance actors are moving to act to limit emissions quickly and effectively.

In Europe, many countries are setting ambitious targets aligned with the EU Directive 2010/31/EU:

Country	Sector	Initiatives/target
Netherlands	All	Building codes require all new buildings to reach near zero energy by 2020
Austria	All	Building codes require all new buildings to reach near zero energy by 2020
Denmark	All	Building energy code requires that, nationally, energy consumed by buildings in 2020 is 75 percent less than a 2008 baseline.
Sweden	All	The building code requires that all new buildings are net zero energy by 2020
Finland	Residential	The building code requires all new residential buildings to meet Passive House standards by 2015, en route to achieving near zero energy for all new buildings by 2020
France	All	Building code sets a target for all new buildings to be energy positive by 2020
Germany		Building code requires all new buildings to operate with no fossil fuels by 2020
Ireland	All	Ireland had previously set the most ambitious target for new builds, of net zero energy buildings by 2017. However, the 2017 revision of the building code will implement the near zero energy by 2020 target.

The Global Alliance for Buildings and Construction[24] (GABC) was formed at COP21 to advance the built environment's move to a low carbon future. The GABC released a roadmap for the built environment to set overarching goals to create a resilient global real estate. The roadmap calls for new buildings to be net zero by 2030, and a fully renovated low-energy building stock by 2070 at the latest. The Global Alliance roadmap also notes the importance of driving reductions in materials, and transition away from refrigerants with a high global warming potential. The roadmap calls for a reduction in embodied carbon of 50% by 2030, with refrigerants phased out by 2025.

At the same time, the World Green Building Council (WorldGBC) created the Advancing Net Zero program of which GBCA is part of. In 2017, the program set clear targets and parameters for new and existing buildings. The program calls for all new buildings to eliminate their operating emissions by 2030 and for existing buildings to do so by 2050[25].

The move to recognise the influence and impact to and from climate change is now seen as a material financial risk. In December, the Task Force on Climate-related Financial Disclosures released their recommendations on aspects that needed to be reported by organisations specifically around climate related issues. Key to the disclosures are analysis of scenarios of long term transitional or physical risks from a 2°C scenario or lower. Blackrock investment, the world's largest asset manager, noted that all investors should incorporate climate change awareness into their investment process. This includes considerations for emissions reductions in line or exceeding the Paris Agreement targets[26]. This is similar to advice given by Dutch pension funds APG and PGGM. It is also clear that increasingly the finance industry sees climate related issues not just as a risk, but also as an opportunity[27].

20 Portions of this appendix were adapted from EY's Carbon Positive Technical Study Report available on our website.
21 http://envolverde.cartacapital.com.br/wp-content/uploads/nature18307_proof1.pdf
22 Rogejl, 2016
23 Energy Performance of Buildings Directive (EPBD) http://www.estif.org/policies/epbd0/
24 The GABC was launched in COP21 by 90 organisations including the WorldGBC and the World Resources Institute. It aims to mobilise all stakeholders, including member states and non-state actors from the Buildings and Construction sector to scale up climate actions in the sector.
25 WorldGBC, 2017
26 https://www.blackrock.com/investing/literature/whitepaper/bii-climate-change-2016-us.pdf
27 PCAF, 2017

Domestic developments

The Federal and State Governments have decarbonisation targets that are based on percentage reductions in emissions from a base year. The ambition and base year selected by different state and territory governments varies widely, with the implied rate of decarbonisation of each target varying considerably (Figure 7). However most states have set 100% decarbonisation targets by 2050, with Tasmania and the Northern Territory having 60% reduction targets by the same date. The Federal Government has so far only announced a 2030 reduction target of a 26-28% reduction in national GHG emissions versus 2005, with longer term ambitions still to be agreed.

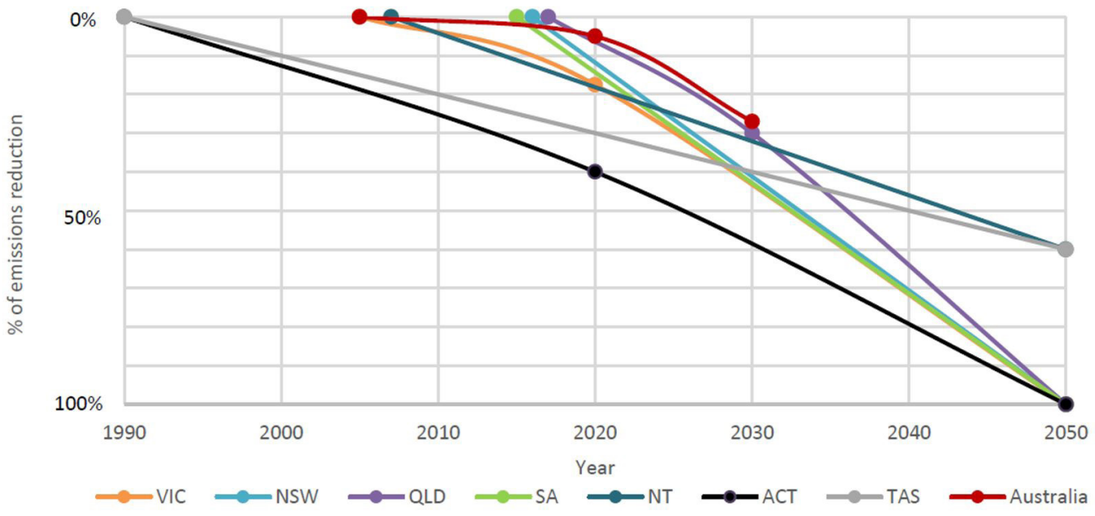


Figure 3 Australian Federal and State Government Targets

Analysis by the Climate Change Authority (CCA) concluded that Australia's appropriate share of the global carbon budget is 1% of the global total, or around 10.1GtCO2e cumulative emissions to 2050. This means that, to stay within the 1.5-2 degree limit and decarbonise at a consistent rate, Australia needs to ultimately achieve an 80% reduction from current levels by 2050. Figure 4 shows the required absolute emissions reduction trajectory for Australia's building sector to achieve this target. Note that this analysis assumes a constant decarbonisation rate across all economic sectors, including the building sector.

Modelling undertaken by Australian Sustainable Built Environment Council (ASBEC) on the potential decarbonisation of the built environment provides a perspective on what is achievable in the property sector. The ASBEC modelling assumes that barriers are removed to allow all appropriate energy efficiency and fuel switching projects, with a positive net present value (NPV), to be implemented. It also assumes that policy settings advantage distributed solar PV, encouraging increased uptake, without requiring full grid decarbonisation. The modelling indicates that the entire buildings sector has the potential to decarbonise by approximately 2045.

ASBEC's Low Carbon, High Performance report outlines a series of policy changes that must occur to drive change in the built environment. This document provides detailed modelling of potential emissions reductions from the building sector, setting out a policy roadmap towards 2050. The report notes "Projected 2050 emissions from buildings can be reduced using existing technology, including energy efficiency measures; switching non-electric equipment and appliances to electricity; and greater use of solar photovoltaic panels." It also notes that "Implementing all of the energy efficiency opportunities identified in this report could deliver over $20 billion in financial savings by 2030, in addition to productivity benefits and improvements in quality of life for Australian businesses and households[28]."

