AUSTRALIAN RENEWABLE ENERGY AGENCY (ARENA)

SUBMISSION TO THE SENATE ECONOMICS LEGISLATION COMMITTEE

INQUIRY INTO THE BUDGET SAVINGS (OMNIBUS) BILL 2016 [PROVISIONS]

This submission concerns Schedule 5 of the Bill: Australian Renewable Energy Agency's Finances.

Overview

Cutting the $1.3 billion in long-term grant funding provided in the *Australian Renewable Energy Agency Act 2011* (ARENA Act) would remove a primary way of attracting private investment to the projects that will deliver affordable and reliable electricity to Australians while cutting carbon emissions.

ARENA's grant funding, and scope to invest in projects until 2022, reduces the investment risk of renewable energy projects, thereby giving the private sector the confidence it needs to invest in such projects. This, in turn, creates local jobs, expertise, supply chains and exports. It also leads to projects that can be commercially financed, including by the Clean Energy Finance Corporation and the Clean Energy Innovation Fund.

Why do we need ARENA's concessional finance?

Australia's energy supply is currently undergoing a transition to a near future involving much more renewable energy.

ARENA has a role in both accelerating and easing that transition.

Since its inception in 2012, ARENA's objective has been to improve the competitiveness and increase the supply of renewable energy in Australia. This means bringing down the cost of renewable energy and increasing the amount of it being generated in Australia.

ARENA has primarily achieved these goals by providing grant support to innovative Australian renewable energy projects, helping accelerate these technologies on the path to commerciality.

Innovation Fund complements grant funding but cannot replace it

The establishment by the Australian Government of the Clean Energy Innovation Fund (Innovation Fund), jointly-managed by ARENA and the Clean Energy Finance Corporation (CEFC), is a welcome development that will lead to innovative, later-stage technology projects receiving low-cost debt and/or equity support.

However commercial equity and debt are not substitutes for ARENA's grant funding support and the impact this support has in accelerating renewables innovation.

This is demonstrated by an assessment of projects in ARENA's current investment portfolio, only a handful of which would have met the criteria for funding under the Innovation Fund. Instead the Innovation Fund, or commercial equity and debt, are complementary financing for ARENA projects that earn revenue or are highly prospective.

ARENA's provision of grant support for projects is not an ongoing subsidy; the support bridges an otherwise insurmountable gap in the technology innovation chain, providing funding for projects that are not yet attractive to private sector investors due to the timeframes being too long, capital required too high, or the rate of return too low.

ARENA's involvement in a project reduces the risk to third party investors; ARENA's $1 billion in support for projects has been more than matched by $1.2 billion in additional investment in the projects from other sources.

ARENA has a highly commercial approach to grant funding. Almost 30 per cent of its grants by value are partially or wholly repayable if the project is successful. However, even these projects on average have a significant concessional component; because technology solutions are not yet commercially viable without support, ARENA is not able to fully be repaid or make an additional return across its portfolio. These funds are an investment in transitioning the energy system, providing options for lower cost emissions reduction, and giving energy users access to reliable and affordable renewable energy.

If the Budget Savings (Omnibus) Bill 2016 passes Parliament in its current form, ARENA will lose most of its ability to provide grants to technology innovators. In turn, this means that over time the pipeline of projects suitable for the Innovation Fund is likely to be much diminished.

The breakthrough in Australian solar cell research by the University of New South Wales mentioned below illustrates this. This kind of work is rarely supported by the private sector, yet Australia's leadership in solar cell research is estimated to have contributed $8 billion to the national economy in the past decade.[1]

Creating and maintaining a strong economy

Just as governments have invested in innovation, and assisted other sectors that are vital to creating and maintaining a strong economy, ARENA has committed around $1 billion in support of over 270 renewable technology projects with a total cost of over $2 billion. ARENA's involvement has given other investors the confidence to commit funds to the projects.

[1] "Don't wipe out solar research in Australia, top scientists urge", UNSW Newsroom, 26 May 2016

The agency has also helped a number of renewable energy solutions take the final step to becoming fully commercial.

The Weipa Solar Plant in Queensland became the first of its kind in Australia to successfully commence a commercial diesel-displacement operation at a remote mine site, generating electricity for Rio Tinto's Weipa bauxite mine, processing facilities and local township. Following a second and larger off-grid hybrid solar-diesel demonstration project with resources company Sandfire, it is now standard commercial practice for the mining industry to consider renewables as a way to reduce cost and increase energy security.

