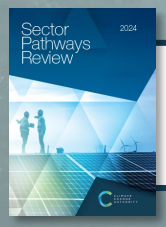
Sector Pathways Review 2024

At a glance



The full report is published on the
Climate Change Authority's website

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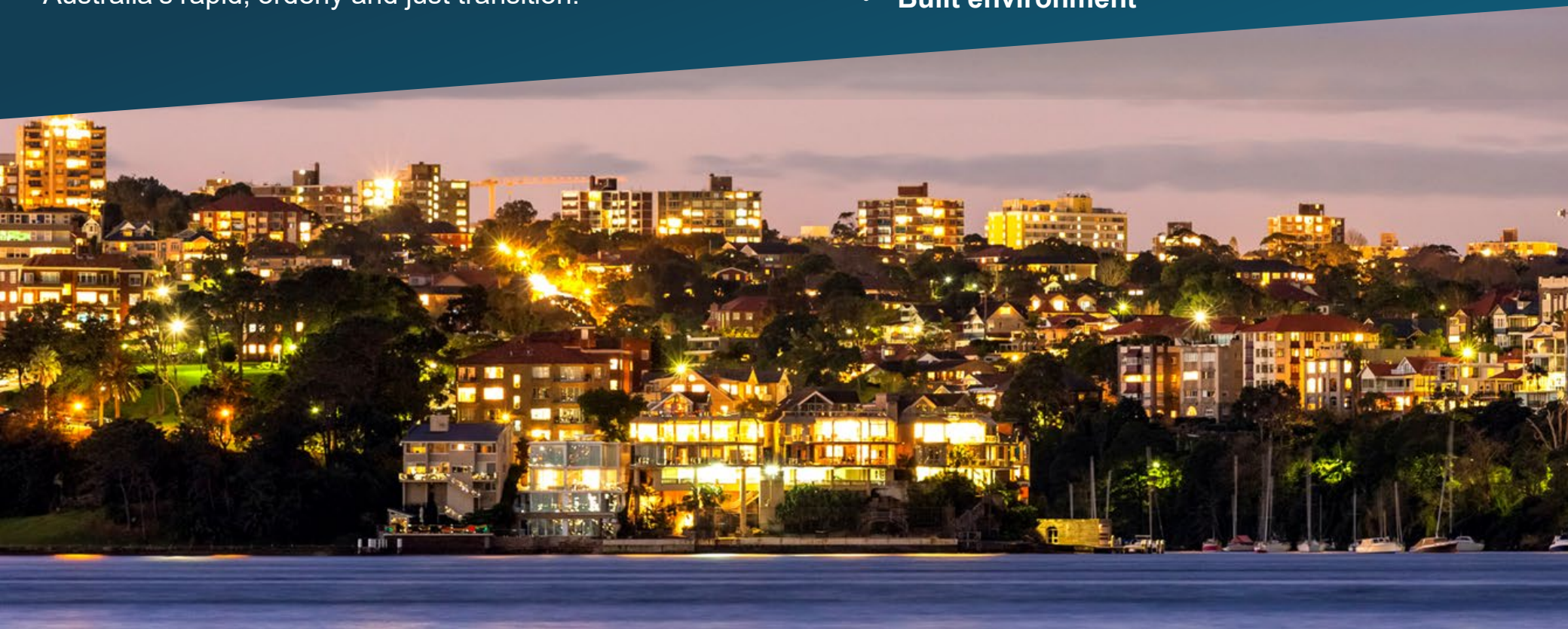
SUMMARY

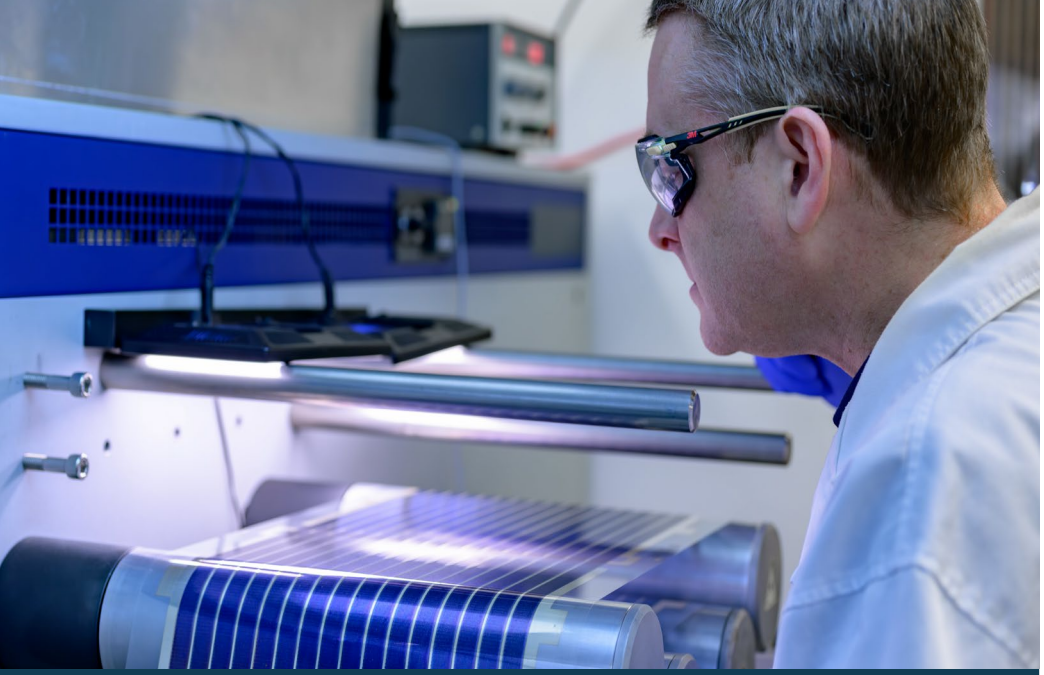
Every sector of the economy must play its part in Australia's transition to net zero emissions by 2050. The pathways that best support this transition require Australia to accelerate the deployment of mature, low emissions technologies while rapidly developing emerging technologies.