This analysis suggests that the building sector should be on a decarbonisation pathway ahead of the CCA's two degree budget. This reflects the greater potential for and lower cost of abatement available to the building sector as compared to other segments of the Australian economy.

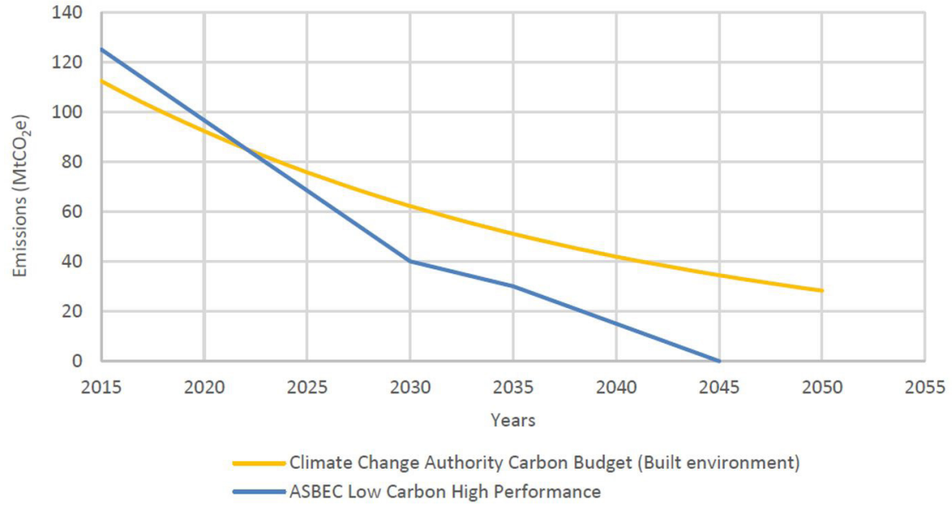


Figure 4 Australian science-based trajectories

In 2017, the Australian Government released the National Carbon Offset Standards for both buildings and precincts (Standards). The Standards provided clear guidance on what emissions should be addressed by buildings and precincts in operation. It provides a framework consistent with international standards, and has been adopted by the private sector, the Property Council of Australia, State government bodies and others. The Green Building Council of Australia and the NSW Office of Environment and Heritage provided significant assistance in the development of the standards.

In addition, there are aspects that exist in Australia's regulatory environment that can be used to build from to decarbonise the built environment. The first is the National Construction Code, which outlines a number of energy efficiency measures that all buildings must follow. While the energy efficiency provisions of the code have not been updated since 2012, an upcoming planned update proposes significant increases in stringency for commercial buildings. It is expected that increases will occur for the residential sector in 2022. Recognising the long-term opportunity, ASBEC is working on a document setting out a trajectory towards 2030 that will be used to influence the long-term development of the code.

Another aspect relevant to Australia is the Federal Government's Commercial Building Disclosure Act, and its use of the NSW Office of Environment and Heritage's NABERS rating system. The Commercial Building Disclosure (CBD) Program is a regulatory program that requires energy efficiency information to be provided in most cases when commercial office space of 1000 square metres or more is offered for sale or lease. Energy efficiency information is being provided through achieving a NABERS Energy rating. NABERS provides a rating from one to six stars based on a building's energy and carbon consumption. Over the past 15 years, these ratings have become a recognised and valued mechanism for measuring performance of commercial buildings in operation.

The success in the premium and A-grade commercial building owners to embrace the value of NABERS Energy ratings as a disclosure and benchmarking mechanism has not expanded to the rest of the market yet. The recent rule change applying Commercial Building Disclosure rules to smaller assets will help expand the uptake of ratings. However, the mid-tier sector has been slow to take-up of energy efficiency improvements. There are multiple factors why this is the case, including a lack of awareness, difficulty in accessing capital and information, lack of networking among mid-tier owners and tenants, split incentives, lack of skills and expertise amongst industry professionals. To begin addressing these issues, the Australian government commissioned GBCA to release a report 'Mid-tier commercial office buildings in Australia: A national pathway to improving energy productivity'[29] exploring what was needed to drive change in this sector.

Decarbonisation of the built environment relies on shifting the grid to renewables. On October 2017 the Australian Government released their energy policy: Powering forward: A better energy future for Australia. This policy is

28 ASBEC, 2017

29 https://www.gbca.org.au/uploads/97/36449/Mid-Tier%20Commercial%20Office%20Buildings%20Pathway%20report.pdf

informed by the advice of the independent Energy Security Board (ESB). The headline feature of the policy, and the primary subject of this paper, is its establishment of a National Energy Guarantee (NEG) as the government's preferred alternative to the outstanding recommendation from the Finkel Review for a Clean Energy Target (CET).

The NEG comprises:

- A reliability guarantee set to deliver the right level of dispatchable energy—from ready-to-use sources such as coal, gas, pumped hydro, storage and demand response—needed in each state. It will be set by the AEMC and AEMO (starting in 2019).
- An emissions guarantee set to contribute to Australia's international commitments. The level of the guarantee will be determined by the Commonwealth and enforced by the AER (starting in 2020 with the expiration of new investment through the Renewable Energy Target (RET).

At this stage the detail of how the NEG will be implemented remains uncertain and will depend on further consultation through COAG and by regulators.

A review of international voluntary mechanisms and targets

The analysis compared different two degree trajectories set by international initiatives, which were designed explicitly to align with a two degree outcome include Climate Bonds Initiative's (CBI) and Science Based Target's (SBT) Commercial buildings trajectories. These require full decarbonisation of a building's operational emissions by 2050 in the case of the CBI, or a trajectory that sits within the IEA's and IPCC's 1.5–2 degree window in the case of SBT.

Another initiative, RE100, requires companies in any sector to commit to using 100% renewable energy and allows the company to select the date they aim to reach this target. The trajectory shown on the graph below shows the average date companies have committed to this 100% target. The average date for achieving 100% renewable energy for RE100 companies is approximately 2025, thus indicating the potential to totally decarbonise the electricity sector by this time.

Regarding initiatives developed by other green building councils, the Canadian Green Building Council (CaGBC) and the WGBC have both set two degree aligned targets of achieving carbon neutrality for existing buildings by 2050. The WBGC also has set a 2030 carbon neutrality target for new buildings.

