



Investing in green hydrogen

CEFC investments draw on our understanding of clean energy finance to drive the growth of a thriving green hydrogen industry that is expected to make a substantial contribution to Australia's transition to net zero emissions.

March 2024



Australian Government



Kickstarting the green hydrogen economy

Australia aims to be a global hydrogen leader, exporting green hydrogen and using it to decarbonise Australian industries.

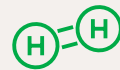
Catalysing investment

The CEFC is focused on investing in projects which align with the National Hydrogen Strategy and put Australia on a path to be a global green hydrogen leader by 2030. We are also seeking to harness the potential of green hydrogen to support the national ambition of reaching net zero emissions by 2050.

The National Hydrogen Strategy estimates that through developing a domestic hydrogen industry, \$50 billion could be generated in additional GDP by 2050.

We aim to encourage emerging investor interest in hydrogen where economic returns do not yet achieve investor benchmarks. This includes identifying opportunities to attract large-scale institutional capital by proving up risks to allow the market to move to larger-scale projects.

Our CEFC hydrogen strategy



Renewable hydrogen

Supports the transition to a low carbon energy system through investment support for electrolyser technologies which use renewable energy.



End-use applications

Overcomes barriers to adoption by investing in the rollout of hydrogen end-use technologies and supporting infrastructure, such as for long haul transport.



Scale

Focuses on investments in projects which scale to 10 MW or more, building on the demonstrated electrolyser deployments in Australia which are at 1 MW capacity.



Deployment

Bridges the commercial financing gap for renewable hydrogen production and use by financing large-scale electrolyser deployments or use cases.

\$50b

Potential hydrogen industry



The global market

The Hydrogen Council estimates that by 2050, the production of more than 600 million tonnes of hydrogen needed to reach net zero emissions, could contribute to more than 20 per cent of the annual global emissions reduction.

The Hydrogen Council also estimates that hydrogen could prevent 80 gigatonnes of cumulative CO₂ emissions through to 2050.¹

Tapping into demand

The Hydrogen Council predicts that China, India, Japan, South Korea, Europe and North America will account for 75 per cent of global hydrogen demand, with China emerging as the largest consumer in the years to come, with a demand for 200 million tonnes of clean hydrogen.

Australia is expected to become the largest net-exporter of low-emissions hydrogen by 2050, alongside the Middle East, according to the International Energy Agency (IEA) 2022 World Energy Outlook.²

Export potential demonstrated

Australia became the first country in the world to ship liquified hydrogen in February 2022. The shipment to Japan was a major milestone in a \$500 million Hydrogen Energy Supply Chain pilot project and demonstrated the potential for an end-to-end supply chain between both countries.³

¹ Hydrogen Council: Global Hydrogen Flows: Hydrogen trade as a key enabler for efficient decarbonization

² IEA: 2022 World Energy Outlook p397

³ Australian Trade and Investment Commission: Australia exports world's first shipment of liquified hydrogen