Governments – working together and with businesses, communities and households – need to plan and act to overcome the barriers, take the opportunities, and ensure Australia's rapid, orderly and just transition.

At the request of the Australian Parliament, the Climate Change Authority has identified the potential technology transition and emissions pathways in six sectors:

- **Energy and electricity**
- **Transport**
- **Industry and waste**
- **Agriculture and land**
- **Resources**
- **Built environment**





TECHNOLOGIES REQUIRED FOR THE TRANSITION

The pathways that best support Australia's transition to net zero emissions by 2050 involve accelerating deployment of mature zero and low emissions technologies, and the rapid development and commercialisation of emerging technologies.

	ELECTRICTY AND ENERGY	TRANSPORT	INDUSTRY AND WASTE	AGRICULTURE AND LAND	RESOURCES	BUILT ENVIRONMENT
Mature technologies	Wind, solar, pumped hydro, lithium batteries, gas-fired generation, synchronous condensers.	Battery electric light vehicles, mode shift, overhead electric rail.	Electrification (low/medium temperature process heat), energy efficiency, circular economy, diversion of organic waste from landfill.	Forest/ vegetation protection, carbon farming, enhanced fertilisers, improved herd and pasture management, manure management, off-grid renewable energy.	Electrification, energy efficiency, carbon capture and storage, off-grid renewable energy and storage, fugitive abatement measures in oil and gas extraction, underground coal mine gas drainage and utilisation.	Electrification (hot water, cooking, air conditioning), rooftop solar and battery storage, energy/thermal efficiency.
Demonstrated and early-stage technologies	Hydrogen production and turbines, new battery/long duration storage solutions.	For transport other than light vehicles: electrification, hydrogen, renewable fuels.	Electrification/ hydrogen for high temperature process heat, hydrogen (in ammonia, alumina, iron), carbon capture and use, direct air capture/ engineered removals.	Renewable fuels, battery electric farm vehicles, feed supplements, methane vaccines, early-life nutrition, new forms of protein.	Electrification (mining haulage), ventilation air methane abatement measures, renewable fuels, open-cut coal mine gas drainage.	Grid integration.

AUSTRALIA'S PATHWAY TO NET ZERO BY 2050

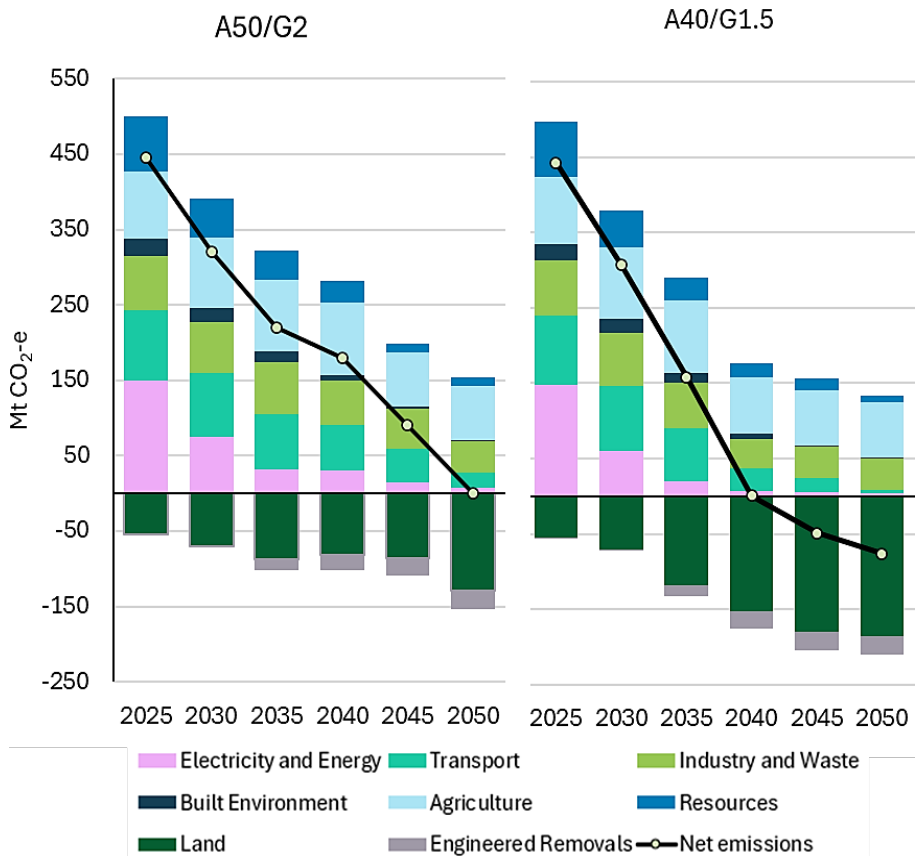
The transition to net zero involves much more than each sector moving along technology-based decarbonisation pathways.

