



ARENA

**INVESTMENT
PLAN 2023**



Australian Government
Australian Renewable
Energy Agency

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ARENA acknowledges the traditional custodians of Country across Australia and their continuing connection to land, sea and community. We pay our respects to elders past and present.



01

DELIVERING THE ENERGY TRANSITION

Delivering the energy transition will require innovation, commercial support and a focussed effort as we face the challenges of weaning our modern world off fossil fuels and removing carbon from our economies.

Australia's electricity system is rapidly evolving and more work is needed to ensure a successful energy transition. Solar PV is largely commercial but further innovation and cost reduction is needed to enable cheap hydrogen production and electrification of heavy industry. Energy storage continues to advance with new battery chemistries and alternative technologies emerging, along with the need for longer-duration electricity storage as coal-based power generators retire. Thermal energy storage is gaining traction given the need for renewable heat and an increasing focus on decarbonisation of industry.

Renewable hydrogen continues to scale in Australia; however, the industry remains at an early stage with further technology and commercial barriers to be overcome. Production credits or revenue underwrite mechanisms are being implemented to give industry the confidence to proceed with the development and construction of projects, while providing certainty on the ability to bridge the commercial gap between production cost and an offtaker's willingness to pay.

The traditionally hard to abate metals sectors are trialling technologies that decarbonise aluminium and target low carbon iron and steel processing pathways. Beyond aluminium and steel, the energy transition will require a significant ramp-up in the value chains of critical minerals such as lithium, cobalt and nickel over a short timeframe, which brings its own innovation and scaling challenges.

Decarbonisation of light passenger transport is under way globally, with Australia seeing a significant increase in the use of battery electric vehicles. Zero emissions heavy road transport is also showing promise, but significant innovation and testing is still required before its adoption becomes widespread. Early progress is evident in aviation technologies along with the emergence of potential solutions for decarbonising rail and maritime transport.

As the penetration of renewable energy and decarbonisation technologies increases, the challenges become more complex.

ARENA's expertise, deep understanding of the energy sector and willingness to fund innovative and ground-breaking projects means we provide a pathway to commercialisation for many new technologies and businesses that might otherwise struggle to get off the ground or be potentially lost to overseas markets.

This Investment Plan details our strategic priorities and funding programs, as well as how to apply for ARENA funding.

We periodically review and update our strategic priorities and may reflect any changes in a revised investment plan at which point this document will be superseded.

You can also read about ARENA's:

- overall strategy including our operating context, vision and purpose, key activities and approach to delivery, performance reporting and risk management in our **Corporate Plan**
- principal objectives and priorities for ARENA's key activity of providing financial assistance in our **General Funding Strategy**
- achievements and outcomes to date in our latest **Annual Report**.

These can be found at arena.gov.au/about/publications



02

ABOUT ARENA

The Australian Renewable Energy Agency (ARENA) was established on 1 July 2012 by the Australian Renewable Energy Act 2011 (Cth) (ARENA Act). ARENA is a Commonwealth corporate entity under the Public Governance, Performance and Accountability Act 2013 (Cth) (PGPA Act).

The ARENA Act is supported by the Australian Renewable Energy Agency Regulation 2016 (Regulation), which extends ARENA's functions with respect to renewable energy technologies to include electrification and energy efficiency technologies.

Through our role in improving the competitiveness of renewable energy technology and increasing the supply of renewable energy in Australia, ARENA is helping to achieve the Government's climate change and energy objectives, anchored by emissions reductions goals of 43 per cent by 2030 and net zero by 2050.

Based on the functions set out in the ARENA Act and the priorities contained in the General Funding Strategy, ARENA provides financial assistance for:

- research into, and development of, early-stage technologies that are world-leading or address specific Australian requirements
- demonstration of the feasibility of new technologies or supporting business models that are novel in application

- pre-commercial deployment of technologies where this is expected to improve the competitiveness of future projects.