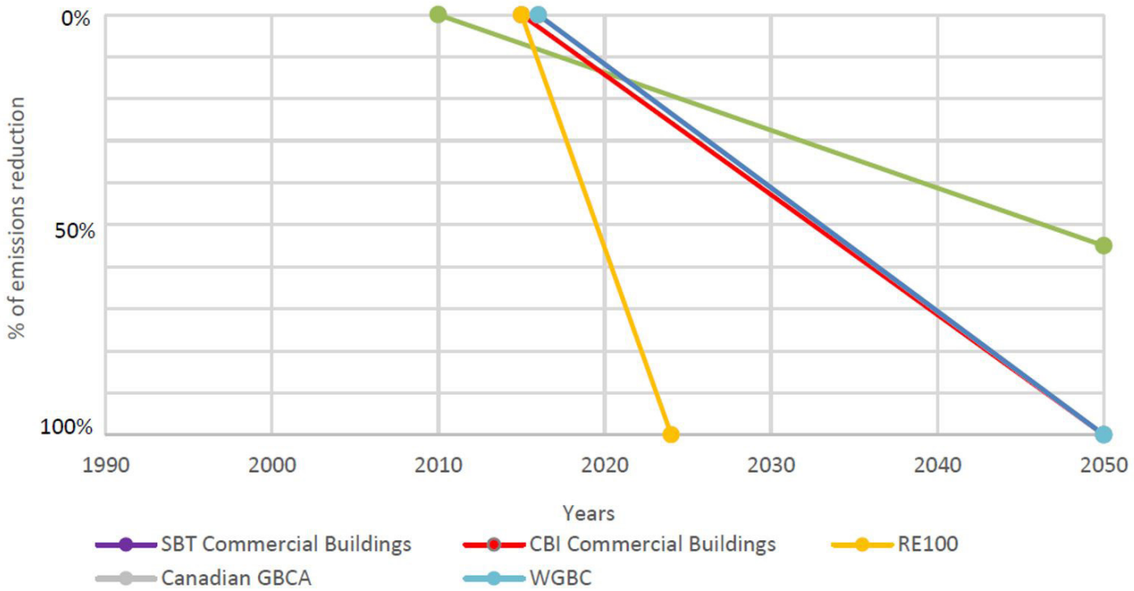


Figure 5 Building Sector Initiatives

Industry sentiment

Industry sentiment was also explored at a series of facilitated discussions. Two sets of workshops were held. The first in April and May in the four major cities. The second set in Melbourne, Sydney and Brisbane during November 2017 and were facilitated by EY[30]. Attendees to both workshops were drawn from government, academia, property development and management, engineering and the finance sector. Each workshop following a similar format of guided discussion around key topics, supported by background research and peer comparison.

The workshops yielded valuable insights. There was consensus that to decarbonise the built environment, the following should happen:

- Set a clear 2030 target for all new buildings and 2050 for existing buildings. Leading buildings and best practice buildings will need to achieve this target at a faster pace.
- The residential sector must adopt these targets as well.
- While it is not practical to include transport emission calculations in a trajectory, there is value in actions that will contribute to the electrification and diversification of the sector at the building level.
- The base building and whole building split needed to be addressed, with contractual requirements introduced to encourage data sharing, monitoring, and targets between parties.
- There should be an increased focus in tracking, reporting, and benchmarking the operational energy of all buildings.

There was also support for having a clear set of actions such as energy efficiency, fuel switching, renewables, with a clear view that offset use should be limited. There was broad agreement that offsets should only be used for scope 3 emissions. Further support was also expressed for mandating or incorporating requirements for renewable energy use in all buildings and fitouts.

Conclusion

Globally, the building industry is seen as a key sector for rapid decarbonisation. Achieving a 1.5°C target requires the built environment to significantly decarbonise earlier than most sectors in the economy[31].

The majority of emissions from the building sector are from electricity use. Building energy efficiency upgrades, and decarbonisation of the electricity grid, are some of the more cost effective approaches to abate GHG emissions within Australia. The information in this Appendix highlights the common alignment of trajectories with a two degree scenario as well as carbon neutrality of new buildings by 2030 and existing buildings by 2050.

If Australia was to stay within the proposed carbon budget using the most cost efficient approach, the building sector would need to decarbonise more rapidly than other sectors.

Considering the actions being taken globally, particularly in Europe, there is scope to increase the energy efficiency in buildings from current practice in Australia. 6 star Green Star rated buildings are already required to achieve a significant reduction in energy consumption to achieve a rating today (40% reduction over code), with most achieving a 50% to 60% reduction in energy consumption.

Once demand is addressed, the source of energy needs to be addressed. The RE100 initiative shows what is achievable in terms of full electricity decarbonisation from business leaders. Green Star rated buildings are already claiming rewards for procuring 100% renewable energy as part of a long-term contract, through on-site generation or a mix of both.

30 EY, Carbon Positive, A Technical Report, 2018.
31 http://www.climateinstitute.org.au/verve/_resources/TCI_1-5C_businessfinance_FINAL.pdf

Appendix D: The role of GBCA and Green Star in the built environment

GBCA aims to drive the sustainable transformation of the built environment.

The GBCA is Australia's leading authority on sustainable buildings and communities. GBCA has three main areas of activities:

- Setting standards and certifying achievements in the built environment through Green Star
- Educating and communicating the value of sustainability to all stakeholders
- Advocating for changes in the regulatory environment at a local, state, and federal level.

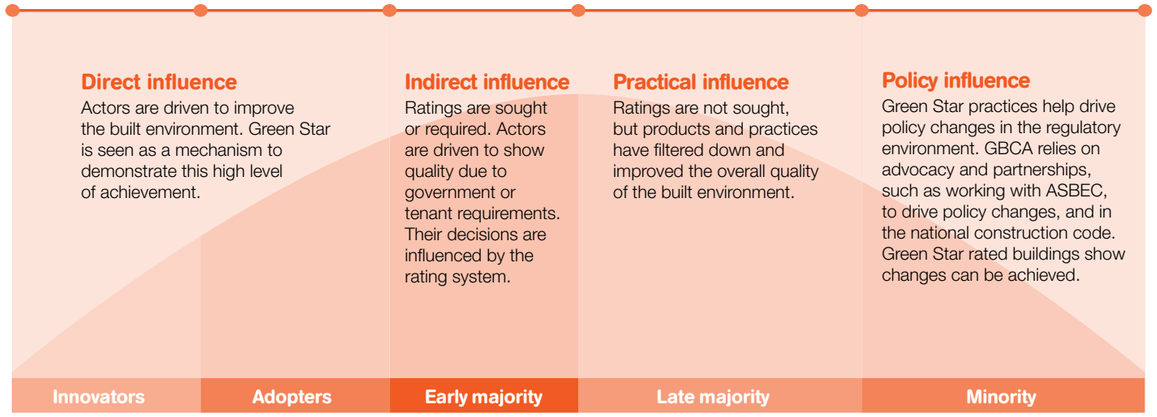
Action across the built environment is needed to limit global warming to 1.5°C as outlined in the Paris agreement. GBCA aims to support this goal through a combination of actions – some of which GBCA has direct control; and some targeted activities to influence broader change.

GBCA is able to affect the built environment directly through Green Star.

Green Star is an internationally recognised rating system that delivers independent verification of sustainable outcomes throughout the life cycle of the built environment. Green Star is for leaders and high performing practitioners. It is designed to showcase leadership and demonstrate to other parties that outcomes have been achieved.