It requires actively managing a major reorganisation of public and private finance, supply chains, production systems, industrial zones, energy sources, infrastructure and workforces within Australia.

It means close collaboration between governments, businesses, First Nations people, landholders, communities and households, and between Australia and its Pacific neighbours and international trading partners.

Each sector is on a different pathway to zero emissions. For some, the pathway will be steep and rapid because technologies are mature and ready to scale (e.g. electricity and energy). Others face a slower and more gradual route because technologies are at an earlier stage of development or more barriers stand in the way (e.g. agriculture). Many sectors are dependent on the progress of others, particularly those reliant on the supply of renewable energy from the electricity and energy sector (e.g. transport, built environment).

Gross emissions, removals and a net emissions trajectory, 2025 - 2050



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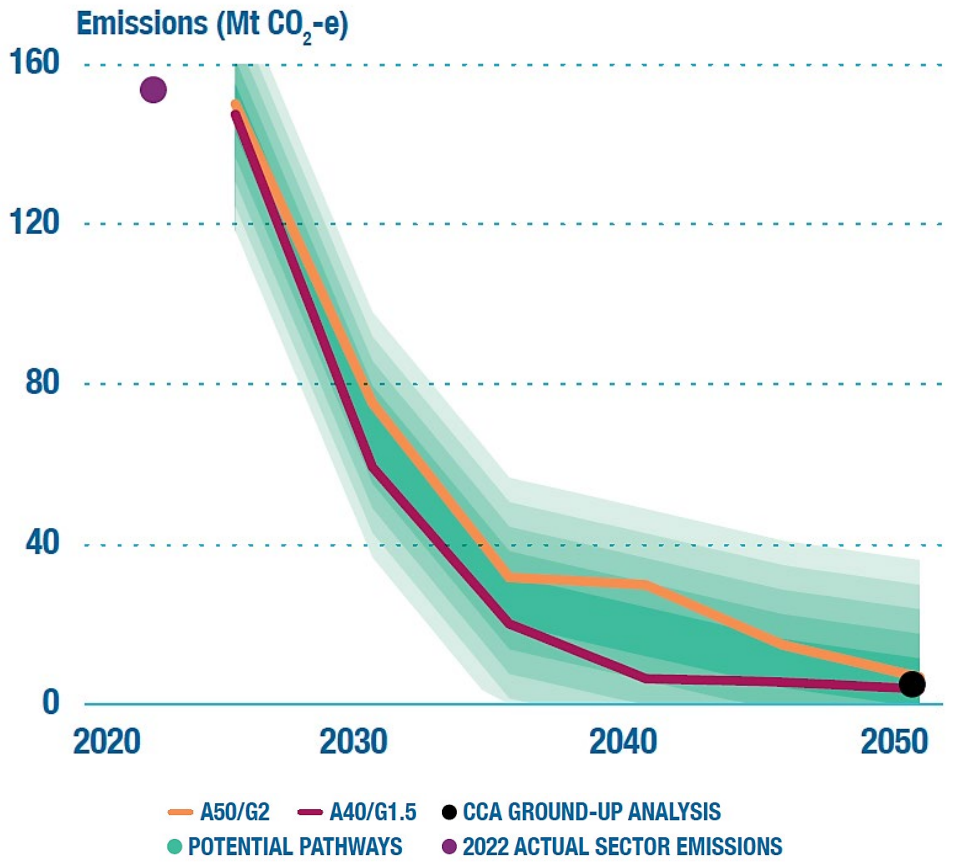
A40/G1.5 – High global ambition consistent with 1.5-degree outcome. Australia overachieves on its 2030 target and reaches net zero by 2040.

Electricity and energy sector

- Decarbonising electricity will address Australia's largest source of emissions and is vital to unlocking emissions reductions in other sectors.
- A massive construction effort is required to install renewable capacity, and poles and wires, to supply two-to-three times more electricity than generated today by 2050.
- Action is required to ensure there is enough storage in the system for system reliability.
- There must be enough synchronous generation in the system to maintain system security.



