



Australian Government



# CEFC Advancing Hydrogen Fund



## Applications for renewable hydrogen

### 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.

The CEFC Advancing Hydrogen Fund is aiming to invest up to \$300 million to support the growth of a clean, innovative, safe and competitive Australian hydrogen industry.

The CEFC debt and/or equity finance will focus on projects that align with the National Hydrogen Strategy, including projects which have State or Territory Government financial support.

#### Eligible projects can include:

- advancing hydrogen production
- developing export and domestic hydrogen supply chains, including hydrogen export industry infrastructure
- establishing hydrogen hubs
- other projects that assist in building domestic demand for hydrogen.

As with all CEFC investments, projects seeking finance through the Advancing Hydrogen Fund must be commercial, reflecting the requirement that the CEFC work to deliver a positive return for taxpayers across its portfolio.

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Hydrogen has the potential to make a substantial contribution to our clean energy transition, reducing emissions across the economy while driving the development of an important new industry. CEFC finance remains central to filling market gaps, whether driven by technology, development or commercial challenges. We are confident we can use our capital to help build investor confidence in the emerging hydrogen sector.”

**Ian Learmonth**  
CEFC, CEO

An early priority for the Advancing Hydrogen Fund will see the CEFC seek to invest in projects included in the ARENA Renewable Hydrogen Deployment Funding Round, a \$70 million grant program aiming to demonstrate the technical and commercial viability of hydrogen production at a large-scale using electrolysis

## CEFC hydrogen strategy

1

### Renewable hydrogen

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

2

### End-use applications

Overcome barriers to adoption by investing in the roll-out of hydrogen end-use technologies and supporting infrastructure, such as for long haul transport

3

### Scale is key

With demonstrated electrolyser deployments in Australia at 1MW, the Advancing Hydrogen Fund will focus on investment in projects which scale to 10MW-plus

4

### Deployment

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

## Benefits of CEFC finance

The CEFC continues to bring 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. Investment in the emerging hydrogen sector is an exciting extension of the CEFC's investment focus.

CEFC finance for the hydrogen sector has the potential to deliver significant benefits:

- **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 economics of scale, and increase skills and market knowledge
- **Access to tailored finance:** providing investing support to 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.

## Working with ARENA

The CEFC and ARENA are already working together to unlock the barriers to investment for the advancement of Australia's hydrogen economy.

An early priority for the Advancing Hydrogen Fund will see the CEFC seek to invest in projects included in the \$70 million ARENA [Renewable Hydrogen Deployment Funding Round](#).

The Round is receiving expressions of interest for projects which: demonstrate electrolysis and associated renewable hydrogen technologies at scale; facilitate a pathway to technical and commercial viability of renewable hydrogen in Australia and provide price discovery and transparency in relation to the current and projected economics for renewable hydrogen technologies.

ARENA and the CEFC have previously worked together to accelerate clean energy developments, including through the successful large-scale solar funding program. The [program](#) delivered grant and/or debt finance to 12 developments contributing to large-scale solar becoming cost competitive with wind energy and cheaper than new build coal and gas.



## National Hydrogen Strategy

Australia is well placed to be a major hydrogen producer, with the National Hydrogen Strategy finding that Australia has an abundance of the natural resources needed to make clean hydrogen.

### Hydrogen produced using renewable energy:

- produces no carbon dioxide emissions when used as a fuel
- can be produced as a gas or liquid, or made part of other materials
- can be used as fuel for transport or heating and a way to store electricity

The National Hydrogen Strategy sets a path for Australia to become a major global player in the hydrogen industry by 2030 by removing market barriers, ensuring regulatory consistency and building international trade partnerships.

The strategy outlines an adaptive approach that equips Australia to scale up quickly as the hydrogen market grows.

## Hydrogen production

Hydrogen might be the most abundant element on earth but is rarely found in its pure form.