Australia's hydrogen advantage

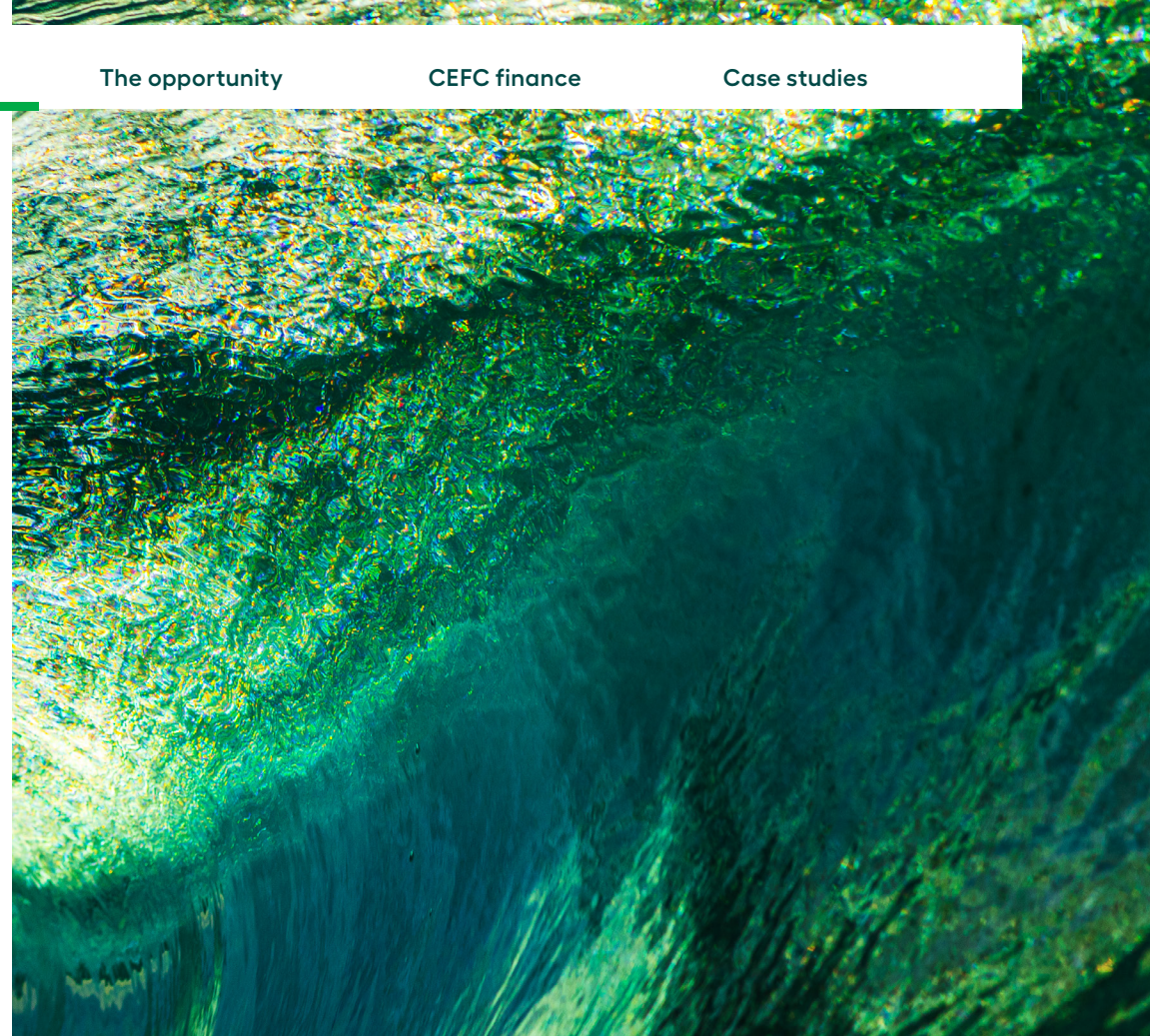
Our nation is well positioned to develop a substantial domestic and export market for hydrogen backed by renewable energy sources.

Australia's hydrogen industry could generate \$50 billion in additional GDP and create more than 13,000 regional jobs and a further 13,000 jobs from construction of new renewable energy infrastructure by 2050 according to analysis by McKinsey and Modelling by the Department of Climate Change, Energy, the Environment and Water (DCCEEW).¹



¹ Australian Renewable Energy Agency: \$2 billion for scaling up green hydrogen production in Australia

² DCCEEW: Australia's National Hydrogen Strategy



Hydrogen hubs

A key element of Australia's approach will be to create hydrogen hubs – clusters of large-scale demand. These may be at ports, in cities, or in regional and remote areas and will provide industry with a springboard to scale.²

Hubs will make the development of infrastructure more cost-effective, promote efficiencies from economies of scale, foster innovation, and promote synergies from sector coupling. These will be complemented and enhanced by other early steps to use hydrogen in transport, industry and gas distribution networks, and integrate hydrogen technologies into our electricity systems in a way that enhances reliability.



The green hydrogen opportunity for Australia

Although renewable hydrogen has experienced significant global momentum, many countries are focused on downstream technologies that use hydrogen, rather than positioning themselves as a leading global hydrogen producer.

Australia has strong foundations and significant competitive advantages for developing a substantial green hydrogen domestic and export market.

Australia's hydrogen advantages



Abundant natural resources

Australia has some of the world's best renewable energy resources and significant land availability with access to water resources. Geoscience Australia has identified 262,000 km² of coastal land suitable for hydrogen production, enough to produce more than the global demand for 2050 predicted by the Hydrogen Council.