Green Star showcases leadership in every meaning of the word, whether you are targeting world leadership or are starting forth on a journey of ongoing improvement. It demonstrates to other parties that outcomes have been achieved and that sustainability is at the forefront of your strategy. It is one of many tools that GBCA uses to move the market forward. The diagram below articulates how Green Star fits into GBCA's strategic actions to drive transformation in the built environment.

Our role in the built environment



Green Star has an impact far beyond its role as a certification scheme. Its principles influence government policy. The property industry relies on its benchmarks to show quality outcomes. Even those who find little value in the rating use it for guidance to improve their assets. Green Star has influenced practices that have now become standard in industry. Best practice now means high quality interiors, energy efficiency, and low impact materials. Governments use Green Star as proof that potential changes in policy are doable, tested, and valuable.

While Green Star leads the way, other actions are required to drive change in the built environment. GBCA also influences the built environment through our advocacy activities, development and training programs, and communication and research.

GBCA believes that we can build on the experience of Green Star buildings and voluntary leadership in the Australian built environment including breaking perceptual barriers by having case studies that 'prove it can be done'. GBCA can leverage Green Star buildings to influence broader change. We can also use the learnings from Green Star ratings to train and assist the broader built environment to overcome technical barriers.

Appendix E: The roadmap principles

GBCA undertook the development of this roadmap following these principles:

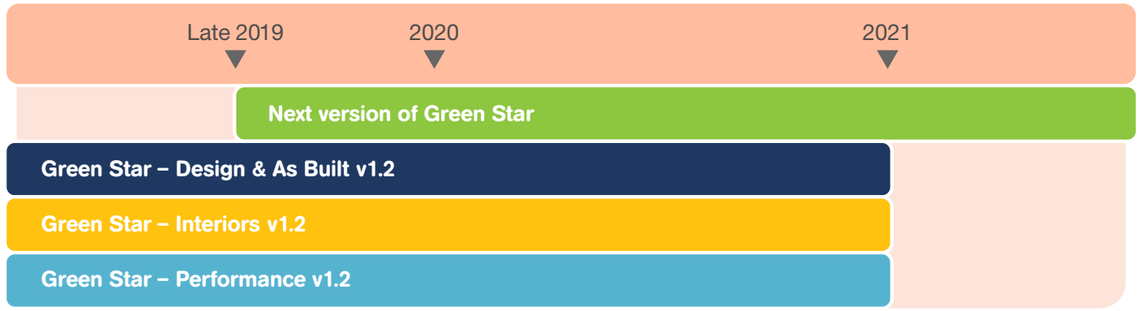
Principle	The roadmap must:
Leadership & innovation	• Provide a clear definition of, and reward, world leadership. • Facilitate, reward and showcase innovation in technology and approach. • Target areas where market transformation may have a broad impact across the built environment.
Achievable	• Provide an achievable pathway to allow all projects to start the transition. • Focus on the key steps that need to occur first to achieve the priorities and outcomes.
Flexible and simple	• Allow projects the flexibility to choose the pathway to a permanent transition for their project.
Cost effective & value creating	• Focus on mechanisms where a clear business case and business value can be demonstrated.
Evidence based with measurable impact	• Approach initiatives with the most impact towards achieving goals. Promote the effective use of data and learnings to report impact outcomes and support further action.
Clear and transparent	• Support unique, transparent and verifiable outcomes relevant to all stakeholders. • Ensure a low likelihood of action being misinterpreted as greenwashing.
Consistent	• Be in line with existing Australian and International schemes including the National Australian Built Environment Rating System (NABERS), RE100 and the Australian Government's National Carbon Offset Standard. • Align with voluntary standards such as Climate Bonds and Science Based Targets where possible. • Provide a consistent approach across the GBCA Rating tools.
Good governance while evolving	• Be transparent about current and future requirements. • Aim to be flexible with regular reviews to consider impact and effectiveness of existing approach and new emerging technology and practices.

Appendix F: Green Star and the roadmap

The following actions will be encouraged in Green Star over the next decade. This applies to ratings for new and existing buildings, as well as ratings for fitouts (where relevant).

The roadmap is expected to begin implementation from the next revision of Green Star onwards. This next update is expected to be released in 2020. Projects that have registered, or will be registering, under any current or previous versions of the rating system will not be impacted by this roadmap. However, these projects are strongly encouraged to follow the guidance here, as it is likely that clients will be seeking buildings that meet these expectations.

There will be a transition period of 12 months beginning on the date of the next versions of all Green Star rating tools for buildings and fitouts. This means that during 2020 an applicant, will be able to register an asset under either the new version or the previous one. Once 2021 begins, applicants will only be able to register under the new version exclusively.



Notes:

- The targets have been set with the expectation that Green Star rated buildings will be leading vs conventional practice.
- Where a target is noted, it means that it will become expected for a building seeking such star rating to achieve it. The precise mechanism will be developed as part of the rating system development process.
- The requirements outlined in this document are proposed, but may be subject to change as the development of each update proceeds. They are provided in this roadmap as a best estimate of when they should become applicable to the rating system.
- Industrial facilities, data centres, and other specialty buildings have contractual engagements or use cases that make implementing some targets in this roadmap difficult. Companies in this sector are encouraged to review this roadmap and provide feedback.

Action	Green Star requirement	Notes	Targets		
			6	5	4
Adopt a vision for a zero emissions built environment.	Fitouts are required to disclose energy information, seek operational fitout ratings3, use renewables, and address other emission sources.	The next revision will have requirements for green lease clauses for tenant emissions from energy demand, waste, and water. It will also require operational fitout ratings where available.	2020 for new buildings.		
			2026 for existing buildings.		
	Fitouts will be required to commit to address a number of emissions reductions measures.	Fitouts seeking a rating will be required to agree, through green lease clauses, fitouts guides, or other similar documents, to: • Work jointly to share energy consumption information, and reduce energy consumption in the base building. • Introduce limits on waste stream contamination. • Introduce water use consideration. This requirement seeks to encourage tenants and building owners to discuss, and agree to, mechanisms to transparently measure and disclose the ongoing performance of buildings. This requirement is part of a broader discussion that needs to occur as part the built environment. Over time, all emissions from all occupants in a building should be considered, reduced, and eliminated. However, the current base building and tenant division makes this task difficult. This roadmap proposes that Green Star is used as a mechanism to build trust between building owners and tenants, and to build mechanisms to encourage the joint measurement and elimination of emissions from both sides of a building.	2020	2023	
Measure, improve, and disclose the ongoing performance of buildings.	Existing buildings fitted out with smart metering and monitoring solutions.	All buildings should be refurbished to include smart metering and monitoring solutions. Estimates from IEA and others indicate this is a fundamental step to reduce carbon emissions in buildings.	2026		
	Fittous fitted out with smart metering and metering solutions.	As above, but for fitout energy use.	2020		
	New buildings required to commission and tuned.	The next version of Green Star should propose a new conditional requirement for all buildings to be commissioned and undergo a tuning process. This criteria should be adopted by authorities and extended to the building code by 2030 at the latest.	2020		
	Fitouts are commissioned and tuned, and work with the base building to address any outstanding issues.	As above.	2020		
	All buildings seeking a Green Star rating must continue on to Green Star - Performance.	GBCA will propose that all new buildings will need to demonstrate ongoing performance to maintain their rating. In the case of Green Star, this means a Green Star - Performance rating. This mirrors the success of NABERS Energy in the commercial sector, replicating it to all other users of Green Star.	2020		
	Seek obtain and disclose an operational fitout energy rating.	The next version of Green Star will provide a mechanism for fitouts to continue to measure and report on energy use throughout operations. This will be required for fitouts seeking to continue to promote themselves with a Green Star rating.	2020		