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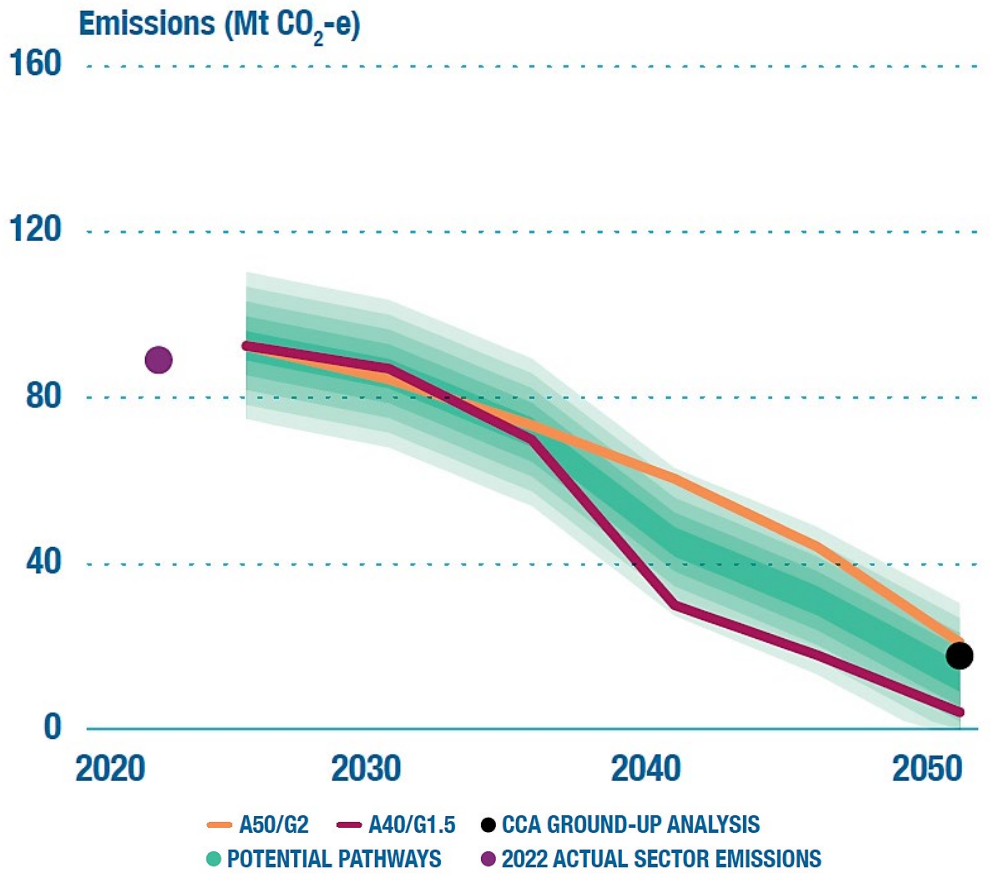
Transport sector

- Global manufacturers can supply the electric vehicles to decarbonise the passenger and light commercial vehicle fleet, which accounts for roughly half of Australia's transport emissions.
- Roll-out of charging infrastructure needs to lead the rapid uptake of electric vehicles.
- A mix of solutions will be required in other transport categories, including alternative liquid fuels and potentially hydrogen. Biofuels, such as biodiesel and Sustainable Aviation Fuel, will play an important but niche role – further planning and clarity are needed on the growth of this industry.



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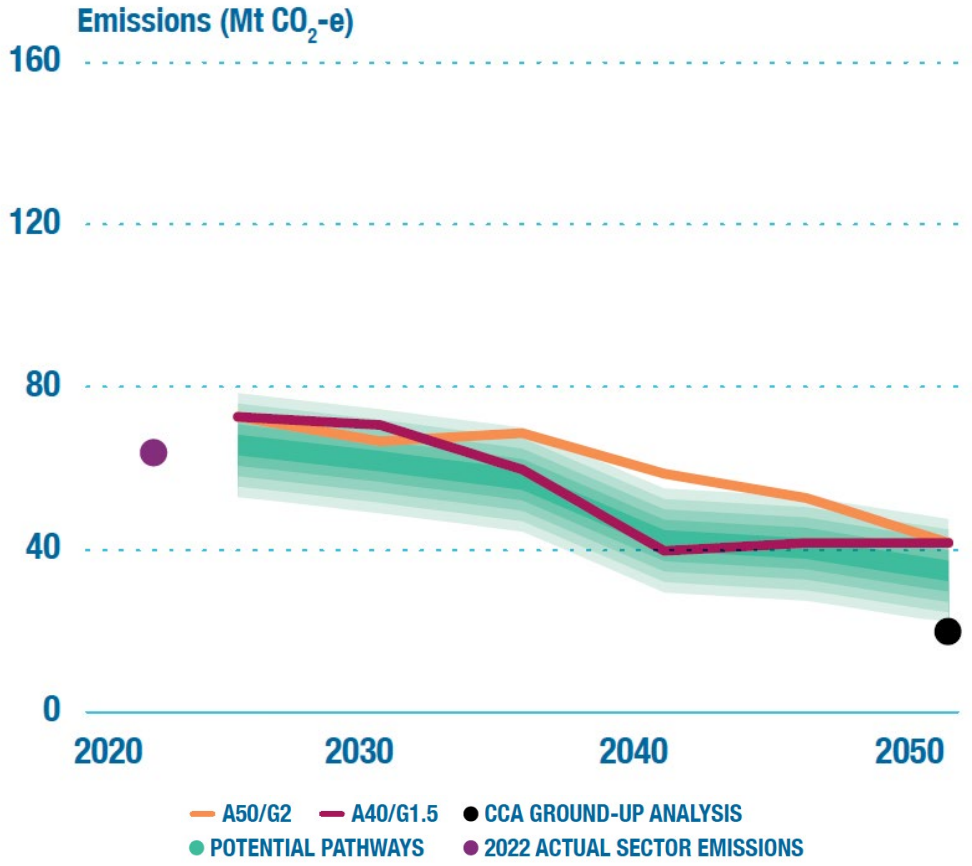
Industry and waste sector

- Australia can secure a prime position as a manufacturer and exporter of low emissions alumina and aluminium by converting current high emitting processes to renewable electricity and hydrogen.
- Australia can achieve emissions reductions in the manufacture of steel with available lower emitting technologies, using natural gas in the short term. Low or zero emissions hydrogen will enable deep decarbonisation of both steel for domestic markets and ammonia production.
- The progress of hydrogen in achieving projected cost and production levels to displace fossil fuels in domestic markets needs to be closely monitored.



