



Australian Government



CEFC and the Technology Investment Roadmap



“

The CEFC has a strong commitment to investing in innovative technologies alongside ARENA, with a shared goal of lowering emissions and developing a strong clean energy sector in Australia. We see the LETS as an exciting next step in this work and the CEFC looks forward to playing a key role in their commercialisation and development.”

Steven Skala AO
Chair, CEFC

Australia’s Technology Investment Roadmap

Australia’s Technology Investment Roadmap is a strategy to accelerate development and commercialisation of low emissions technologies.¹

The first Low Emissions Technology Statement (LETS), delivered in support of the Roadmap, identified five priority technologies as having significant emissions abatement and economic potential: clean hydrogen, energy storage, carbon capture and storage, low carbon materials (steel and aluminium) and soil carbon.

Together with project proponents and co-investors the CEFC has developed a strong pipeline of potential investments which support LETS priorities. We have also made a number of investment commitments that support the Technology Investment Roadmap. Many of these technologies are familiar to the CEFC – from those we have financed to those we are strongly considering financing.

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

¹ <https://www.industry.gov.au/data-and-publications/technology-investment-roadmap-first-low-emissions-technology-statement-2020>

Increasing investment in clean energy technologies has been central to the role of the CEFC since we began investing.

Together with private sector project proponents, investors and financiers, and government agencies such as ARENA, CEFC capital has supported substantial investment across a broad range of technologies that are reducing Australia’s emissions.

We have invested in technologies which are now well established, such as wind and solar, as well as those that are emerging, including soil carbon, waste to energy and grid-scale energy storage. Through the Clean Energy Innovation Fund, we also continue to work with cleantech entrepreneurs in advancing technology innovation.

We bring this broad investment and market experience to drive investment in low emissions technologies, strengthen the economy and support jobs and businesses.

Innovation, technology and CEFC finance

CEFC finance for lowering emissions is central to filling market gaps, whether driven by technology, development or commercial challenges. In investing to lead the market, our goal is to put our capital to work in new areas, building investor confidence and accelerating solutions to difficult problems.

The CEFC is bringing this unique combination of financial expertise, technical knowledge and industry experience to address some of the major challenges outlined in the LETS. In addition, CEFC Chair Steven Skala AO has joined a new permanent advisory council that will provide advice on the preparation of future LETS.

“

Affordable, clean and reliable energy is the cornerstone of improved productivity, competitiveness and lower emissions from industry. Lower energy costs will reduce pressure on household budgets and improve Australian quality of life. Low-cost and reliable energy will encourage more onshore energy-intensive manufacturing. Improved productivity and reduced emissions intensity will help us capture new opportunities in a global low emissions economy.”

Low Emissions Technology Statement³

² <https://www.industry.gov.au/data-and-publications/technology-investment-roadmap-first-low-emissions-technology-statement-2020>

³ <https://www.industry.gov.au/sites/default/files/September%202020/document/first-low-emissions-technology-statement-2020.pdf>

Technology challenges and opportunities

The first annual LETS, delivered in September 2020, identified four major technology challenges and opportunities²:

1

Delivering more affordable, clean and reliable energy to households and industry for transportation, heating, production and power

2

Expanding production and increasing productivity, creating jobs and substantially reducing emissions from Australia's primary industries

3

Preserving and expanding onshore manufacturing of energy-intensive products and capturing new export markets for low emissions commodities

4

Scaling geological and biological sequestration such that we provide globally significant permanent sequestration of CO₂.

“

CEFC investments have helped drive more than \$30.8 billion in additional private sector investment commitments Australia-wide. This experience and our commercially rigorous investment practices will enable the CEFC to continue to spearhead investment in new and emerging technologies as foreshadowed in the LETS.”

Ian Learmonth
CEO, CEFC

LETS technology filters and priorities

Taking a technology-led approach, the LETS applied four key filters across the technologies identified in the Technology Investment Roadmap, and further refined these to categorise technologies and investment priorities⁴.

In assessing our contribution to delivery of the LETS, CEFC finance has the potential to make an impact across the economy, including in agriculture, cleantech innovation, energy generation and storage, infrastructure, property, transport and waste.