Growing hydrogen expertise

Australia has significant hydrogen research and development expertise. The National Hydrogen Strategy notes that Australia leads the world on the Normalised Citation Impact for research into storage, distribution and use of hydrogen.



Established energy export markets

Australia's proximity to key Asian export markets, including Japan, South Korea and China, provides a significant competitive advantage. Australia has a long history of being a trusted energy exporter to these markets.



Government support

The Australian Government has committed to ensuring policies and regulations support the development of a safe, cost competitive hydrogen industry.



Strong market development track record

Australia has experience in developing large-scale industries, most notably the large-scale renewable energy sector.



Domestic market opportunities

Australia's large agriculture, fertiliser, manufacturing and logistics industries provide a strong foundation to support a significant domestic market for hydrogen.



Working with industry and investors

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As we get closer to 2030 and 2050, the impetus to accelerate the commercial development of green hydrogen and bridge the commercial gap for early-stage green hydrogen technologies is becoming increasingly urgent. The global shift towards clean energy, and the opportunity for growth in the clean hydrogen sector is clear.”

Ian Learmonth
CEO, CEFC

Hydrogen Headstart

Hydrogen Headstart aims to help bridge the commercial gap for early hydrogen projects, putting Australia on course for up to 1 GW of electrolyser capacity by 2030.

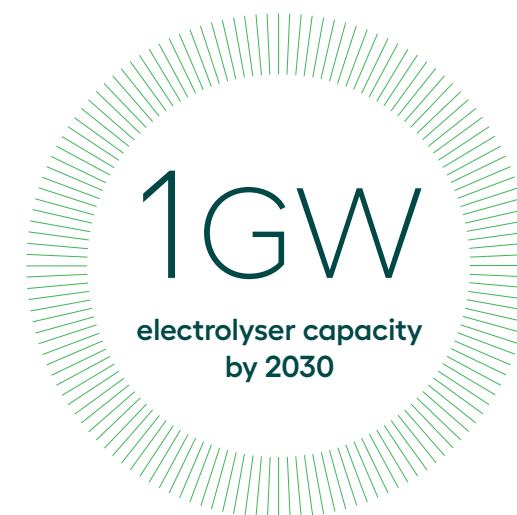
The \$2 billion initiative, co-developed by the Australian Renewable Energy Agency (ARENA) and the DCCEE, provides revenue support for large-scale renewable hydrogen projects through competitive hydrogen production contracts.

In December 2023 a short list of six applicants representing total electrolyser capacity of more than 3.5 GW across Australia was announced.¹ These applicants have been invited to submit full applications. Successful funding recipients are expected to be announced in late 2024, with funding expected to be available in 2026-27.

The CEFC will seek to provide complementary equity and debt finance for relevant projects, through the \$300 million Advancing Hydrogen Fund.

Investor collaboration

The CEFC signed a Memorandum of Understanding with the Japan Bank for International Cooperation (JBIC) in October 2023 to strengthen cooperation across the hydrogen, renewable energy and electricity infrastructure sectors as both nations strive to decarbonise their economies. The CEFC and JBIC will consider co-investment opportunities in Australia and share investment knowledge and experience to support and fast track investment in the clean energy transition in Australia and Japan.



¹ ARENA: Hydrogen Headstart applicants are potential world leaders



Producing hydrogen for a net zero future

Hydrogen might be the most abundant element on earth but is rarely found in its pure form. Practically, this means that hydrogen needs to be extracted from its compound and the extraction process needs energy.

Green ammonia

Hydrogen is mainly used for ammonia production in Australia, accounting for approximately 70 per cent of total hydrogen use nationally.

The ammonia is used in multiple industrial processes. Traditionally ammonia has been produced through the steam methane reforming (SMR) process, where it produces “grey” ammonia. The SMR process is a material carbon emitter, accounting for almost one per cent of total Australian greenhouse gas emissions.

Accelerating the transition to green ammonia, produced using renewable energy, represents a sizeable abatement opportunity for Australia, with the potential to position Australia as a leading global producer and exporter of green ammonia.

Hydrogen production

Hydrogen can be produced or extracted using virtually any primary source of energy, including renewables. Although most of the world’s hydrogen production today is being produced through the more CO₂-intensive processes of steam methane reforming and coal gasification, hydrogen can also be produced through an electrolysis process that makes use of renewable electricity, leading to the production of “green” or CO₂-neutral hydrogen.