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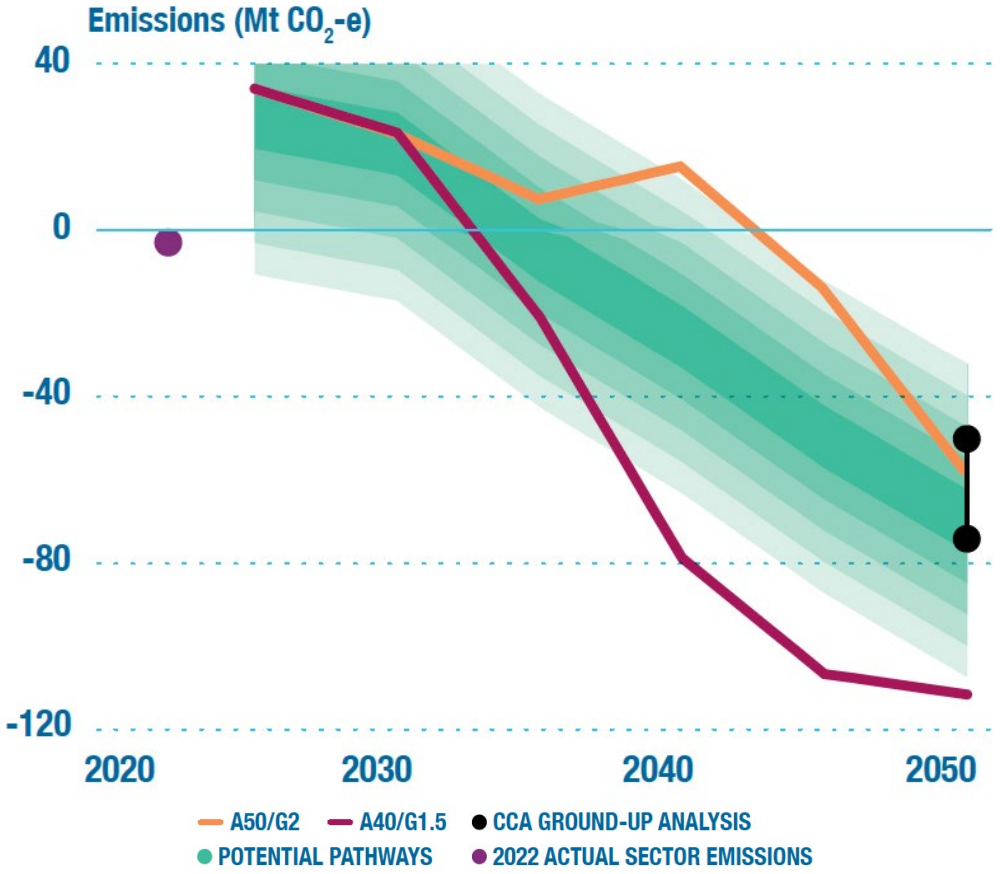
Agriculture and land sector

- Reducing livestock emissions, which account for more than half of agricultural emissions, requires changes in the way protein is grown.
- Major reductions in livestock emissions may not be realised until the late 2030s and in the 2040s. More investment in R&D is needed.
- Achieving Australia's net zero emissions reduction target may require the conversion of land to forest and this would require careful planning.
- The supply of suitable land for reforestation is limited, highlighting the need to focus on directly reducing emissions in all sectors.



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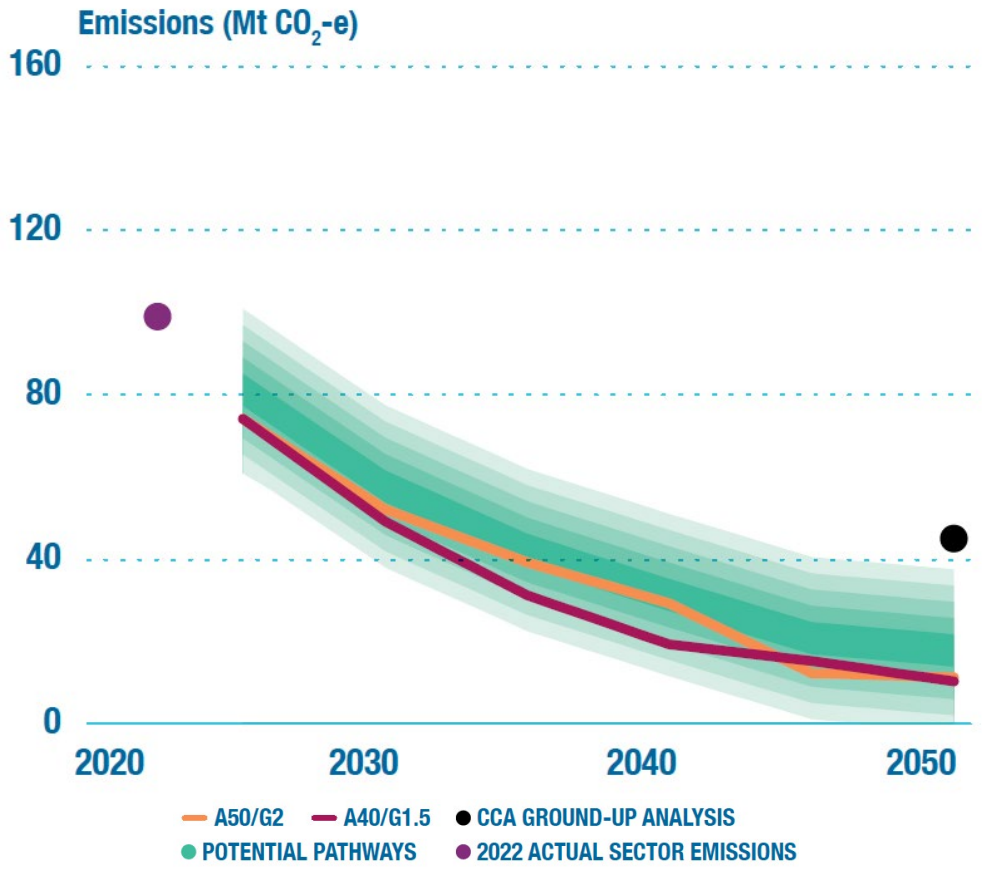
Resources sector