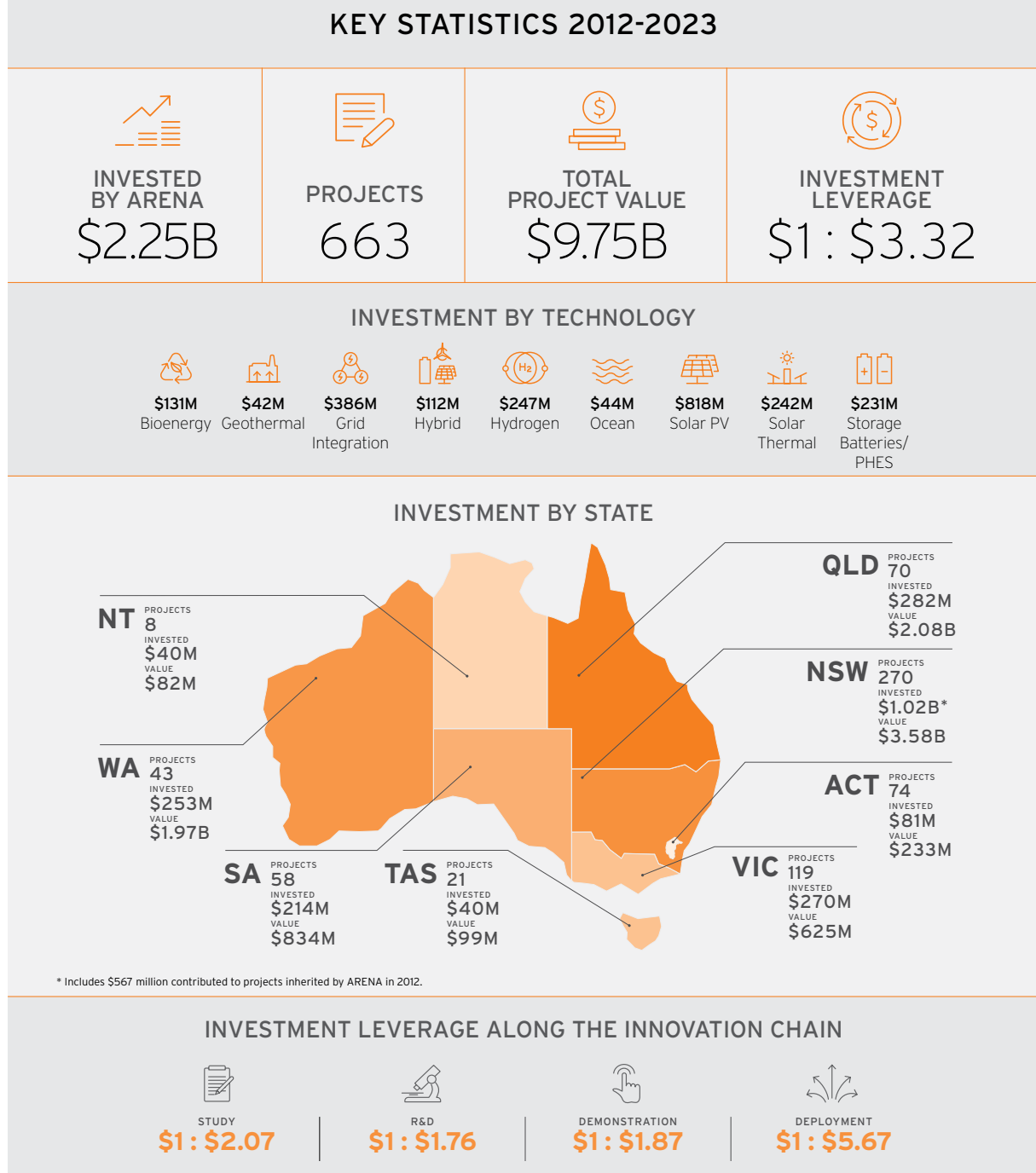
Our **purpose** is to support improvements in the competitiveness of renewable energy and enabling technologies, increase the supply of renewable energy in Australia, and to facilitate the achievement of Australia's greenhouse gas emissions targets by providing financial assistance and sharing knowledge to accelerate innovation that benefits all Australians.

Our **vision** is a prosperous Australia that is a renewable energy superpower in a net zero world.

Our **mission** is to support the global transition to net zero emissions by accelerating the pace of pre-commercial innovation, to the benefit of Australia.