Action	Green Star requirement	Notes	Targets		
			6	5	4
Power buildings with 100% renewable electricity and switch away from fossil fuel use.	New buildings registering from this date will need to be fully powered by renewables.	Moving buildings to renewable electricity is the fastest way to reduce the vast majority of emissions in the built environment. New 6 star rated buildings will need to show that they are powered by renewables upon completion. Buildings will also be encouraged to explore how they are installing systems and technologies to ensure they are integrating with grid systems to both enhance its reliability, and emissions reduction capability.	2020	2023	2026
	New buildings will be fossil fuel free[6].	Future versions of Green Star should propose that buildings begin on a trajectory to eliminate all gas use from buildings. For new buildings this means setting targets from which time no fossil fuel use would be allowed for most common uses, with some exceptions. See the Innovation Challenge 'Powered by Renewables' for more information.	2023	2026	2028
	Existing buildings will need to be fully powered by renewables and have a plan to transition away from fossil fuels.	For existing buildings this will translate to their electricity being sourced from renewables from 2025 onwards. More information on the types of renewables allowed is provided in the 'Renewables and Green Star' guide available on our website. This also means that a requirement for having a transition strategy to transition away from fossil fuels in buildings by the target date will be introduced. See the Innovation Challenge 'Powered by Renewables' for more information. Buildings will also be encouraged to explore how they are installing systems and technologies to ensure they are integrating with grid systems to both enhance its reliability, and emissions reduction capability.	2023	2025	2028

Action	Green Star requirement	Notes	Targets		
			6	5	4
Power buildings with 100% renewable electricity and switch away from fossil fuel use.	Fitouts registered from this date will be required to be fully powered by renewables.	As previous, increasing the demand for renewable electricity will result in a broader investment in this space, as well as investment and interest in reliability solutions.	2020	2023	2028
	Fitouts registering from this date will be required to be in buildings fully powered by renewables.		2023	2026	2028
	Fitout and backup generators are replaced with non-fossil fuel options.		2023	2026	2028
	Fossil fuel from cooking or other uses is eliminated from the fitout space, or offset.		2023	2026	2028
Increase the use of on-site, or near site, renewables, and measures to support the decarbonisation of the grid.	Buildings will be rewarded further for use of on-site, or near-site renewables.	Where possible due to solar access opportunities, future versions of Green Star will reward installation of on-site solar and associated storage as relevant. GBCA notes the difficulty this may present to CBD projects in particular, and will develop appropriate guidance as development of the next revision of Green Star proceeds.	2020	2020	2020

Action	Green Star requirement	Notes	Targets		
			6	5	4
Reduce building total and peak energy demand by prioritising passive design, demand control, and energy efficient systems.	Reduction of 40 to 50% in total energy demand compared to the 2016 NCC.	The proposed revisions to the building code are expected to significantly increase the energy reduction against the current baseline. This amendment is expected to be roughly equivalent to a 20%-30% increase over the current code requirements. Based on analysis of percentage improvements, there is still an opportunity to increase over the required code changes. An analysis of 6 star rated buildings shows that an additional improvement of 20% is doable. Based on a review of international codes, it would be expected that all buildings would likely be needed to be placed on this trajectory. However, It is noted that ASBEC's trajectory work may change this benchmark. This number will be updated once the ASBEC work is released. Building façade is the longest lasting element of a building that influences energy demand. Appropriate shading and orientation are critical at reducing peak demand. While this roadmap notes its importance, it cannot accurately determine a benchmark. This will be resolved through the updates of the rating system.	2020	2023	2026
	40 to 50% reduction in energy consumption over an average building.	This requirements is equivalent to a 5.5 star NABERS Energy in commercial buildings, 5 star NABERS energy in retail centres, or similar. An analysis of current ratings shows that a 5.5 star NABERS Energy target in 7 years is achievable for 6 star rated commercial office buildings. As building technology improves and buildings are refurbished over time, buildings should be aiming to achieve this target as a minimum. For all other buildings, performance improvements should be equivalent to around 40% compared to an average building.	2026	2030	2035

Action	Green Star requirement	Notes	Targets		
			6	5	4
Reduce building total and peak energy demand by prioritising passive design, demand control, and energy efficient systems.	Select buildings with a low base building energy use, and that has achieved a Green Star – Performance rating.	World leading fitouts will be required to consider selecting buildings with either low energy demand, or that have achieved a Green Star – Performance rating. As Green Star – Performance will be put on a trajectory of continuous improvement, even low rated assets will continue to improve over time. Selecting assets with a Performance rating will continue to create a market for transparently disclosing their performance, and to continuously improve it. The roadmap also recommends that this requirement could be met by selecting buildings with a high NABERS Energy star rating, currently proposed to be 5.5 stars. It also considers buildings that are on a path to this target over the next 5 years to be acceptable.	2020	2023	2026
	Install energy efficient equipment, computers, lighting and appliances.	To continue encouraging the introduction of energy efficient equipment, and its use, 6 star and 5 star rated fitouts would be required to look for best of class or similar for major energy consuming equipment.	2020	2020	2023
Stimulate markets for carbon neutral products and services.	Reduction of 10% embodied carbon emissions against a reference building. Additional 10% reduction of embodied carbon emissions against a reference building.	As the emissions from operational energy are reduced, the share of emissions from embodied carbon will increase. The next version of Green Star proposes to introduce embodied carbon requirements similar to the conditional requirement that exists for operational energy. This requirement will be ramped up over time. GBCA will then strongly advocate for embodied carbon to be introduced as a measure in the building code by 2030.	2020	2023	2026
			2020	2023	2026
			2023	2025	2027
	Selection of carbon neutral products and services credit introduced in 2020.	To increase the amount of carbon neutral products and services, the next version of Green Star will introduce rewards for the use of carbon neutral certified products or services in new and existing buildings.	2020		