Electrolysis uses an electric current to split water (H₂O) into its constituent parts, being hydrogen and oxygen gas. Where renewable energy is used, the gas has a zero-carbon footprint. While hydrogen has served mostly as an input into a range of industrial processes, it could be used across a number of applications in the energy and industrial sectors, to make a meaningful contribution to the transition to a net zero emissions economy.

As a leading investor in renewable energy, the CEFC is committed to working with the hydrogen sector to support the production of “green” or CO₂-neutral hydrogen.

Green hydrogen applications

Transportation

Fuel for light and heavy-duty vehicles, material handling, rail, shipping, marine and aviation.

Feedstock for industry

Including providing low emissions feedstock for ammonia, methanol, oil refineries and steel mills.

Generation and balancing

Providing centralised power, including storage, and distributed power (off-grid and back-up).

Fuel for industry

Especially in medium-high grade heat applications which are notoriously difficult to electrify.

Fuel for buildings

Applications include blending into the gas grid and combined heat and power.



Investing with the CEFC

Benefits of CEFC finance

The CEFC brings a unique combination of financial expertise, technical knowledge and industry experience to address some of Australia's most intractable energy and emissions challenges.

CEFC finance remains central to filling market gaps, whether driven by technology, development or commercial challenges. We also invest to lead the market, putting our capital to work in new areas, building investor confidence and accelerating solutions to difficult problems.

What CEFC finance seeks to achieve

Through investing alongside counterparties to support new investment in hydrogen we are looking to:

- Drive large-scale deployment of electrolyser technologies: leading to technology cost reductions, improved supply chain expertise, increased industry expertise and offtake opportunities.
- Catalyse the hydrogen industry: to accelerate the deployment of large-scale renewable energy hydrogen technologies, including demand-side projects to achieve price discovery, increase transparency of current and projected economies of scale, and increase skills and market knowledge.
- Provide access to tailored finance: supporting project proponents as they seek to accelerate hydrogen developments.
- Support the implementation of the National Hydrogen Strategy: including its aims to create jobs, especially in regional areas, contribute to a cleaner environment, increase prosperity and enhance Australia's fuel security.

Advancing Hydrogen Fund

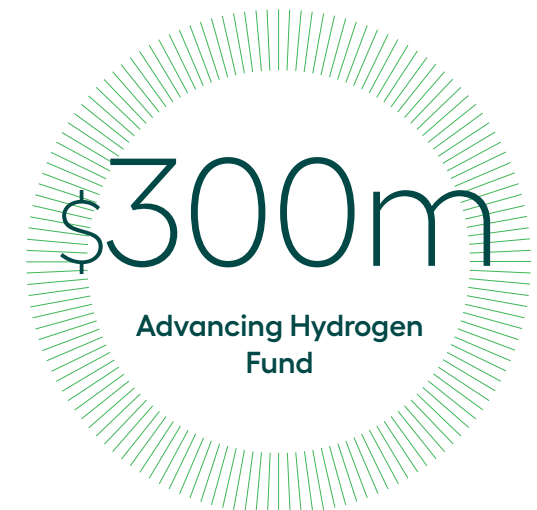
We invest in hydrogen through our dedicated \$300 million Advancing Hydrogen Fund as well as in hydrogen-related climate tech opportunities. Equity and debt finance are used to support projects that align with the National Hydrogen Strategy.

Eligible investments through the Advancing Hydrogen Fund may include those which:

- advance hydrogen production
- develop export and domestic hydrogen supply chains, including hydrogen export industry infrastructure
- establish hydrogen hubs
- assist in building domestic demand for hydrogen.

Projects seeking finance through the Advancing Hydrogen Fund must be commercial, reflecting the requirement that the CEFC works to deliver a positive return for taxpayers across its general portfolio.

The CEFC has also invested in hydrogen-related climate tech through its Clean Energy Innovation Fund, which is a specialist venture capital investor in innovative businesses helping to accelerate the transition to net zero emissions.





Case study

Hysata innovation leads green hydrogen push

\$10.5m

CEFC commitment

20%

more efficient

→ **Learn more** about our investment in Hysata

The project

Hysata is commercialising innovative advanced electrolyser technology, based on University of Wollongong research, that is some 20 per cent more efficient than incumbent technologies.