The impact of our work is significant. Since 2012, we have been instrumental in building the foundation of the renewable energy ecosystem in Australia. ARENA has committed over **\$2.25** billion in grants to **663** renewable energy projects to date, with a total project value of **\$9.75** billion, meaning that for every dollar of Commonwealth funding third parties have invested **\$3.32**¹.

FIGURE 1 - ARENA AT A GLANCE - FUNDING COMMITMENTS TO PROJECTS 2012-2023.



AS AT 30 JUNE 2023

In September 2020 the Australian Government extended ARENA's funding, committing baseline funding of **\$1.43 billion for the 10 years to 2032**. ARENA has periodically received further funding to deliver budget programs, aligned to ARENA's priorities and mandate, that support industries, technologies and regions to decarbonise.

For information on active funding programs visit arena.gov.au/funding

¹Investment leverage ratio is calculated and updated at the end of each quarter, based on the current ARENA amount committed and the current total project cost.

An aerial photograph of an industrial facility, likely a water treatment plant, situated in a vast, arid desert landscape. The facility features several large rectangular basins, some containing greenish water, and various industrial buildings and structures. A winding road or canal cuts through the site. The surrounding terrain is dry and sparsely vegetated with small green shrubs.

03

OUR INVESTMENT APPROACH

HOW WE MAKE OUR FUNDING DECISIONS

ARENA is committed to achieving maximum impact and value from the projects we fund.

We provide funding for projects across the innovation chain, from research through to pre-commercial deployment. Our funding is focused on finding and demonstrating technology solutions and business models that reduce technical, commercial and regulatory barriers and improve Australia's knowledge and expertise.

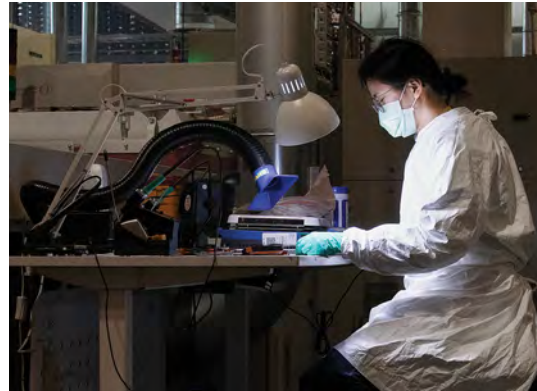
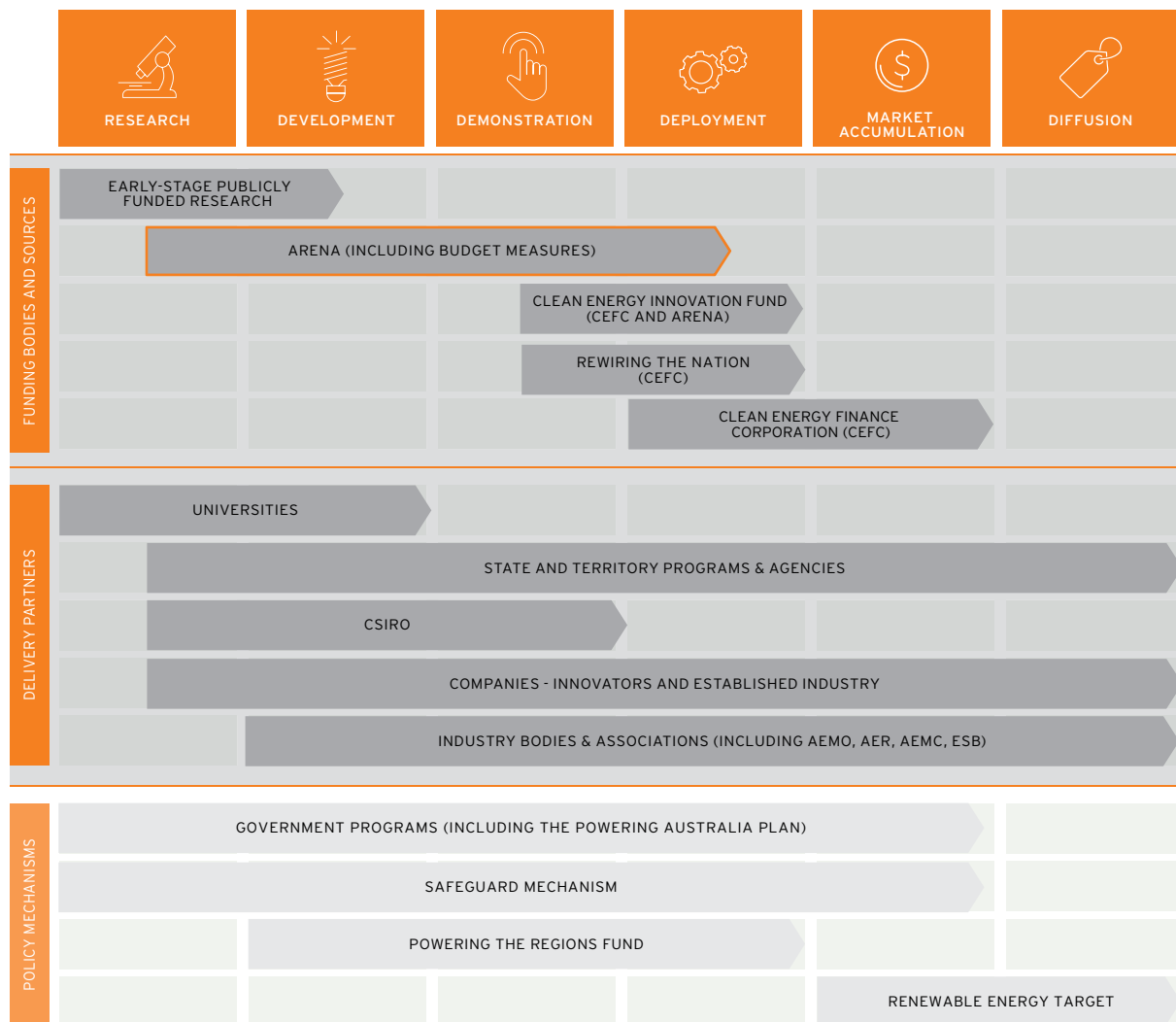