Action	Green Star requirement	Notes	Targets		
			6	5	4
Increase the use of low-GWP refrigerants.	Install refrigeration systems with low-GWP refrigerants. Install supplementary systems with low-GWP refrigerants. Phase down high-GWP refrigerants in existing buildings.	HFC refrigerants are being phased down for use by 2035. A future version of Green Star will introduce requirements to have systems be designed with no high GWP refrigerant use. Existing buildings must also begin the phase down of high-GWP refrigerants over the next decade, and begin considering other options when refurbishing their HVAC systems. *GBCA notes that this phase out does not apply to process loads in industrial settings at this stage.*	2023	2025	2027
			2026	2028	2030
			2030		
Support high quality offsets for remaining emissions as a transition strategy.	Offset[32] total remaining embodied carbon emissions from construction. Offset total remaining carbon emissions from building operations. Offset total remaining carbon emissions from organisation operations.	As there are a number of additional emissions that are influenced but not controlled by the built environment, GBCA expects to introduce Carbon Neutral certified requirements in Green Star for distinct star ratings over time.	2023	2026	2028
			2026	2028	2030
			2023	2028	2030
Increase access to active transport facilities and public transport.	Increase access to active transport facilities, and advocate for the improvement of local cycling infrastructure.	Increasing cycling infrastructure in cities is a critical and valuable method to reduce overall emissions. A future update to Green Star will attempt to harness the collective influence of the built environment to improve cycling infrastructure.	2020	2023	2023
		For existing buildings.	2026		
	Fitouts select buildings with active transport facilities.		2020	2023	2023
Support the adoption of electric vehicles.	New buildings provide or pre-install electric vehicle charging infrastructure.	Future versions of Green Star will include further requirements for providing additional electric vehicle charging facilities either at the time of construction or over time.	2020	2023	2023
	Existing buildings provide electric vehicle charging infrastructure.		2025	2030	2030

32 More commentary on the use of offsets in the built environment is provided in appendix D.

Appendix G: Supporting the roadmap through advocacy

The following policy outcomes will be sought by GBCA through its engagement with local, state, and federal governments.

Notes:

- This table outlines actions the built environment must take, and the advocacy position that GBCA will seek to enable this action.
- The 'Targets' column indicates the deadline by which all new buildings and all existing buildings should have met the 'Action' column.
- In some cases targets are explicitly set out in the Advocacy column. These are highlighted to specify specific actions required to advance the overall target for the entirety of the built environment.

Action	Advocacy position	Targets	
		New	All
Adopt a vision for a zero emissions built environment by 2050.	In consultation with industry, establish a national plan towards 2050 zero carbon buildings and establish responsibilities at the ministry level.	2030	2050
	Expand mandatory disclosure to new sectors, with a priority focus on tenancies & fitouts.		
Measure, improve, and disclose the ongoing performance of buildings.	Improve access to energy consumption data requiring energy metering and sub-metering for all buildings by 2030.	2030	
	Introduce requirements in the NCC for all new buildings to be commissioned and tuned from 2025 onwards.		
Power buildings with 100% renewable electricity switch away from fossil fuel use.	Reform policy and markets as necessary to: increase the uptake of storage solutions and renewable energy; facilitate district-based utilities; address energy market barriers; ensure and provide fair tariff structures and value for distributed solutions; and improve access to networks. National energy policy delivers long-term certainty, incentivises investment in storage and renewables, and provides clarity on the attributes of any certificates or tracking mechanism used for renewable energy distribution.	2050	

Action	Advocacy position	Targets	
		New	All
Increase the use of on-site, or near site, renewables, and measures to support the decarbonisation of the grid.	Require on-site storage solutions and on-site renewable energy as part of upgrades to the NCC in 2025. Incentivise the replacement of non-electric appliances including natural gas, and avoid incentivising installation of non-electric appliances.	2030	2050
Reduce building total and peak energy demand by driving passive design first and efficient systems next.	Support, in the National Construction Code, the upgrade of energy performance standards and an upgrade trajectory consistent with ASBEC's proposal. Introduce ambitious targets and incentives at the city and state level aiming to achieve energy demand reductions of 20 to 30% for all buildings by 2035. To achieve the above, create new tipping points for change with incentives and financing mechanisms that encourage upgrades and retrofits of existing buildings. Specifically, a call for: • Incentives to accelerate uptake of energy upgrades. • States & Territories introduce incentives incl. stamp duty concessions & differential rates for new buildings & significant refurbishments. • Promotion and expansion of low interest loans for green retrofits.	2030 2050	-
Stimulate markets for carbon neutral products and services.	Expand the reach of the National Carbon Offset Standard to cover a larger share of building products and materials.	2030	2050
	In collaboration with industry lead a review of opportunities to reduce embodied carbon in building products and through the supply chain.		
Phase out high-GWP refrigerants.	Incentivise the phase-down of high-Global Warming Potential (GWP) refrigerants, e.g. in HVAC systems.	2035	2050
Support high quality offsets for remaining emissions as a transition strategy.	Lead a review of the availability and market for domestic carbon offsets in Australia, and to identify opportunities to use offsets as part of an incentivise mechanism to encourage building upgrades.	2030	2050

Action	Advocacy position	Targets	
		New	All
Increase access to active transport facilities and public transport.	Support better governance for improved decisions, ongoing investment, long-term integrated planning and sustainable development across our major cities and urban growth areas.	2030	2050
	Prioritise policies that incentivise and better value active transport infrastructure consistent with the broader social, economic, and environmental benefits it provides.	2030	2050
Promote the electrification of vehicles.	Support mechanisms designed to reduce the use of private fossil fuel vehicles (e.g. congestion pricing) and incentivise the increasing adoption of electric vehicles (e.g. charging infrastructure).	2030	2050

Appendix H: Supporting the roadmap through education

Support, train and build capacity

We've trained more than 66,000 industry professionals to create greener buildings and communities. And what we've learnt during that time is that our industry is diverse – and it changes fast. We are currently developing new coursework to support the industry to achieve the targets in the Carbon Positive Roadmap. It will aim to build capacity to support a transition to carbon positive built environment.

Given the urgency for change to low carbon buildings, to facilitate quick update, GBCA will create opportunities and a platform for knowledge transfer of. This includes:

- learning from existing proven technologies, practices and policies from overseas. European Passive design, UK/EU residential construction best practice design and funding models; UK/EU low carbon materials and approaches have all established practices that could be adopted in Australia and improve efficiency.
- providing forums in which learnings can be transferred between Australian leaders and organisations looking to commence a transition to carbon neutral buildings. – for example forums that share learnings from mistakes, not just successes.
- Developing courses and events with a focus on:
  - Net zero buildings and precincts – definitions, practices and carbon accounting standards.
  - Setting targets, the business case and methods for implementing a net zero carbon trajectory for buildings.
  - Innovation and latest design and technology for energy efficiency and renewable energy.
  - Procurement approaches to delivering renewable energy in buildings.
  - Storage, grid services and renewable energy trading.
  - Metering and monitoring to make the most of data.
  - Reducing scope 3 emissions:
    - Supplier contracting with carbon reduction targets.
    - Innovation, low-carbon product and service development.
    - Transport carbon reduction.
  - Sourcing offsets – principles, tips and approaches to procurement with case studies from market leaders.