Expectations

Hysata technology was recognised at COP28 as an Energy Transition Changemaker for its project with Queensland power generator Stanwell which involves the commercial demonstration of a 5 MW electrolyser unit. The high efficiency of the Hysata electrolyser, coupled with a simple approach to mass manufacturing and low supply chain risk, puts the company on a path to delivering the world's lowest-cost green hydrogen.

The Hysata electrolyser system has been designed for ease of manufacturing, scaling and installation.

Why we are supporting

The development of high-efficiency Australian technology, which could be used in large-scale projects provides a real advantage for local hydrogen industry drawing from renewable energy sources. The CEFC commitment to Hysata was made via the Clean Energy Innovation Fund managed on behalf of the CEFC by climate-tech specialists Virescent Ventures.





Case study

Ark Energy sees hydrogen as the future for green zinc

\$12.5m
CEFC commitment

155 t
Green hydrogen a year

The project

Ark Energy is developing the SunHQ H2 hydrogen hub in Townsville, which includes a 1 MW polymer electrolyte membrane electrolyser, compressors, storage and refuelling infrastructure.

Expectations

The facility is expected to produce up to 155 tonnes of green hydrogen a year and is a key part of plans to enable the Sun Metals zinc refinery to become the first in the world to produce green zinc. The SunHQ hydrogen hub at the zinc refinery will draw its energy from the Sun Metals solar farm to produce green hydrogen. Excess hydrogen will be available to third-party customers.

Why we are supporting

Decarbonising heavy transport is a key part of reducing emissions, and green hydrogen provides an important alternative where electrification is not an option. The CEFC commitment, made via the Advancing Hydrogen Fund, supports the construction of the hydrogen production and refuelling infrastructure for the zinc refinery. The commitment also backs five purpose-built, zero emissions ultraheavy duty Hyzon hydrogen trucks for transporting zinc concentrate to the refinery and finished zinc ingots to Port of Townsville.

→ [Learn more](#) about Ark Energy





Case study

HydGene technology harnesses biomass waste

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Our innovative technology not only paves the way for the growth and adoption of decentralised manufacturing hubs, but also plays a crucial role in the global transition to an affordable, green hydrogen economy.”

Dr Louise Brown

CEO and Co-founder,
HydGene Renewables

\$2m

CEFC commitment

The project

HydGene Renewables has developed an alternative green hydrogen solution that converts biomass sugars into hydrogen gas, via a carbon-negative process using bacteria. The process takes place in HydGene-designed modular plants, enabling localised green hydrogen production in rural and remote areas, where the cost of transporting hydrogen can be high. The HydGene technology is particularly suited to markets where feedstock supply and waste are abundant, such as the agricultural, forestry, paper and pulp and food industries.