FIGURE 2 - COLLABORATION ACROSS THE INNOVATION CHAIN



When making funding decisions, we carefully consider a project's merit. A project must demonstrate that it is technically or commercially innovative, will advance market knowledge, has a pathway to commercialisation and can help unlock future investment.



OUR FUNDING PROGRAMS

ARENA has a range of funding programs that support projects from research and development through to demonstration and deployment. The funding programs range from continuously open programs to those that are run periodically to target specific outcomes and types of projects. We also administer Budget programs and support the Clean Energy Innovation Fund through our role on the Joint Investment Committee.

Visit arena.gov.au/funding for up-to-date information on the programs currently open for applications. You will also find information on the funding application process, funding guidelines and relevant timelines.

Our funding is provided as a grant. Where a proposal has the potential for significant commercial success, ARENA funding may include recoupment rights contingent upon future outcomes. We will provide further guidance to applicants on which type of funding is appropriate to your project.

Integrity

As a granting agency responsible for the allocation of Commonwealth funds, ARENA recognises that it is critical our processes and decision-making are fair, transparent, robust and defensible from an integrity perspective. Integrity, probity and professionalism have always been critical to our work, and these values are reinforced under our Integrity Framework. A strong integrity approach supports our accountability to the Minister, the Parliament and the Australian public.

See [Before applying for ARENA funding \(page 17\)](#) for more details.

04

OUR STRATEGIC PLAN

Our strategic priorities

ARENA will support:

- the transition to an electricity system powered by renewables through investment in technologies that enable ultra low-cost solar, unlock new flexible demand, improve the economics of energy storage and optimise large-scale integration of renewable energy.
- the unlocking of a viable renewable hydrogen industry in Australia by investing in the commercialisation of renewable hydrogen production and delivery, and proving the viability of the most prospective end uses.

- the transition to low emissions metals focusing on the steel, aluminium and other critical energy mineral value chains.
- the development of transport decarbonisation pathways, focusing on light and heavy road transport.

The strategic priorities are funded through our baseline funding and, where applicable, Budget program funding that aligns with these areas. ARENA also delivers other Budget programs that may extend beyond the scope of our strategic priorities.

For more details on our strategic priorities and Budget programs please refer to the remainder of this document and visit arena.gov.au/funding

For information on active programs, how to apply, key dates and guidelines please visit arena.gov.au/funding.