Seek commitments and create a market

GBCA will work to develop a clear market for carbon positive buildings and fitouts. As part of this roadmap we commit to:

- Seeking that government sets NABERS Energy or Green Star - Performance targets for all government owned buildings and tenancies.
- Seek pledges and commitments from corporate and institutional partners to set Green Star (for new and existing) targets for all owned or leased buildings.
- Agree with ASBEC and other partners to support the roadmap and develops additional roadmaps for parts of the built environment sector.
- Distribute the roadmap to regional and international partners and use this to influence their carbon actions and trajectories.

Research, monitor, and report

GBCA will undertake the following initiatives to influence a positive momentum to change of people's ideas attitudes social norms and mindsets.

Communication plan that shows vision and leadership:

- Create an targeted communication plan that provides aspirational leadership that plants a 'flag on a hill' with the aim of generating attitudinal change in both building owners, but also building users, supply chain and community. The plan will focus on a positive message that highlights the change that is already happening. This will also include methods for marketing of Green Star to demonstrate value and attractiveness of Green Star with a carbon trajectory to the building users and investors.
- The communication plan will aim to create demand – to drive a desire for highly efficient buildings powered by 100% renewable energy.
- Focus on the 'why' of carbon neutral – e.g. the co-benefits such as business case or personal health and wellbeing.
- Include a clear credible pathway that makes actions clear and achievable.

Research that demonstrates the value of carbon neutral buildings:

- GBCA will undertake targeted research that provides data to demonstrate the business case and value of carbon neutral buildings.
- In the second three year cycle a carbon impact report will be undertaken to assess the effectiveness of the Carbon Positive Roadmap.
- In the Green Star 2018 update, GBCA will specifically review the ways that Green Star collects information to ensure that the best use of the data can be made and that impact can be measured.

Appendix I:

A carbon positive roadmap for existing commercial*, institutional, and government buildings

Outcome	Action	Green Star **Buildings registering from this date will be encouraged to:**	2020 2023 2026 2028 2030 2035 2040 2050	Advocacy
Commit to a permanent transition to buildings and fitouts with no greenhouse gas emissions	Adopt a vision for a zero emissions built environment	work with tenants to disclose[1] energy information, seek operational fitout ratings[2], use renewables, and address other emission sources	6 star, 5 star, 4 star, All buildings	In consultation with industry, establish a national plan towards 2050 zero carbon buildings and establish responsibilities at the ministry level.
	Measure, disclose, collaborate on, and improve, the ongoing performance of building and fitouts	be fitted out with smart meters.	All ratings, All buildings	Improve access to energy consumption data requiring energy metering and sub-metering for all buildings by 2030. Expand mandatory disclosure to new sectors, with a priority focus on tenancies & fitouts.
Switch to, install, or procure renewable energy, and support the decarbonisation of the grid	Power buildings and fitouts with 100% renewable electricity and switch away from fossil fuel use	be fully powered by renewables and have a plan to transition away from fossil fuels	6 star, 5 star, 4 star, All buildings	Reform policy and markets as necessary to: increase the uptake of storage and renewable energy; facilitate district-based utilities; address energy market barriers; ensure and provide fair tariff structures and value for distributed solutions; and improve access to networks. National energy policy delivers long-term certainty, incentivises investment in storage and renewables, and provides clarity on the attributes of any certificates or tracking mechanism used for renewable energy distribution. Incentivise the replacement of non-electric appliances including natural gas, and avoid incentivising installation of non-electric appliances.
	Increase the use of on-site, or near site, renewables, and measures to support the decarbonisation of the grid[3]	(All) have on-site, or access to near-site, renewables[3], install battery storage systems, or technologies that promote grid decarbonisation.	All ratings, All buildings, All buildings	
Build, operate, or occupy low energy intensive buildings and fitouts	Reduce building and fitout energy demand by prioritising passive design, demand control, and energy efficient systems	have 40 to 50% reduction in energy consumption over an average building[4]	6 star, 5 star, 4 star, All buildings	Introduce ambitious targets and incentives to achieve energy demand reductions of 20 to 30% for all buildings by 2035.
Adopt zero carbon materials, products, and services	Stimulate markets for carbon neutral products and services	select carbon neutral products and services	All ratings	Expand the reach of the National Carbon Offset Standard to cover a larger share of building products and materials In collaboration with industry lead a review of opportunities to reduce embodied carbon in building products and through the supply chain. Incentivise the phase-down of high-Global Warming Potential (GWP) refrigerants, e.g. in HVAC systems.
	Increase the use of low-GWP refrigerants	phase down high-GWP refrigerants in existing buildings	All ratings, All buildings, All buildings	
	Support high quality offsets for remaining emissions as a transition strategy	offset total remaining carbon emissions from building operations	6 star, 5 star, 4 star, All buildings	Lead a review of the availability and market for domestic carbon offsets in Australia, and to identify opportunities to use offsets as part of an incentivise mechanism to encourage building upgrades.
Support the transition to electric vehicles	Increase access to active transport facilities and public transport	increase access to active transport facilities, and advocate for the improvement of local cycling infrastructure.	All ratings, All buildings	Support better governance for improved decisions, ongoing investment, long-term integrated planning and sustainable development across our major cities and urban growth areas. Prioritise policies that incentivise and better value active transport infrastructure consistent with the broader social, economic, and environmental benefits it provides. Support mechanisms designed to reduce the use of private fossil fuel vehicles (e.g. congestion pricing) and incentivise the increasing adoption of electric vehicles (e.g. charging infrastructure).
	Support the adoption of electric vehicles	provide electric vehicle charging infrastructure	6 star, 5 star, 4 star, All buildings	

New rated. Registration date · New all. DA Approval · Existing rated. Certification date · All buildings. Target met

Engagement & Support

Create demand

- Set NABERS Energy or Green Star - Performance targets for all government owned buildings and fitouts.
- Seek pledges and commitments from corporate and institutional partners to set Green Star (for new and existing) targets for all owned or leased buildings
- Agree with ASBEC and other partners to support the roadmap
- Distribute roadmap to regional and international partners

Develop skills to deliver the future

- Facilitate knowledge transfer of existing proven technology and practices through case studies and
- Partner with stakeholder to deliver a training program focused on delivering a carbon positive future
- Deliver critical training through our courses, events, and forums on driving change in line with this roadmap.

Communicate a vision and progress

- Create a targeted communications campaign around the aspirations of the roadmap.
- Collect and capture data to be used as evidence.
- Writing regular reports - including demonstrating the business case and value
- Regular review of the carbon positive roadmap, and review against targets.

Appendix I provides two versions of this roadmap, one for new buildings, and one for existing buildings.

Notes

* Industrial facilities, data centres, and other specialty buildings have contractual engagements or use cases that make implementing some targets in this roadmap difficult.

[1] Or other commitment forms, such green leasing clauses, operational manuals, fitouts guides, etc.

[2] Where available.

[3] On-site renewables will be required where appropriate access for sufficient generation is available on site. Rules will be created as part of the development process.

[4] Equivalent to 5.5 star NABERS Energy in commercial buildings, 5 star NABERS energy in retail centres, or similar.