LETS technology prioritisation filters

Abatement potential

Australia's comparative advantages

Scale of economic benefit

Technology readiness

CEFC investment approach

The CEFC takes a commercial approach to our activities. We invest to deliver a positive return for taxpayers across our portfolio while also delivering on our public policy purpose to increase investment in Australia's clean energy transformation. CEFC lifetime investment commitments to 30 June 2020 will contribute an estimated 220 Mt CO₂-e in lifetime abatement.⁵ Lifetime investment commitments to 31 December 2020 reached \$30.8 billion, with some \$7 billion in CEFC capital deployed across the economy.

LETS technology categories

Priority low emissions technologies

Emerging and enabling technologies

Watching brief technologies

Mature technologies

CEFC investment approach

In working with private sector investors and project proponents, the CEFC seeks to address the main sources of carbon emissions in the economy. We focus on enabling technologies that will contribute to the reliability and security of the electricity system. We also focus on new and emerging technologies that can support lower emissions and increased productivity.⁶

⁴ <https://www.industry.gov.au/sites/default/files/September%202020/document/first-low-emissions-technology-statement-2020.pdf>

⁵ <https://www.cefc.com.au/annual-report-2020/performance/contributing-to-a-low-emissions-economy/>

⁶ <https://www.cefc.com.au/annual-report-2020/performance/cefc-investment-strategy/>

Priority low emissions technologies

LETS definition:

Potentially transformative economic and abatement impacts. They have high potential to reduce emissions both domestically and internationally across multiple sectors and applications. They are aligned with Australia's comparative advantages. These technologies will be the focus of new public investment. The Government will strive to remove barriers to the development of these technologies.

Role of CEFC finance:

Investment in new generation, storage, transmission and infrastructure is critical to support the security and reliability of Australia's energy grid. We are working closely with investors and regulators on the developing opportunities in exciting new areas such as renewable energy zones, pumped storage, grid-scale battery storage and renewable hydrogen, with a view to accelerating investment and project delivery. Through our specialist Clean Futures Team, we have dedicated team members to focus on the key areas of electricity grid, Renewable Energy Zones, energy storage and hydrogen. Through the Clean Energy Innovation Fund we also continue to work with cleantech start-ups in advancing technology innovation.

CEFC finance in action



Advancing Hydrogen Fund

\$300_m

CEFC commitment

LETS priority low emissions technology:
Clean hydrogen

Hydrogen has the potential to make a substantial contribution to our clean energy transition, reducing emissions across the economy while underpinning the development of an important domestic and export industry. Renewable hydrogen can enable the deep decarbonisation of notoriously difficult-to-abate sectors, particularly in transport and manufacturing, while accelerating the contribution of renewable energy across the economy. Eligible projects can include those which advance hydrogen production, develop export and domestic hydrogen supply chains, including hydrogen export industry infrastructure, establish hydrogen hubs and assist in building domestic demand for hydrogen. 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.

Snowy 2.0 grid infrastructure

\$125_m

CEFC commitment

LETS priority low emissions technology:
Energy storage enabler

TransGrid Services provides contestable transmission load and grid connection services in NSW and the ACT. As part of its agreement with Snowy Hydro Limited to provide connection services for 30 years, TransGrid Services will design, construct, operate and maintain a new 330 kV switching station and associated transmission lines to connect Snowy 2.0 to the NEM. Snowy 2.0 is Australia's largest renewable energy project and a critical part of efforts to improve the security and reliability of the National Electricity Market. Snowy 2.0 will provide an additional 2,000 MW of dispatchable, on-demand generating capacity and approximately 350,000 MW hours of large-scale storage to the National Electricity Market. To provide context, this is enough energy storage to power three million homes over the course of a week.



Victorian big battery powers up

\$160_m

CEFC commitment

LETS priority low emissions technology:
Energy storage

The 300 MW Victorian Big Battery (VBB) is on track to be one of the largest energy storage facilities in the world and will provide a critical boost to the state's grid security, drive down power prices and support more renewable energy. The VBB will be powered by Tesla Megapack storage units and is expected to operational for the 2021-22 summer. It is being developed by Neoen, one of the world's leading independent producers of exclusively renewable energy. The project is a world-class example of how utility scale batteries can help electricity networks support a higher penetration of renewable energy, providing dispatchable resources that will underpin the increasing share of clean energy expected to power Australia in years to come.