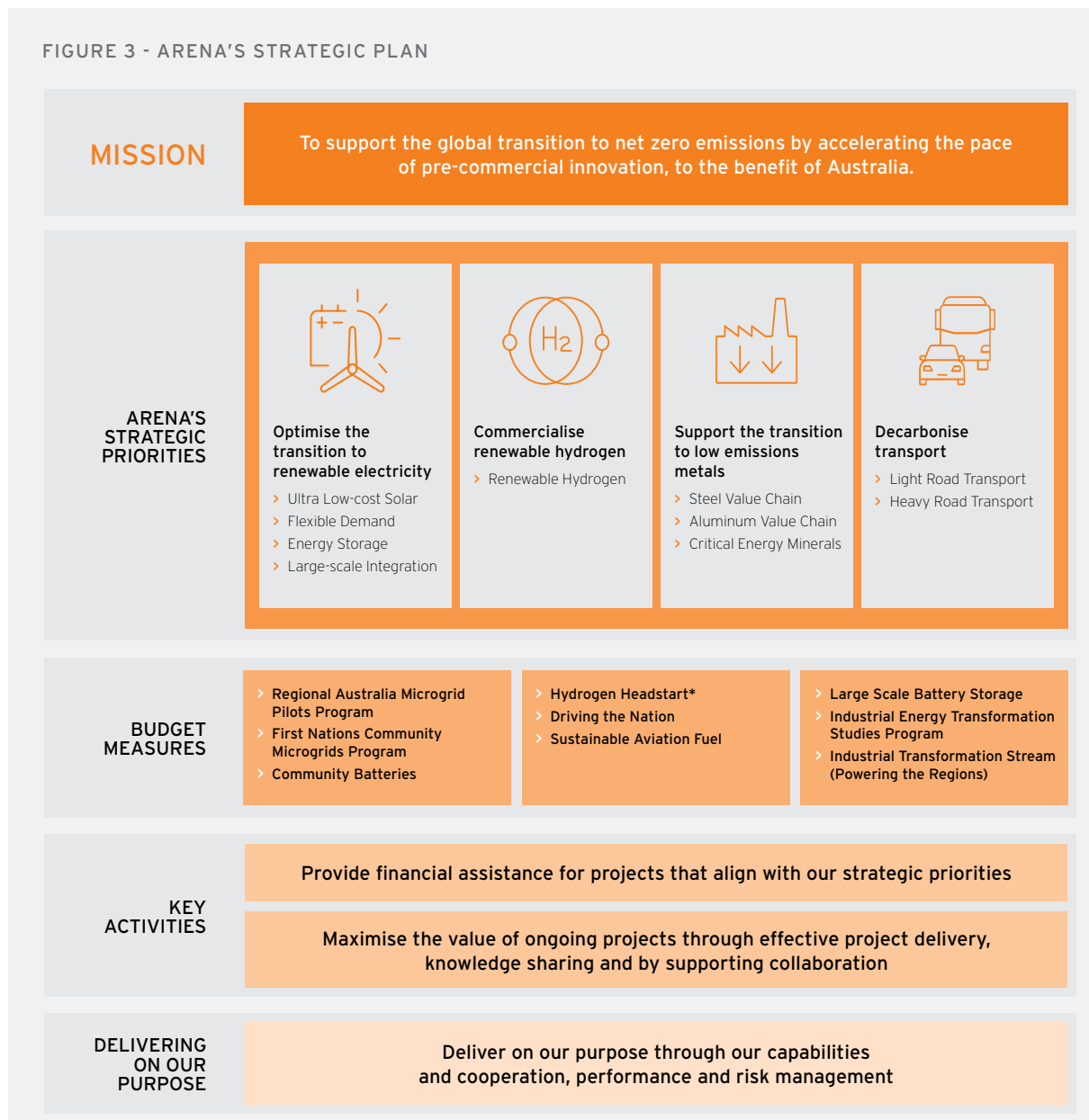
ARENA works collaboratively with the Clean Energy Finance Corporation (CEFC) to administer the Clean Energy Innovation Fund (Innovation Fund). Virescent Ventures manages the Innovation Fund on behalf of the CEFC.