Laing O'Rourke's SunShift redeployable solar hybrid system also became commercially available, as a result of ARENA supporting the feasibility study and pilot project needed to prove the technology. This solution is suitable for a range of off-grid applications where temporary power is required, such as construction sites, mine operations and disaster relief.

Provision of data to industry and project developers

A core function of ARENA is to extract knowledge, or intellectual capital, from the projects it supports, and make that knowledge widely available. This helps future projects to benefit from positive outcomes from earlier projects but also to avoid making similar mistakes.

One recent area of focus has been to spread knowledge of best practice community consultation and involvement in large-scale renewables projects. This work will continue no matter what the level of funding, although if the legislation is passed knowledge sharing will diminish over time as ARENA's projects are completed.

As well as disseminating knowledge from projects, ARENA supports industry-wide knowledge-building such as the AREMI project, which is a publicly-accessible repository for information on energy infrastructure, renewables resources and projects.

More jobs, more skills, more export markets

ARENA-supported projects have created thousands of regional jobs, trained hundreds of researchers and trades-people and helped Australian companies build export businesses.

The large-scale solar competitive funding round alone will create more than 2000 regional jobs.

Australian companies are also leading engineering service providers for off-grid systems that incorporate advanced components such as renewables and storage.

Lowering the cost of reducing carbon emissions

Renewable energy projects supported by ARENA are not just improving the affordability and reliability of renewables; they are helping to reduce the cost of transitioning to a lower carbon future, while driving innovation, new energy infrastructure, new industry skills and economic activity. This will provide Australia with more low cost options for reducing emissions.

With ARENA's support, renewable energy researchers and developers are reducing the cost of renewable energy, which in turn lowers the current and future cost for Australia in meeting the nation's emission reduction targets.

With world-record breaking solar cells

ARENA-supported researchers at the University of New South Wales (UNSW) and Australian National University (ANU) developed fundamental technology advances to improve solar PV performance. By 2020, around half of the world's PV manufacturing capacity will use this technology (PERC), reducing solar costs (by approximately 10 per cent) and carbon emissions for Australia but also globally.

UNSW PV researchers supported by ARENA have long held world records in PV efficiency. Last year a new world record was set at 40.4 per cent of sunlight converted into electricity using the Power Cube technology. In contrast, most rooftop solar PV systems have 17-20 per cent efficiency.

Advances like this in the applied science of solar cells help to bring down the cost of rooftop solar systems such as those used by Australian households, as well as the large-scale systems used by solar farms.

With Australian-first large-scale solar farms

ARENA also helps to bring down the cost of renewable energy by assisting developers with the high project costs that come with doing something for the first few times, helping to build industry capacity and capability, and create new business models.

In fact, by supporting early generations of Australia's large-scale solar projects ARENA estimates that its support has lowered the cost of this technology by 40 per cent in three years, making it almost cost-competitive with wind and creating a skilled workforce and efficient supply chains in the process.

By capturing the benefits of solar thermal

While this pathway has primarily involved Solar PV, ARENA also recognises the role that solar thermal technologies may take in the future.

Although currently more expensive, the ability to attach many hours of cheap storage, which can be dispatched during periods when there is no solar resource, means that solar thermal may be a significant renewables solution in the future.

ARENA currently supports significant research and development in this area, together with small-scale demonstration. A number of projects in ARENA's investment pipeline include the use of solar thermal technologies in South Australia, which currently has the greatest need for system-wide storage.

Similarly to the way in which ARENA has assisted in lowering project costs for large-scale solar PV, ARENA could play a role with solar thermal and other technologies that make renewables more affordable and reliable, such as battery storage.

Putting households in charge of their electricity bills

A number of ARENA-supported projects are bringing down the cost of renewable energy by using renewable energy innovations to put electricity consumers in charge of their energy use and emissions reduction.

For example, the world's largest battery storage "virtual power plant" will be created in South Australia to boost grid stability and reduce power price volatility while increasing renewable energy. With ARENA's support, AGL is installing 1000 centrally-controlled batteries in South Australian homes and businesses to store the electricity produced by rooftop solar, creating a virtual 5 megawatt power station that can quickly deliver enough energy to power 1000 homes in the state where and when it is needed most. The project will take pressure off the grid, displace gas-fired electricity, and potentially reduce electricity costs.

Prudently investing taxpayers' funds

ARENA takes a commercially-rigorous and strategic approach to its funding programs and the projects it selects for support. It funds projects that improve business models or reduce overall industry costs.