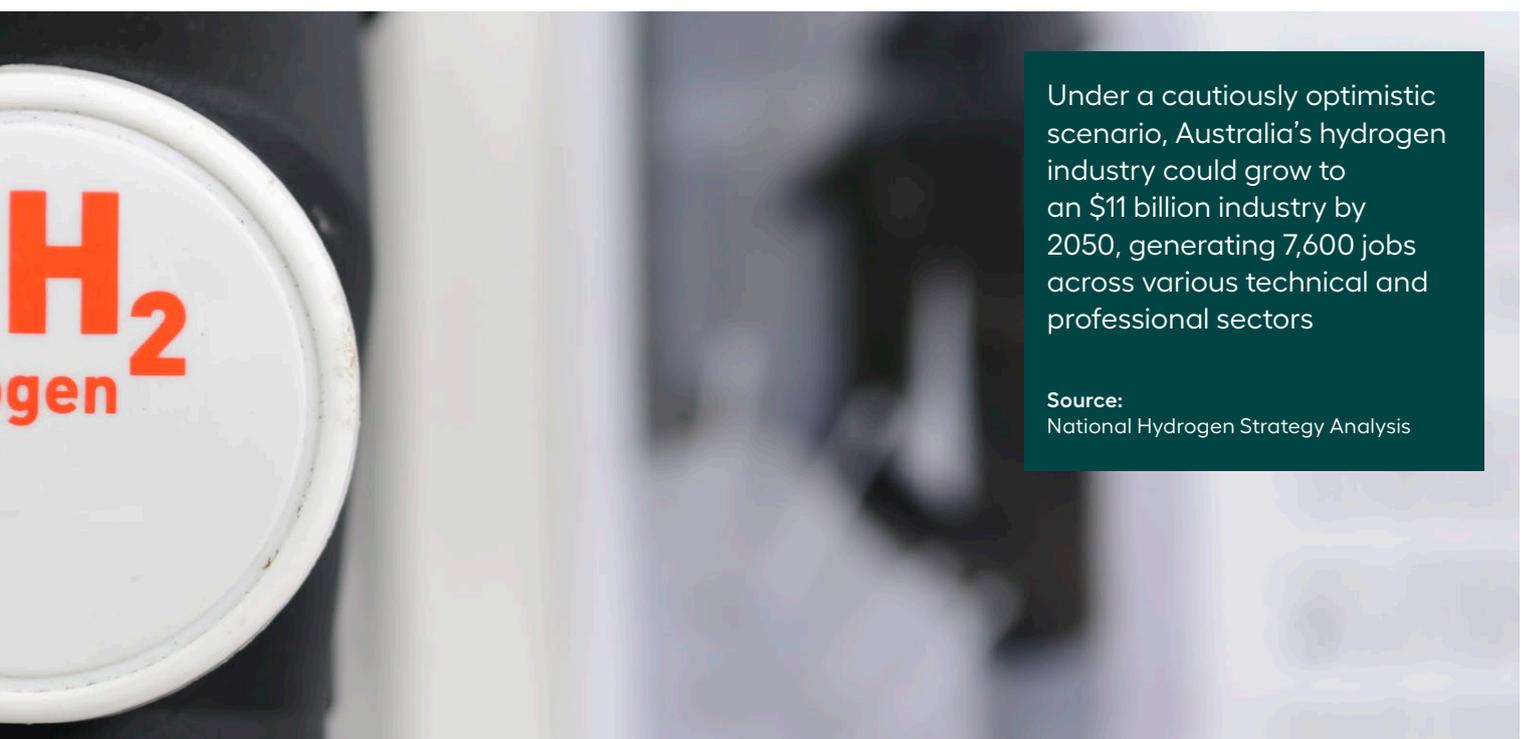
Practically, this means that in order to produce hydrogen, it needs to be extracted from its compound. This extraction process needs energy. Hydrogen can be produced or extracted using virtually any primary source of energy, including renewables.

Although most of the world's hydrogen production today is being produced through the more CO<sub>2</sub>-intensive processes of steam methane reforming (SMR) 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 CO<sub>2</sub>-neutral hydrogen.