World first grid scale inertia services

\$50_m

CEFC commitment

LETS priority low emissions technology:
Energy storage

International renewable energy developer Neoen, which owns the landmark "big battery" in South Australia, has increased the Hornsdale Power Reserve (HPR) from 100 MW to 150 MW. The expansion provides an Australian first large-scale demonstration of the potential for battery storage to provide grid stabilising inertia services that are critical to the increasing integration of renewable energy. Neoen expects the increased storage capacity of HPR will further enhance its ability to stabilise the grid, avoid price volatility in the market and reduce the risks of blackouts. In a world first and in close cooperation with AEMO and ElectraNet, Neoen and Tesla are testing the capacity of HPR to deliver grid-scale inertia services, an essential component of grid stability.



Lifting organic carbon levels in soil

\$1.7_m

CEFC commitment

LETS priority low emissions technology:
Soil carbon

Soil Carbon Co is developing a biotechnology to improve the drought resilience of farming land, increase productivity and remove carbon from the atmosphere. The microbial treatment for seeds has the potential to increase the level of organic carbon in soil, enabling it to retain more water and improving the ability of crops to withstand extreme weather conditions. It could also reduce the amount of nitrogenous fertiliser used in agricultural production, further reducing emissions. Retaining organic carbon in soil is vital for extensive agricultural systems. Carbon is difficult to store in soils in the long-term because it naturally reacts with oxygen or water and is released back into the atmosphere. The technology aims to overcome this by storing the carbon in melanin, which is more stable.

Emerging and enabling technologies

LETS definition:

Emerging technologies are those that have transformative potential, but require continued monitoring of global learning rates, research and investment trends, or are the focus of existing policies and institutions. Enabling technologies include infrastructure such as charging and refuelling stations, energy management systems, digital infrastructure, energy efficiency, and market design activities required to overcome the challenges and realise the opportunities for priority low emissions technologies. ARENA, the CEFC and the CER will continue to support these technologies.

Role of CEFC finance:

The CEFC is a specialist investor with a deep sense of purpose: to be at the forefront of Australia's successful transition to a low carbon economy. With access to \$10 billion, we invest in new and emerging technologies and opportunities on behalf of the support of the Australian Government. This includes our activities through the Clean Energy Innovation Fund, the largest dedicated cleantech investor in Australia, as well as through our specialist asset finance programs, which provide low cost finance to borrowers investing in smaller-scale clean energy assets.

CEFC finance in action



Australia's largest virtual power plant

\$30_m

CEFC commitment

LETS technology group:
Generation enabler

A Tesla-powered and operated virtual power plant (VPP) is being rolled out in South Australia, with 3,000 home energy systems to be installed across social housing. The goal is to drive down energy bills while delivering Australia's largest VPP. Housing SA tenants who sign up for a special low electricity tariff will have 5 kW in rooftop solar and a 13.5 kWh battery storage system installed at their home at no cost to them. The solar plus battery storage systems will be able to generate about 80 per cent of a tenant's annual electricity requirements from renewable energy, drawing from the energy generated and stored on site, and reducing their reliance on the grid.



Lithium key to a cleaner future

\$20_m

CEFC commitment

LETS technology group:
Low carbon materials; Raw materials processing efficiency

The Pilgangoora lithium-tantalum project in Western Australia is aiming to produce lithium concentrate, a central component used in electric vehicles and battery storage. The Pilgangoora lithium mine is in the Pilbara region, about 120km south of Port Hedland. It will produce lithium raw materials (spodumene concentrate) that can be used to support a full range of lithium products for lithium ion batteries and energy storage solutions. The first stage of the Pilgangoora lithium-tantalum project in Western Australia has been completed and the mine is producing high quality spodumene concentrate. The CSIRO identified lithium as a current and potential future source of comparative advantage for Australia in the global clean energy transition.