To ensure that ARENA provides support only to projects of the highest merit and achieves the best possible value for taxpayers, every project considered for assistance must have an identified pathway to commercialisation and co-investment from the project proponent and/or other financial supporters. Each project is subjected to a rigorous, independent assessment process and only 10-25 per cent[2] of applications are approved for funding.

Since its formation ARENA has also renegotiated or closed 25 projects with total grant funding savings of around $800 million. These projects were largely inherited at ARENA's inception, and with the guidance

[2] Depending on sector and ARENA program.

of the agency's commercially-focused board ARENA was able to recycle the savings into projects that met ARENA's objectives.

The future of renewables innovation

ARENA has a substantial pipeline of projects which have applied for, or are in the process of applying for ARENA funding (see ARENA's pipeline in separate attachment).

As of 30 June, 2016, the agency's active pipeline contained 135 renewable projects worth $3.5 billion, asking for $804 million in grant funding.[3]

Most of the larger projects are situated in rural and regional Australia.

Innovation to meet climate goals

Australia's carbon emissions from electricity are 35 per cent of total emissions, with stationary energy accounting for another 18 per cent[4]. Lowering the economy's energy intensity is one of the major available pathways for reducing emissions, and renewable energy and energy efficiency are key parts of that transition.

If ARENA's grant funding is preserved, the agency is well-placed to help Australia deliver future emissions reduction. It is also important to note that commitments made in Paris by Australia require a doubling of clean energy research and development spending between 2015 and 2020. ARENA's research and development funding, which relies on grants, contributes towards this commitment.

Retention of ARENA's remaining $1.3 billion would allow the agency to continue its work accelerating Australia's shift to a sustainable, affordable and reliable energy future.

Detailed work undertaken by ARENA has shown this funding could be allocated to systematically solve many of the nation's energy problems with carefully-targeted initiatives, including:

- **$560 million** to integrate renewable energy technologies into the electricity network, such as by using solar thermal plants, battery storage solutions and smart control systems, which will reduce variability and increase capacity.
- **$240 million** to increase the uptake of renewable energy technologies and energy efficiency in the industrial sector.
- **$240 million** to develop new biofuels and support innovation in electric vehicle infrastructure and technology.
- **$100 million** to reduce the cost and increase the efficiency of solar photovoltaic technology.
- **$150 million** to support new energy efficiency initiatives.

[3] The total ARENA pipeline has a project cost of $6.965 billion asking for $1.976 billion of grants
[4] Quarterly Update of Australia's National Greenhouse Gas Inventory: December 2015, Department of the Environment, May 2016

The cost of uncertainty

Because of their complexity and risk, renewable energy projects cannot simply be turned 'off' and 'on' with the flick of a funding switch. They take years to develop and, if ARENA's grant-making abilities are removed, many of the projects currently in ARENA's pipeline will take some time to return to the same state of readiness.

Geodynamics and Yorke Biomass have recently made public statements that they are mothballing renewable energy projects until there is more certainty around ARENA's funding.

There would also be residual uncertainty that legislation could be changed again; confidence and certainty take a long time to build and are easily lost. ARENA's funding was already reduced by $435 million during 2014. Generally, one of the first questions asked of ARENA by stakeholders is 'what is the status of your funding?'.

The same dynamic impacts the technology workforce, particularly in research institutions. ARENA grant funding supports hundreds of highly specialised Australian science and technology staff. Even a temporary cessation of funding would cause the workforce to reduce or dissipate and take many years of steady funding to rebuild to its current expertise and number.

ARENA's ability to fulfil its legislated mandate

As a matter of governance, the proposed legislation seeks to change ARENA's funding profile without amending the Agency's objectives or functions. Under the *Australian Renewable Energy Act*, ARENA's primary legislative function is the provision of financial assistance to renewable technology innovation projects, defined as grants.

In short, the fundamental changes to ARENA's funding profile, as they are outlined in the Budget Savings (Omnibus) Bill 2016*,* will significantly hinder the Agency's ability to perform these legislative functions under the ARENA Act.

It is also Government policy to expand ARENA's mandate to include energy efficiency and low emissions technologies, to bring its investment focus into alignment with that of the CEFC.

APPENDIX

CASE STUDIES

ARENA as a driver of Australia's large-scale solar industry

The recently-announced outcome of ARENA's large-scale solar competitive funding round provide the strongest example yet of the agency's success in using grant funding to accelerate the shift to renewable energy in Australia.