- Australia can continue as a world leading resource producer. However, there will be a shift to increased iron and other metals and minerals production, and away from coal and eventually gas.
- The electrification of LNG processing with low or zero emissions electricity and deployment of carbon capture and storage to sequester reservoir CO_2 can lower the fuel combustion and fugitive carbon dioxide emissions footprint of Australia's gas industry.
- Electrification of mining haulage and ore processing are significant opportunities for Australia to build on its strengths as a resource exporter and position itself as an exporter of low emissions resources.



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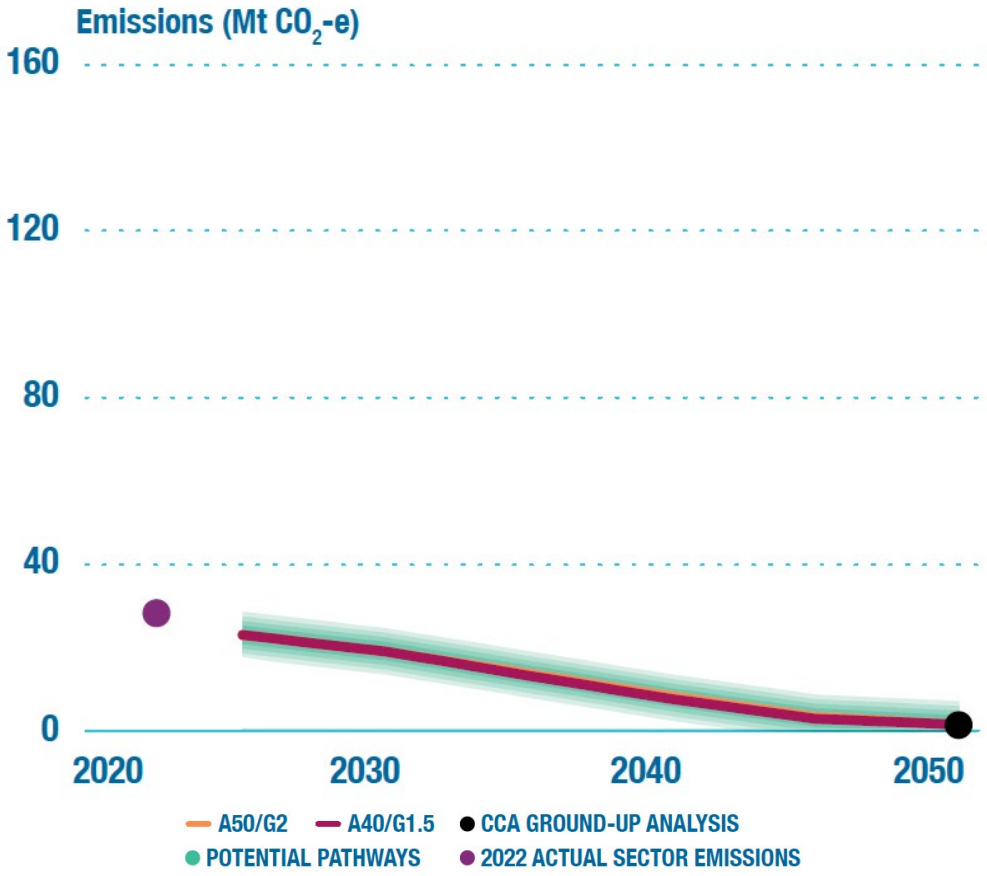
Built environment sector

- Energy efficient, electrical appliances for hot water, heating and cooking can lower emissions and save money for households and businesses. Stronger regulation and targeted funding to address upfront costs can drive faster outcomes.
- The energy efficiency of the building stock can be improved by extending standards and reporting to a wider range of commercial buildings and implementing a mandatory residential building efficiency scheme.
- Boosting energy efficiency and valuing demand response can reduce emissions while the supply of electricity decarbonises and can lessen the investment needed in new clean energy infrastructure.