Red bins find their super power

\$90m

CEFC commitment

LETS technology group:
Waste-to-energy and recycling

Australia's first large-scale energy-from-waste project – a 36 MW plant at Kwinana in Western Australia – is expected to power up to 50,000 homes using household waste. When built, the \$700 million Avertas Energy project will be able to process around 400,000 tonnes of domestic "red bin" and commercial and industrial residual waste per year. By processing household waste from local councils, it will produce cost-competitive baseload renewable energy. It is also expected to reduce CO₂-e emissions by more than 400,000 tonnes per year, the equivalent of taking 85,000 cars off the road.



Smarter, cheaper EV charging

\$3.5m

CEFC commitment

LETS technology group:
Vehicle charging and refuelling infrastructure

JET Charge, Australia's leading specialist in electric vehicle (EV) charging infrastructure, is developing smart charging hardware that will reduce the cost of smart and connected charging stations and make them more user friendly. JET Charge is deploying its proprietary smart charging technology under a services-based model that will ensure that EV charging occurs when the electricity grid can best support it. The technology also has the potential to match EV charging to times when renewable power penetration into the grid is at its highest.



World leading fertiliser industry for WA

\$60m

CEFC commitment

LETS technology group:
Low carbon materials; Raw materials processing efficiency

West Australian sulphate of potash producer Salt Lake Potash is building a world leading, low emissions fertiliser industry in Australia. The company's sulphate of potash (SOP) brine operation at Lake Way near Wiluna in WA has the potential to cut emissions from fertiliser production by more than a third, supporting significant carbon abatement in the agriculture sector. SOP is a premium specialist fertiliser used to improve the quality of crops, particularly in regions prone to drought and high salinity. The Lake Way SOP operation will use the brine production technique on the vast salt lakes near Wiluna, emitting substantially less carbon during production than SOP created using the alternative Mannheim technology.

Watching brief technologies

LETS definition:

Prospective technologies with transformative potential, perhaps where developments are currently driven primarily overseas. International developments will be closely monitored and supporting infrastructure needs assessed.

Role of CEFC finance:

The Clean Energy Innovation Fund is the largest dedicated cleantech investor in Australia, created to invest \$200 million in early-stage clean technology companies. The Innovation Fund targets technologies and businesses that have passed beyond the research and development stage and which can benefit from early stage seed or growth capital to help them progress to the next stage of their development. It draws on CEFC finance and expertise to provide primarily equity finance to innovative businesses which work in the areas of renewable energy, energy efficiency and low emissions technologies including the watching brief technologies identified by the LETS.

CEFC finance in action



Innovator takes to the high seas

\$4.7m

CEFC commitment

LETS watching brief sector: Transport

Award-winning Australian manufacturer Omni Tanker Holdings, which produces innovative carbon fibre tank containers, is expanding its business to meet international shipping demand in the bulk liquid transport equipment market. Omni Tanker's ISO standard carbon fibre tank containers are six times the strength of steel tankers, and more than 35 per cent lighter. They can transport a wide range of corrosive liquids and high purity chemicals. The combination of light weight and exceptional chemical resistance of Omni Tanker's carbon fibre tanks means transporting them requires less energy and produces lower emissions.



Powering next wave of Australian solar

\$7m

CEFC commitment

LETS watching brief sector: Buildings (building integrated PV)

Sunman is developing technology with the potential to revolutionise the use of solar PV in Australia, producing lightweight, flexible panels that can be used across a wider range of applications than existing glass panels. Its innovative eArc solar panels, made from a lightweight polymer composite material, are 70 per cent lighter than a glass panel and can be moulded to contoured surfaces offering potential for use beyond conventional rooftops, such as a mobile power generation for remote sites and vehicles, and in construction materials to encase buildings.



When technology meets food waste

\$1m

CEFC commitment, via Tenacious ventures

LETS watching brief sector: Other

The CEFC is an investor in Tenacious Ventures, Australia's first dedicated agrifood tech venture capital firm. In its first investment, Tenacious Ventures is providing investment support to Canberra-based Goterra, a start-up combining robotics with fly larvae to break down most food scraps and create a packaged larvae livestock feed. Goterra's modular infrastructure for biological services units – MIBs – deliver onsite waste management, without the hauling and trucking required with more conventional waste management systems. Fully automated and biosecure, the MIBs can manage five tonnes of food waste per day.