Electrolysis is a process where an electric current is used to split water (H<sub>2</sub>O) into its constituent parts, being hydrogen (H<sub>2</sub>) and oxygen (O<sub>2</sub>) 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 has the potential to be used across a number of applications in the energy and industrial sectors, to make a meaningful contribution to the transition to a low 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 CO<sub>2</sub>-neutral hydrogen.



Under a cautiously optimistic scenario, Australia's hydrogen industry could grow to an \$11 billion industry by 2050, generating 7,600 jobs across various technical and professional sectors

Source:  
National Hydrogen Strategy Analysis

## Australia's hydrogen advantage

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 renewable energy hydrogen domestic and export market:

- **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 km<sup>2</sup> of coastal land suitable for hydrogen production, enough to produce more than the global demand predicted by the Hydrogen Council for 2050.
- **Growing hydrogen expertise:** Australia has significant hydrogen research and development expertise, with more than \$150 million committed to 37 pilot projects which will develop expertise in producing, storing, transporting and using hydrogen. The National Hydrogen Strategy notes that Australia also 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.

### 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 and renewable energy

The CEFC, working with investors, developers and ARENA, has played a key role in developing the renewable energy sector, which is now making a meaningful contribution to Australia's clean energy transition. But with Open NEM data showing renewables made up just 21 per cent of the National Energy Market in 2018-19, it is clear there are significant investment requirements ahead.

Hydrogen has an important role in Australia's clean energy transition, as a clean, flexible, storable and safe energy vector. In a rapid demand-response scenario, when electricity supply exceeds conventional demand, hydrogen electrolysis can be ramped up within seconds; when electricity demand exceeds supply, hydrogen electrolysis can be equally rapidly ramped down.

Hydrogen production from electrolysis can run when renewable electricity is abundant and use electricity which would otherwise be curtailed. In areas where renewable energy varies with the seasons, hydrogen can be produced in large volumes during times of plentiful supply, such as in summer for predominantly solar regions. It can then be used in times of limited supply to generate electricity through fuel cells or gas turbines or stored as gas for winter heating.

A Hydrogen Industry Roundtable co-hosted by the CEFC and ARENA confirmed that:

- The electricity for the production of renewable hydrogen can optimally be sourced from dedicated onsite renewable energy and/or through contracted grid supplied renewable energy, depending on the demand requirements
- A certification program could be used to verify the origin and carbon footprint of end use
- Electrolysers have the potential to provide a key role to support the electricity system
- Understanding the role of network providers and the Australian Energy Market Operator is required to develop an appropriate regulatory framework to support the further development of hydrogen.

## Hydrogen Hubs

The National Hydrogen Strategy notes that 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 or remote areas, and will provide the industry with its springboard to scale.

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.

## Hydrogen the fuel of the future

Hydrogen is an extremely versatile energy carrier which is gaining significant support worldwide as the “fuel of the future”, in part due to the ability of renewable hydrogen to replace fossil fuels in a large variety of applications.

The development of a renewable hydrogen industry will enable deep decarbonisation of difficult-to-abate sectors and increase the contribution of renewable energy across the economy.

In its National Hydrogen Roadmap, the CSIRO reported that the hydrogen value chain is underpinned by a series of mature technologies that are being demonstrated in pilot projects globally.

While there was considerable scope for further research and development, the CSIRO found that this level of maturity meant the market had moved from technology development to market activation, involving the transition from emerging technologies to bankable assets, similar to the development of solar PV.

The CEFC Advancing Hydrogen Fund will support this transition by providing finance to accelerate the development and commercialisation of hydrogen projects.