The Innovation Fund can provide equity finance for innovative clean energy businesses that support renewables, energy efficiency and low emission technologies. Funding from the Innovation Fund helps eligible projects

and businesses get to the next stage of commercialisation. The Innovation Fund does not provide grants.

More information on the Innovation Fund is available at: cefc.com.au/innovationfund

FIGURE 3 - ARENA'S STRATEGIC PLAN



*ARENA supporting design phase of the program in collaboration with Department of Climate Change, Energy, the Environment and Water (DCCEEW)

OPTIMISE THE TRANSITION TO RENEWABLE ELECTRICITY

Australia's electricity system is rapidly evolving. Solar and wind are now the cheapest sources of new bulk electricity supply, and significant numbers of Australian households and businesses continue to install rooftop solar and other distributed energy technologies. Grid-scale innovations are also driving the transition, including increased use of grid-scale batteries.

Demand for renewable electricity is expected to increase significantly as Australia moves towards net zero. Key drivers of this demand will be greater electrification of sectors such as transport and heavy industry, as well as the development of new industries such as hydrogen production.

Further technical and commercial innovation, as well as market reforms, will be critical to ensure the electricity system can transition efficiently, reliably and cost-effectively.

Our focus

Our focus areas within this priority include:

- > enabling **ultra low-cost solar** to decarbonise our electricity system and improve the competitiveness of future industries such as renewable hydrogen and low emissions metals.
- > unlocking new **flexible demand** to reduce system balancing costs.
- > improving the **economics of energy storage** and increasing the diversity of technologies available to allow for low-cost firming of electricity and heat supply.
- > optimising the **large-scale integration** of new grid-scale renewable electricity to ensure secure and reliable operation at high levels of instantaneous renewables penetration.

1. Enable ultra low-cost solar

ARENA's Solar 30-30-30 ambition is to achieve: 30 per cent module efficiency at an installed cost of 30 cents per watt by 2030. If achieved, we expect to be able to achieve an LCOE (Levelised cost of electricity) of <\$20/MWh.

IMPROVE CELL AND MODULE EFFICIENCY AND COSTS	Demonstrate new technologies or methods that can increase module efficiency towards 30 per cent, reduce manufacturing costs and risks, increase module lifetimes and increase bifaciality factors.
REDUCE BALANCE OF PLANT (BOP) AND DEPLOYMENT COSTS	Demonstrate new technologies or methods that can reduce installed costs towards 30 cents per watt, such as simplified mounting designs, prefabrication, improved installation methods (e.g. automation in the field) and other design innovations.
REDUCE OPERATIONS AND MAINTENANCE (O&M) COSTS	Demonstrate technologies or methods that reduce O&M costs, such as automation and robotics.
REDUCE OTHER COSTS AND OVERCOME BARRIERS TO SCALE-UP	Demonstrate other technologies or methods that can reduce the LCOE of solar PV through levers such as inverter efficiency, end-of-life management and soft costs.

2. Unlock new flexible demand

DEMONSTRATE THE VALUE AND VIABILITY OF FLEXIBLE DEMAND	Demonstrate novel load shifting and shedding technologies or business models that inform the regulatory framework. This could focus on industrial, commercial and residential settings, including managed charging of electric vehicles.
IMPROVE THE ENABLERS OF FLEXIBLE DEMAND	Inform the regulatory framework and standards relating to supporting infrastructure and system integration required to enable flexible demand. For example IT and interoperability, dynamic operating envelopes, data and analytics, market signalling, business models and access to value streams.

Note: We have an impressive portfolio of Flexible Demand projects and expect to share valuable learnings as they progress. We will only be funding new projects if they are highly innovative and fill a gap in our existing portfolio.



3. Improve the economics of energy storage

ACCELERATE COMMERCIALISATION OF LARGE-SCALE LONGER-DURATION ENERGY STORAGE (LDES)	Accelerate the commercialisation of LDES technologies (especially those capable of providing electricity over 8+ hours) including thermal, electrochemical, and mechanical storage.
ACCELERATE BATTERY INNOVATION	Improve performance and/or reduce the cost of novel battery chemistries and demonstrate innovative battery manufacturing or recycling pilots.
DEMONSTRATE TES IN INDUSTRIAL HEAT APPLICATIONS	Accelerate the commercialisation of thermal energy storage (TES) technologies for industrial heat.