Appendix J:

A carbon positive roadmap for new commercial*, institutional, and government buildings

Outcome	Action	Green Star **Buildings registering from this date will be encouraged to:**	2020	2023	2026	2028	2030	2035	2040	2050	Advocacy
Commit to a permanent transition to buildings and fitouts with no greenhouse gas emissions	Adopt a vision for a zero emissions built environment	work with tenants to disclose[1] energy information, seek operational fitout ratings[2], use renewables, and address other emission sources	All ratings				All buildings				In consultation with industry, establish a national plan towards 2050 zero carbon buildings and establish responsibilities at the ministry level.
	Measure, disclose, collaborate on, and improve, the ongoing performance of building and fitouts	be commission and tuned	All ratings				All buildings				Improve access to energy consumption data requiring energy metering and sub-metering for all buildings by 2030. Introduce requirements in the NCC for all new buildings to be commissioned and tuned from 2025 onwards. Expand mandatory disclosure to new sectors, with a priority focus on tenancies & fitouts.
		continue to use Green Star – Performance[3].	All ratings				All buildings				
Switch to, install, or procure renewable energy, and support the decarbonisation of the grid	Power buildings and fitouts with 100% renewable electricity and switch away from fossil fuel use	be fully powered by renewables once they are built	6 star	5 star	4 star					All buildings	Reform policy and markets as necessary to: increase the uptake of storage and renewable energy; facilitate district-based utilities; address energy market barriers; ensure and provide fair tariff structures and value for distributed solutions; and improve access to networks. National energy policy delivers long-term certainty, incentivises investment in storage and renewables, and provides clarity on the attributes of any certificates or tracking mechanism used for renewable energy distribution. Incentivise the replacement of non-electric appliances including natural gas, and avoid incentivising installation of non-electric appliances. Require on-site renewable energy as part of upgrades to the NCC in 2025.
		be fossil fuel free[4]	6 star	5 star	4 star					All buildings	
	Increase the use of on-site, or near site, renewables, and measures to support the decarbonisation of the grid[5]	have on-site, or access to near-site, renewables[5], install battery storage systems, or technologies that promote grid decarbonisation.	All ratings				All buildings				
Build, operate, or occupy low energy intensive buildings and fitouts	Reduce building and fitout energy demand by prioritising passive design, demand control, and energy efficient systems	have 40 to 50% reduction in total energy demand compared to the 2016 NCC[6]	6 star	5 star	4 star		All buildings				Support the upgrade of the National Construction Code's energy performance standards and trajectory consistent with ASBEC's proposal.
Zero carbon materials, products, and services	Stimulate markets for carbon neutral products and services	reduce by 10% their embodied carbon against a reference building[7]	6 star	5 star	4 star		All buildings				Expand the reach of the National Carbon Offset Standard to cover a larger share of building products and materials In collaboration with industry lead a review of opportunities to reduce embodied carbon in building products and through the supply chain. Incentivise the phase-down of high-Global Warming Potential (GWP) refrigerants, e.g. in HVAC systems. Lead a review of the availability and market for domestic carbon offsets in Australia, and to identify opportunities to use offsets as part of an incentivise mechanism to encourage building upgrades.
		select carbon neutral products and services	All ratings								
	Increase the use of low-GWP refrigerants	phase down high-GWP refrigerants in existing buildings	6 star	5 star	4 star		All buildings				
	Support high quality offsets for remaining emissions as a transition strategy	offset total remaining embodied carbon emissions from construction.	6 star	5 star	4 star					All buildings	
Support the transition to electric vehicles	Increase access to active transport facilities and public transport	increase access to active transport facilities, and advocate for the improvement of local cycling infrastructure.	6 star	5 & 4 star			All buildings				Support better governance for improved decisions, ongoing investment, long-term integrated planning and sustainable development across our major cities and urban growth areas. Prioritise policies that incentivise and better value active transport infrastructure consistent with the broader social, economic, and environmental benefits it provides. Support mechanisms designed to reduce the use of private fossil fuel vehicles (e.g. congestion pricing) and incentivise the increasing adoption of electric vehicles (e.g. charging infrastructure).
	Support the adoption of electric vehicles	provide or pre-install electric vehicle charging infrastructure	6 star	5 & 4 star			All buildings				

New rated. Registration date · New all. DA Approval · Existing rated. Certification date · All buildings. Target met

Engagement & Support

Create demand

- Set NABERS Energy or Green Star - Performance targets for all government owned buildings and fitouts.
- Seek pledges and commitments from corporate and institutional partners to set Green Star (for new and existing) targets for all owned or leased buildings
- Agree with ASBEC and other partners to support the roadmap
- Distribute roadmap to regional and international partners

Develop skills to deliver the future

- Facilitate knowledge transfer of existing proven technology and practices through case studies and
- Partner with stakeholder to deliver a training program focused on delivering a carbon positive future
- Deliver critical training through our courses, events, and forums on driving change in line with this roadmap.

Communicate a vision and progress

- Create a targeted communications campaign around the aspirations of the roadmap.
- Collect and capture data to be used as evidence.
- Writing regular reports - including demonstrating the business case and value
- Regular review of the carbon positive roadmap, and review against targets.

Appendix I provides two versions of this roadmap, one for new buildings, and one for existing buildings.

Notes

* Industrial facilities, data centres, and other specialty buildings have contractual engagements or use cases that make implementing some targets in this roadmap difficult.

[1] Or other commitment forms, such green leasing clauses, operational manuals, fitouts guides, etc.

[2] Where available.

[3] This will required of new buildings seeking a Green Star rating registering under Future Focus.

[4] With some minor exceptions allowed. Any minor fossil fuel must be offset

[5] On-site renewables will be required where appropriate access for sufficient generation is available on site. Rules will be created as part of the development process.

[6] Equivalent to 5.5 star NABERS Energy in commercial buildings, 5 star NABERS energy in retail centres, or similar.

[7] The reference building will not include operational energy in its embodied carbon calculation. See 'Responsible Carbon Impacts' Innovation Challenge for more information.

Conclusion

Australia will need to drastically reduce its carbon emissions in order to meet its commitment to the COP-21 Paris Agreements. Per capita, our emissions are among the highest in the world with the built environment contributing to around a quarter. It is our responsibility as an industry to take action on this and Green Star has a leading role in driving the changes required by the roadmap. We want you to be involved as we embark on this journey to reduce emissions and meet the targets that will help combat climate change. From high level to practitioners, we can all have an impact on how this is delivered.

Practitioners can help us deliver a roadmap for residential buildings and the precinct scale, as well as joining us in workshops to provide feedback.

We're on the lookout for sponsors to accelerate the next stage of the roadmap.

Partner with us to deliver skills, services and mechanisms to drive change in industry.

Demand the standards outlined in the roadmap at an occupants or tenants level.

Seek the support of government to make the necessary changes to policy and codes.

Help us build a market for zero carbon products and services.

Join us and sign the Green Star Carbon Positive Pledge.

We look forward to working with you walking the journey towards a carbon positive built environment with you.

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