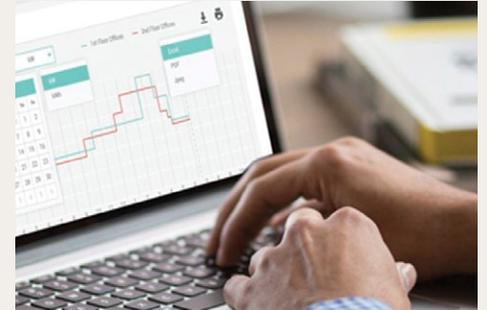
Reinventing the wheel

\$12m

CEFC commitment

LETS watching brief sector: Transport

Geelong-based Carbon Revolution produces the world's only mass produced one-piece carbon fibre car wheel. The unique carbon fibre wheels are as much as 45 per cent lighter than aluminium wheels, reducing vehicle weight and therefore fuel consumption and carbon emissions. Carbon Revolution's carbon fibre wheels offer an alternative to heavier aluminium wheels, which are used in about 50 per cent of cars globally. The carbon fibre wheels are up to 13 times stronger than aluminium wheels and can deliver a six per cent improvement in fuel efficiency when they are fully integrated into vehicle design. Carbon Revolution was established in 2007 and listed on the Australian Stock Exchange in December 2019.



Technology driven solutions

\$5.5m

CEFC commitment

LETS watching brief sector: Buildings

Zen Ecosystems has developed intelligent energy management solutions that could save Australian businesses up to 25 per cent on their energy costs. Traditionally, energy usage has been controlled by building management systems, which are usually only cost effective for large or industrial-use buildings. The Zen technology is designed for smaller footprint businesses as a low cost, easy-to-use cloud platform for managing energy-intensive assets across single and multiple sites, simply by checking in on a desktop or phone. The technology also opens the way for individual users to participate in demand response initiatives, contributing to the continued stability and reliability of the energy system.

Mature technologies

LETS definition:

Existing, proven technologies like coal, gas, solar and wind will play important roles in Australia's energy future, but are not the focus of the Roadmap. The Government will continue to invest in mature technologies where there is a clear market failure, like a shortage of dispatchable generation, or where these investments secure jobs in key industries, but future deployment of mature technologies will primarily be driven by the private sector. The LETS further notes that "continued cost reductions and performance improvements for mature technologies will be needed to support some of the priority low emissions technologies".⁷

Role of CEFC finance:

The CEFC continues to play an important role in the transition of Australia's energy grid. Having financed more than 3 GW of utility scale solar and wind renewable energy since we began investing, the CEFC works closely with the renewables sector to address emerging market and technology developments. This includes a particular focus on how the CEFC can facilitate the power system transition forecast by AEMO, as well as contribute to the goals of the Technology Investment Roadmap. Together with private sector project proponents, investors and financiers, as well as several Australian Government agencies, CEFC capital has supported substantial cost reductions in solar and wind technologies. We see this trend continuing.

⁷ <https://www.industry.gov.au/sites/default/files/September%202020/document/first-low-emissions-technology-statement-2020.pdf>



CEFC finance in action



Synchronous condenser to boost grid

\$57_m

CEFC commitment

LETS mature technology: Solar

The 200 MW (AC) Kiamal Solar Farm, in north-west Victoria, will use a 190 MVAR synchronous condenser to improve grid strength in the region. This will facilitate a timely connection to the Victorian Transmission System, as well as strengthen the grid in north-western Victoria for the longer term. Synchronous condensers operate in a similar way to large electric motors and generators and enable the grid to resist large changes in power system frequency that arise from imbalances in supply and demand. The Kiamal development is Victoria's largest solar farm. It will include more than 718,000 PV panels with single-axis trackers covering some 500 hectares of land. It is expected to produce enough electricity to meet the needs of more than 133,500 homes and displace more than 610,000 tonnes of carbon dioxide emissions annually.