Note: ARENA has provided significant grant funding to support the commercialisation of utility-scale lithium-ion battery storage and pumped hydro energy storage projects. Given the relative maturity of these technologies, as well as the emergence of new sources of private and public support, ARENA does not intend to provide further funding support for new projects in these areas.

4. Optimise large-scale integration of renewable electricity

ENSURE SYSTEM SECURITY IN A 100 PER CENT RENEWABLES GRID	Deliver innovative trials and/or studies to support and accelerate the transition to 100 per cent renewable energy penetration.
LOWER GRID CONNECTION AND TRANSMISSION RISKS	Deliver innovative trials and/or studies in relation to the connection of new generation capacity to the grid and reducing transmission constraints.
IMPROVE GRID MANAGEMENT AND OPERATIONS	Demonstrate novel technologies such as grid monitoring tools.

For more detail on the types of projects ARENA is prioritising for the transition to renewable electricity and before applying, please visit arena.gov.au/funding and review the *Before applying for ARENA funding* section in this document.



COMMERCIALISE RENEWABLE HYDROGEN

Renewable hydrogen is a decarbonisation solution for energy uses that are not well suited to electrification. It is produced from energy generated from renewable sources such as solar and wind. Hydrogen, and its derivatives such as ammonia, can be combusted to produce heat, used as a fuel in transport, used as a chemical feedstock, and stored and transported for long periods and distances.

ARENA's ambition is to support industry to find innovative solutions that can unlock a viable renewable hydrogen industry in Australia and realise our potential as an exporter of renewable hydrogen or zero emissions products in the long term. This will require innovation and support across the full hydrogen value chain, including firming renewable electricity, a step change in electrolyser technology, and rapid proving and scaling of hydrogen production and end uses.

Our focus

We are looking for innovative projects that prove the technical feasibility and commercial viability of technologies along the entire hydrogen value chain - production, transport, storage and end use.

1. Create a viable renewable hydrogen industry

<p>REDUCE LEVELISED COST OF HYDROGEN (LCOH) OF RENEWABLE H2</p>	<p>Reduce the cost of renewable hydrogen production through technologies and commercial innovations that unlock increasing scale in hydrogen production, improve hydrogen production efficiency, and materially lower electrolyser capex and operating costs.</p>
<p>REDUCE DELIVERY COST OF H2</p>	<p>Demonstrate technologies that address technical challenges along the rest of the hydrogen value chain, including storage, compression and transport (including for hydrogen carriers).</p>
<p>DEMONSTRATE AND SCALE USE OF RENEWABLE H2</p>	<p>Test the technical feasibility and commercial viability of renewable hydrogen use cases. This includes ammonia production, new industrial feedstock and energy applications, heavy vehicles and other modes of transport, power generation and export.</p>

For more detail on the types of projects ARENA is prioritising within hydrogen and before applying, please visit arena.gov.au/funding and review the Before applying for ARENA funding section in this document.

SUPPORT THE TRANSITION TO LOW EMISSIONS METALS

Australia is a major global player in the steel, aluminium and critical energy mineral value chains, with mining and processing industries forming a significant part of our economy. These value chains are emissions intensive and will require significant innovation and effort to decarbonise.

With increasing global demand for low emissions materials and end products for the energy transition and growing economies, Australia faces both a challenge and an opportunity to meet that demand in a zero emissions way.

Our focus

We are looking for high impact, incremental and innovative projects that evaluate and demonstrate the technical and commercial viability of technologies, processes and pathways that will support low emissions metals across the following priorities.

1. Accelerate the transition to a low emissions steel value chain

ENABLE ZERO EMISSIONS MINING	Enable zero emissions mining through the elimination of on-site fossil fuel usage and integration of renewable energy.
DECARBONISE DOMESTIC STEEL MAKING	Evaluate and demonstrate innovation in steel making processes, technologies and equipment for green steel making in Australia.
SECURE THE ROLE OF AUSTRALIAN IRON ORE IN GREEN STEEL VALUE CHAINS	Research, demonstrate and scale the use of Australian iron ore in green iron and steelmaking processes.