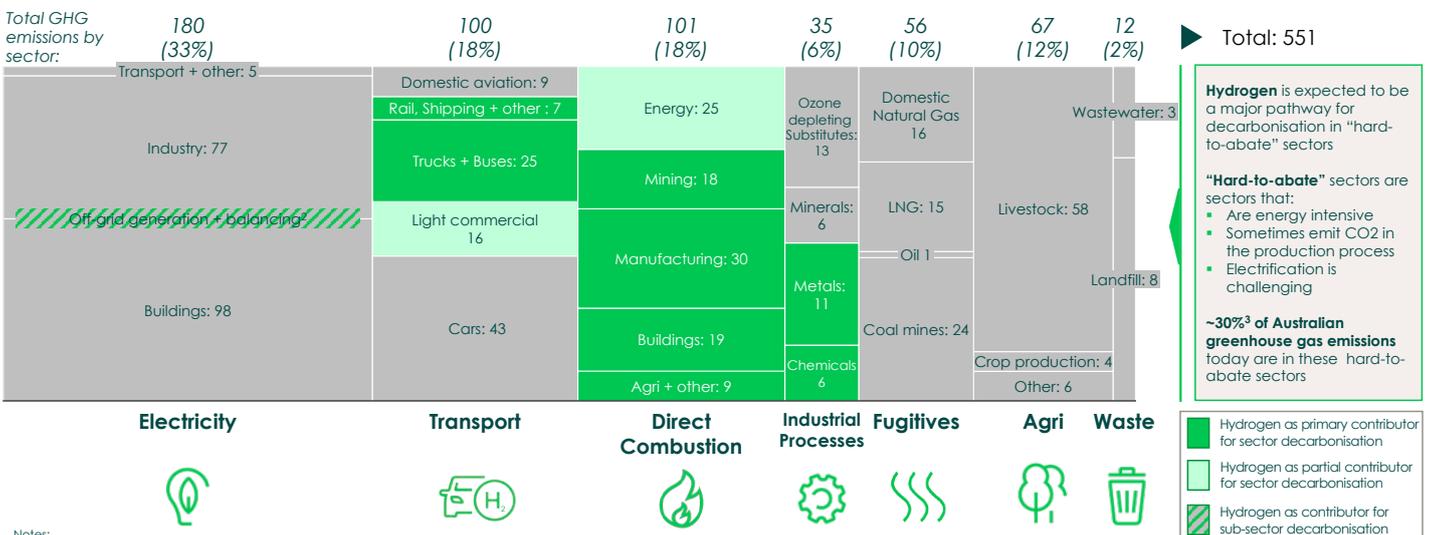
## Emissions reduction potential

Current hydrogen technologies represent the most credible pathway to the decarbonisation of “hard-to-abate” sectors – including those which produce emissions in the production process and/or lack scaleable electrification options.

Together, these sectors are responsible for driving approximately 30 per cent of Australia’s greenhouse gas emissions.

As a specialist investor, the CEFC is working across the market to address some of Australia’s toughest emissions challenges, in agriculture, energy generation and storage, infrastructure, property, transport and waste. CEFC investment in the emerging hydrogen sector is an important extension of these ongoing emissions reduction activities.

### Australian Greenhouse Gas Emissions (excl. LULUCF) MtCO<sub>2</sub>-e, 2019<sup>1</sup>



Notes:  
 1. Source: Australian Department of Industry, Science, Energy and Resources: Australia’s Emissions Projections 2019; colour coding is based on high level CEFC analysis.  
 2. Green Hydrogen as a potential decarbonisation pathway for the off-grid generation and balancing sub-sectors.  
 3. High level assumption based on potential of hydrogen as a contributor for sector decarbonisation.

## About the CEFC

The CEFC has a unique purpose – to lead investment in Australia’s transition to a low emissions economy. We invest to lead the market, operating with commercial rigour to address some of Australia’s toughest emissions challenges. This includes working with our co-investors across renewable energy generation and energy storage, as well as agriculture, infrastructure, property, transport and waste. Through the Advancing Hydrogen Fund, we are supporting the growth of a clean, innovative, safe and competitive hydrogen industry. And as Australia’s largest dedicated cleantech investor, we continue to back cleantech entrepreneurs through the Clean Energy Innovation Fund. With \$10 billion to invest on behalf of the Australian Government, we work to deliver a positive return for taxpayers across our portfolio.