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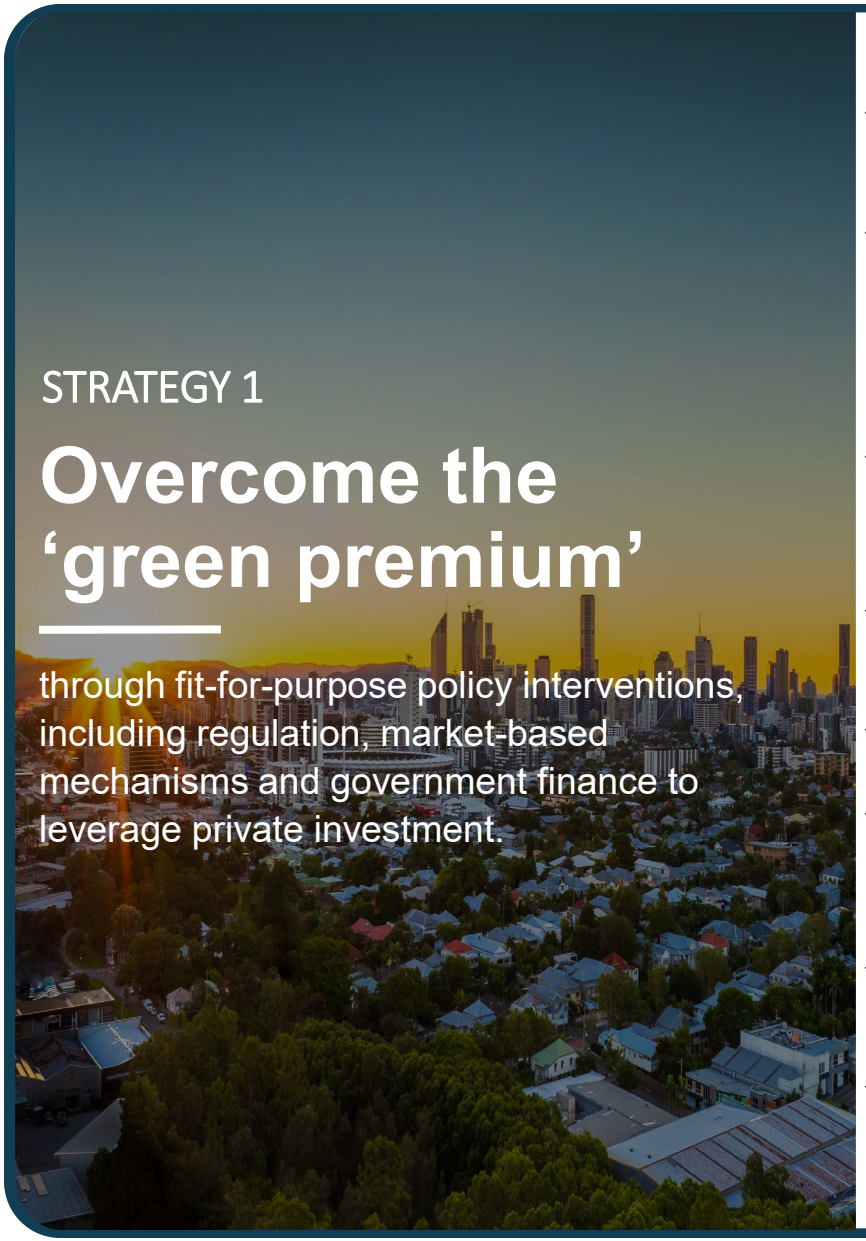
OVERCOMING BARRIERS

Sector pathways can combine to achieve net zero by 2050, provided Australians work together to overcome the barriers that stand in the way.

The authority sets out six strategies that can be incorporated in the Net Zero Plan for overcoming these barriers and enabling Australia's transition to a prosperous, net zero economy.

- **Lack of willingness to pay the 'green premium'** – the higher cost of low and zero emissions technologies relative to the high emissions technologies they must replace, which often face no penalty for the harm caused by the greenhouse gas emissions they generate
- **Slow and complicated development approval processes** for renewable energy and enabling infrastructure projects
- **A lack of community support (referred to as 'social licence') for changes** such as deployment of key clean energy infrastructure like wind farms and transmission lines
- **Constraints in supply chains for important low emissions technologies** including renewable energy generation, electric mining and haulage equipment and low emissions liquid fuels
- **Workforce shortages**, particularly in regional areas and highly skilled new industries
- **Information and data gaps** that impede planning for decarbonisation, the workforce it will require, and the investment decisions that could finance it.



STRATEGY 1

Overcome the ‘green premium’

through fit-for-purpose policy interventions, including regulation, market-based mechanisms and government finance to leverage private investment.