2. Accelerate the transition to a low emissions aluminium value chain

DECARBONISE ALUMINA REFINING	Accelerate the transition to net zero alumina refining through the demonstration of low emissions processing technologies using renewable energy and hydrogen.
DECARBONISE ALUMINIUM SMELTING	Reduce onsite energy consumption and emissions.

3. Support the development of low emissions critical energy mineral value chains

SUPPORT THE DEVELOPMENT OF LOW EMISSIONS CRITICAL ENERGY MINERAL VALUE CHAINS	Evaluate and demonstrate technology for net zero emissions processing of copper, nickel, silicon, lithium, cobalt, manganese, REEs (Rare Earth Elements, e.g. neodymium), graphite, PGEs (Platinum Group Elements) and vanadium.
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For more detail on the types of projects ARENA is prioritising within low emissions metals and before applying, please visit arena.gov.au/funding and review the Before applying for ARENA funding section in this document.

DECARBONISE TRANSPORT

Transport plays a vital role as an enabler of Australia's economy. As the economy grows, demand across transport modes increases, with demand for transport projected to rise across land, air and sea until at least 2050. Transport is responsible for around 20 per cent of Australia's emissions.

The diversity of transport use cases presents a decarbonisation challenge, with different viable pathways to net zero for each use case. Some have relatively clearer pathways (e.g. light passenger vehicles) but face scaling challenges such as commercial models, infrastructure buildout and consumer perception. Others require significant earlier-stage technology innovation (e.g. long-distance trucking and aviation) before becoming viable.

Our focus

We are looking for high-impact, innovative projects across the following aspects of the Australian transport landscape.



1. Accelerate the decarbonisation of light road transport

DEVELOP A FUTURE-PROOF LIGHT VEHICLE CHARGING ECOSYSTEM

Demonstrate technologies and business cases that reduce charging-related barriers to adoption for consumers, while contributing to positive long-term market development.

2. Accelerate the decarbonisation of heavy road transport

DECARBONISE HEAVY ROAD TRANSPORT

ARENA is currently developing its heavy road transport strategy - more details to follow in the next Investment Plan.






For more detail on the types of projects ARENA is prioritising within transport and before applying, please visit arena.gov.au/funding and review the Before applying for ARENA funding section in this document.

Please note that ARENA's funding under this strategic priority will primarily be administered through the Driving the Nation program.



BEFORE APPLYING FOR ARENA FUNDING

BEFORE APPLYING, APPLICANTS SHOULD:

-  Check whether your project aligns with the funding program announcements on our website and review the current program guidelines at arena.gov.au/funding
-  Review which funding opportunity best aligns with your project at [https:// arena.gov.au/funding/](https://arena.gov.au/funding/).
-  Develop a plan to demonstrate that your project contributes to one of ARENA's strategic priorities or the objectives of a Budget funding program.
-  Consider the potential knowledge value of your project, either to fill knowledge gaps or progress innovation in Australia.
-  Assess where your project fits in the innovation chain to see if ARENA is the right place for you to seek funding.

If you've worked through these steps and want to apply for ARENA funding, get in touch via our website at <https://arena.gov.au/contact/>

Australian Renewable Energy Agency

Postal Address
GPO Box 643
Canberra ACT 2601

Location
2 Phillip Law Street
New Acton ACT 2601

Further information is available
at arena.gov.au

Engage with us

ARENAWIRE



Images

Front cover: Alcoa's Wagerup alumina refinery in Western Australia.
Photo by Pete Glenane, HiVis Photography.

Page 4: Australian startup SunDrive's low-cost, high-efficiency solar cell manufacturing facility.

Page 5: Lord Howe Island Board's Hybrid Renewable Energy System.

Page 7: DeGrussa Solar Project at the DeGrussa Copper Mine.

Page 8: UNSW Solar Industrial Research Facility (SIRF).

Page 9: Heliostat field and solar PV receiver at Raygen's solar thermal plant.

Page 13: 5B Maverick redeployable solar modules being rolled out at Port Bonython.

Page 14: Yara Pilbara Fertiliser Facility, which will be supplied green hydrogen by ENGIE's Yuri project.

All other inside page images: stock images.

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ARENA



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