Expectations

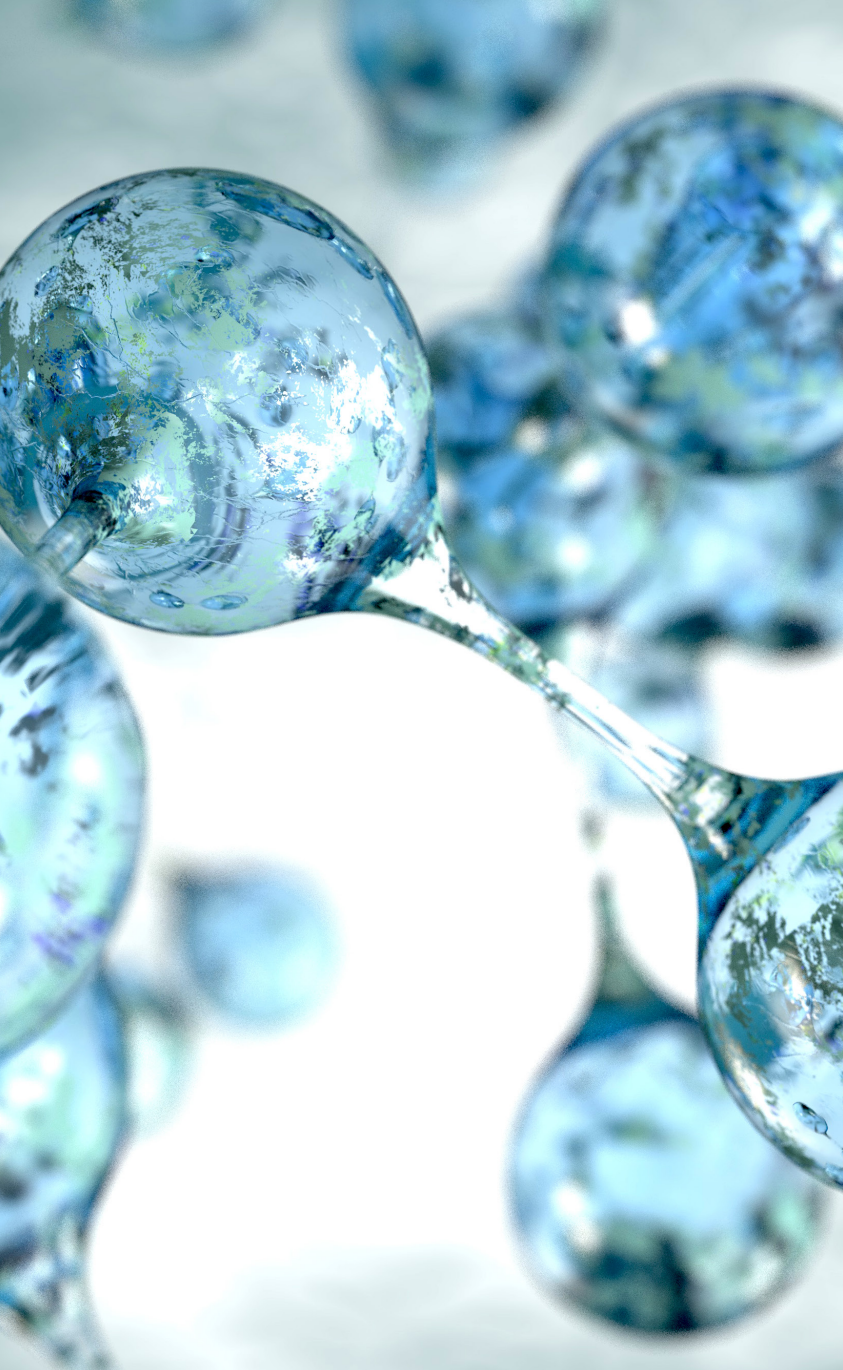
The highly efficient biocatalyst system can be scaled up or down to meet demand. HydGene, which was spun out of Macquarie University research, plans to establish a pilot plant, expand its team and conduct further research.

Why we are supporting

The CEFC investment in HydGene, made via the Clean Energy Innovation Fund and managed by Virescent Ventures, is aimed at accelerating the development of the technology alongside electrolytic hydrogen to grow Australia's green hydrogen.

→ [Learn more](#) about HydGene Renewables





Case study

Hydrogen Park Murray Valley paves way for industry

4,000 tCO₂-e

Green hydrogen a year

\$3.22m

CEFC commitment

The project

Hydrogen Park Murray Valley, next to the Wodonga Wastewater Treatment Plant, in Albury Wodonga, will involve a 10 MW electrolyser. Green hydrogen is expected to be blended into gas networks to supply around 40,000 homes and 20 industrial sites with cleaner energy.

Expectations

When operational, the facility is expected to be the equal largest renewable hydrogen facility in Australia, with the potential to cut emissions by approximately 4,000 tCO₂-e each year.

Why we are supporting

Hydrogen Park Murray Valley will also look to identify other opportunities to use renewable hydrogen in industrial and transport applications, maximising the value of the renewable hydrogen and helping drive decarbonisation across the local economy. The CEFC commitment, made via the Advancing Hydrogen Fund, sits alongside a \$36.1 million commitment from the Australian Renewable Energy Agency made through the Renewable Hydrogen Deployment Funding Round.

→ [Learn more](#) about Hydrogen Park Murray Valley



About the CEFC

The CEFC is an experienced specialist investor with a deep sense of purpose: we're Australia's 'green bank', investing in our transition to net zero emissions by 2050. With access to more than \$30 billion from the Australian Government, we're backing economy-wide decarbonisation, from renewable energy and natural capital to energy efficiency, alternative fuels and low carbon materials. In parallel, we're focused on transforming our energy grid, backing sustainable housing and supporting the growth of our climate tech innovators. We collaborate with co-investors, industry and government, recognising the urgency of the decarbonisation task. We also invest with commercial rigour, aiming to deliver a positive return across our portfolio.

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