Second life for disused coal-fired power station

\$60_m

CEFC commitment

LETS mature technology: Solar

A disused coal-fired power station at Collinsville in Queensland has been redeveloped as a solar farm which is expected to generate enough energy to power 15,000 homes. The coal-fired Collinsville Power Station, located 90km south-west of Bowen and 4km west of Collinsville, was opened in 1968 and operated, with a total output of 180 MW, until December 2012. The new solar power project takes advantage of existing infrastructure to enable it to feed its power into the grid.



Supporting Australian manufacturing

\$120_m

CEFC commitment

LETS mature technology: Wind

The 270 MW Sapphire Wind Farm, located between Glen Innes and Inverell in northern NSW, features the latest Vestas turbine technology, as well as transformers manufactured in Australia. The transformers were manufactured by the Wilson Transformer Company, Australia's largest manufacturer of power transformers. The Sapphire Wind was the first wind farm in Australia to use the new Vestas V126 3.6 MW turbine, which has one of the best available rates of energy production per turbine. The use of the Vestas turbines led to an improved supply chain for turbine equipment and cost efficiencies.

CEFC and the Technology Investment Roadmap: Q&A

How is the CEFC supporting the Technology Investment Roadmap?

The CEFC has a strong focus on supporting the Technology Investment Roadmap. We use our financial expertise, technical knowledge and industry experience to address some of the Australia's most intractable energy and emissions challenges. We are working closely with investors and regulators on the developing opportunities in exciting new areas such as renewable energy zones, pumped storage, grid-scale battery storage and hydrogen, with a view to accelerating investment and project delivery. Through our specialist Clean Futures Team, we have dedicated team members to focus on the key areas of electricity grid, Renewable Energy Zones, energy storage and hydrogen. Through the Clean Energy Innovation Fund we also continue to work with cleantech startups in advancing technology innovation.

What kind of projects can the CEFC invest in?

The CEFC Act requires the CEFC to invest in eligible clean energy technologies, including renewable energy, energy efficiency and low emissions technologies. Further, we are required to ensure that, at any time on or after 1 July 2018, at least half of CEFC funds are invested in renewable energy technologies. As with all CEFC investments, projects seeking finance must be commercial, reflecting the CEFC's requirement to deliver a positive return for taxpayers across the portfolio. This does not include research and development, feasibility studies, prototypes, pilot projects or demonstration projects.

Will the CEFC invest in all the technologies identified in the Roadmap?

Together with project proponents and co-investors, we have developed a strong pipeline of potential investments which would support the Roadmap. Many of these technologies are familiar to the CEFC – from those we have financed to those we are strongly considering financing. As with all CEFC investments, projects seeking finance must be both

commercial and an eligible clean energy technology under the CEFC Act.

How are CEFC investment decisions made?

Our Executive Investment Committee reviews investment opportunities and makes recommendations to the CEFC Board, which approves suitable investments. We apply commercial rigour to individual investment decisions, which are made independently of government. We work to deliver a positive return for taxpayers across our portfolio.

What is the preferred size of investment?

The CEFC considers each investment opportunity on a case by case basis. We provide debt and/or equity finance to eligible larger-scale commercial and industrial projects – typically requiring \$20 million or more of CEFC capital. Smaller-scale projects, from \$10,000 to \$5 million, may be eligible for debt finance through our specialist asset finance programs. Borrowers should contact our financiers directly.

Is concessional finance available for TIR investments?

All CEFC investments are made with the expectation of a positive risk-based financial return. Therefore, concessionality is applied sparingly on a case by case basis. Concessionality may include lower than market interest rates, longer loan maturity, as well as longer and more flexible grace periods before the payment of principal and/ or interest is due.

Is grant funding available?

The CEFC doesn't give grants. We invest both debt and equity, and work to deliver a positive return for taxpayers across our portfolio.

Where can I get more information?

Please visit the CEFC website, where you will find copies of our Investment Guidelines, Investment Policies and asset finance programs. You can also email us at info@cefc.com.au.



About the CEFC

The CEFC has a unique mission to accelerate investment in Australia's transition to net zero emissions. We invest to lead the market, operating with commercial rigour to address some of Australia's toughest emissions challenges. We're 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're 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.