Actions

- ✓ Expand the scope of key existing policy frameworks such as the Safeguard Mechanism, ACCU scheme and National Greenhouse and Energy Reporting Scheme.
- ✓ For the electricity and energy sector—to provide greater certainty and stronger signals for investors—strengthen the Capacity Investment Scheme (which could be legislated, administered by a standalone statutory agency and increased in size and pace) and establish policy settings and market design arrangements that will continue to drive the clean energy transition beyond 2030.
- ✓ Further promote efficient decision-making and resource allocation by harmonising signaling across the economy on the cost of carbon (value of emissions reductions), through standardised guidance developed by the Treasury for use in government and regulatory decision-making.
- ✓ Set interim goals and guiderails within each sector that strive for ambition while promoting an orderly transition, based on the principle of common but differentiated responsibilities and respective capabilities.
- ✓ Tighten and broaden mandatory emissions and energy efficiency standards for consumer and commercial products.
- ✓ Establish a ‘one stop shop’, which could be within the Net Zero Economy Authority, to help people find and access the federal, state and territory emissions reduction financial support programs that best suit their circumstances and needs.
- ✓ Pursue an orderly phase-out of government policies and programs that support emissions-intensive activities while redirecting resources— including skills and capital —to support clean energy and low emissions alternatives.
- ✓ Develop a National Carbon Market Strategy that includes setting out how carbon offsetting will be used to channel finance towards deployment of removals technologies without substituting or delaying direct emissions reductions.

STRATEGY 2

Accelerate the deployment of net zero infrastructure

by reforming planning and approvals processes, coordinating business engagement within and across jurisdictions, and identifying and fast-tracking the development of renewable energy zones and clean industrial hubs.

Actions

- ✓ Prioritise net zero transition projects in a principled, planned approach with input from the Net Zero Economy Authority and in collaboration with state, territory and local governments.
- ✓ Simplify, coordinate and expedite approval processes for priority projects within and between jurisdictions.
- ✓ Use sector plans and National Energy Transformation Partnerships as the basis for building a set of government-industry agreements, with principles, time limits on decision making and agreements under which governments and businesses navigate approvals together.
- ✓ Develop low emissions industrial precincts, including pre-evaluation of regions for suitability for priority activities and new net zero industries, and of the renewable electricity generation and other infrastructure needed to power them, based on principles including environmental and community impacts.
- ✓ Accelerate access to firmed, off-grid renewable electricity, including by developing common user infrastructure.
- ✓ Ensure sufficient energy storage and synchronous generation is deployed in the electricity system for system reliability and security to be preserved, without slowing the closure of coal-fired power stations and deployment of renewables and storage.

STRATEGY 3

Strengthen the foundations for social licence and a just transition to net zero

through enhancing climate literacy, building capacity in business and communities to negotiate benefit and burden-sharing arrangements, and working with communities to support the net zero transition.

Actions

- ✓ Develop a dedicated, independent information and engagement campaign to combat mis- and dis-information and to build climate literacy and understanding of the Net Zero Plan.
- ✓ For priority transition projects, work with state, territory and local governments to adopt a best-practice benefit and burden sharing framework.
- ✓ Make available a toolkit to help governments, project developers and communities (including remote, rural, regional and First Nations communities) negotiate agreements with free, prior and informed consent.
- ✓ Adopt a strategic, place-based approach to urban planning and regional development so, where viable, the benefits of new industries can be co-located with burdens of declining industries and infrastructure.

STRATEGY 4

Think global, act local

for Australia to prosper in a net zero world.

Actions

- ✓ Negotiate bilateral decarbonisation agreements with key trading partners to help secure supply chains for essential net zero technologies and inputs and support an orderly transition away from fossil fuels for mutual benefit.
- ✓ Plan for and signal early investment in the infrastructure necessary for the transformation of the energy system, to retain Australia's spot in the global supply chain queues.
- ✓ Develop and implement plans for the decarbonisation of Australia's exports and to support more rapid emissions reductions overseas, leveraging our comparative advantages (e.g. renewable energy, critical minerals and sequestration potential) and preparing for the inevitable decline in demand for fossil fuel exports.
- ✓ Implement a carbon border adjustment measure to maintain the competitiveness of Australian businesses as decarbonisation accelerates.

STRATEGY 5

Rapidly address workforce shortages

by diversifying and deploying a rapid skills program and enhancing workforce mobility.

Actions

- ✓ Reinstate and expand the ABS Employment in Renewable Energy Activities statistics to enable better workforce planning in clean energy and low carbon activities, particularly in regional areas. Data collection should include renewable energy construction, energy efficiency construction, energy generation and low and zero carbon transport workforces. *See more on information and data gaps on the next slide*.
- ✓ Embed workforce planning in sector plans, with governments working together with businesses to prioritise workforce diversification and ensure a fit-for-purpose education system.

STRATEGY 6

Address information and data gaps

by expanding, simplifying and automating data collection and dissemination.

Actions

- ✓ Expand the suite of government resources that enable individuals and businesses to make better informed purchasing decisions (like the Green Vehicle Guide, the National Australian Built Environment Rating System, GEMS, and Guarantee of Origin) and put them in one place as a one stop shop to provide tailored information, including on:
  - the benefits and risks of investments in electrification, energy efficiency, and fleet electrification.
  - the value proposition for farmers and businesses of adopting low emissions practices and technologies.
- ✓ Following the implementation of mandatory climate-related financial disclosures, prioritise establishing mandatory digital reporting as a next step to give investors, financial institutions, businesses, developers, governments and end-users ready access to data about emissions in their supply chains.
- ✓ Incorporate a net zero data strategy in the Net Zero Plan, which expands the collection of, and enhances the availability of, the data that consumers, businesses and investors require to make informed decisions in keeping with Australia's net zero goals.

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