Australia has the world's highest per capita penetration of rooftop solar but, despite a significant natural solar advantage, has been slow to adopt large-scale solar PV. In 2012, when ARENA was established, there was only one large-scale solar PV farm in Australia; the 10 megawatt Greenough River Solar Farm, near Geraldton in Western Australia.

ARENA has provided $268 million support (together with $65 million from the NSW Government) to build new solar plants in Nyngan, Broken Hill and Moree (total project value $604 million); and has committed a further $92 million to 12 more projects that together will unlock almost $1 billion in private sector investment and also triple Australia's large-scale solar generation capacity.

ARENA has also committed funding support to large-scale solar farm projects in the regional Queensland towns of Barcaldine and Normanton as well as the state's Lakeland area. With ARENA's support, Australia's first large-scale solar farm to be co-located with wind turbines will also be built near Canberra. These projects combined are part of ARENA's plan to build capacity and capability in the supply chain.

Importantly, ARENA has seen the level of grant funding for large-scale solar PV projects drop significantly over the past three years, from over half the total project cost to less than 10 per cent on average.

In 2014 the ARENA funding ask for large-scale solar projects was $1.60 per watt; this dropped to 43 cents at the Expression Of Interest stage of ARENA's $100 million large-scale solar funding round in late 2015; and then to an average of 28 cents in June 2016 when full applications were submitted.

The majority of the costs of a solar farm are local--frames, brackets, cables, construction and cost of finance--so it is vital to provide local support to build scale and overcome the additional costs of doing something for the first few times. This rapid move toward commerciality relied almost entirely on ARENA funding.

The table below illustrates the role grant funding has played in the development of Australia's large scale solar industry:

Large scale solar in Australia – Commercialisation pathway

Technology	2012 – 2014	2015 – 2016	2017 – 2018
Programme	Solar Flagships	ARENA – ERP and ASCI	ARENA – LSS competitive round
Projects	Broken Hill, Nyngan and Moree	Barcaldine, Normanton, Gullen and Lakeland	Various – 12 projects
LCOE	$182/MWh – 152/MWh	$162/MWh - $148/MWh	$134/MWh - $97/MWh
MW (AC)	211	47	482
ARENA $	$268.4m	$50.5m	$91.7m
ARENA $/W	$1.27*	$1.07	$0.19
Jobs (Direct)	1,055	235	2,410

* Does not include $65m of NSW Government grant funding

Expected that solar PV would reach parity with wind by 2020, parity is now expected in 17/18, 3 years ahead of expectations

Case study: AGL Solar Farm (New South Wales)

Lead organisation: AGL
Technology: Solar PV
Location: NSW
ARENA funding: $167 million
Total contribution to project: $439 million

Made up of two solar photovoltaic installations, one located in Nyngan and the other in Broken Hill, the AGL Solar Farm is the largest of its kind in Australia. It is made up of over 2 million solar panels and is now sending electricity to the national grid.

ARENA supported the project to increase local knowledge in planning, constructing and operating utility-scale solar energy plants.

Two universities are conducting related academic research under the Education Investment Fund component of the project. The University of Queensland (UQ) has built a 3.275 megawatt PV research plant at its Gatton campus to test tracking technologies and performance, energy storage, and operational strategies. UQ has also built a data analysis centre at its St Lucia campus to collect and analyse data from the Gatton research plant and the main AGL power stations.

The University of New South Wales developed new energy modelling techniques to assist in the design and integration of solar power stations into the electricity grid.

The solar plant in Broken Hill was completed and operating by October last year, and just six months later its sister plant in Nyngan was switched on.

The speed with which the second solar plant was installed and commissioned demonstrates the value of ARENA's knowledge sharing approach. By drawing on the experience and expertise gained from installing and commissioning the Nyngan solar plant, AGL was able to accelerate development of the Broken Hill operation.

If the solar farm generates more revenue than expected by AGL, ARENA will be able to recoup its investment to maximise government funding for other renewable energy projects in Australia.

Case study: King Island Renewable Energy Integration Project (Tasmania)
Lead organisation: Hydro Tasmania
Technology: Hybrid
Location: Tasmania
ARENA funding: $6 million
Total contribution to project: $18.25 million

King Island used to rely exclusively on diesel to generate power but now has a world-leading power system that consists of solar, wind, diesel, storage and enabling technologies such as demand management and sophisticated controls.

The hybrid energy system, developed by Hydro Tasmania with $6 million in ARENA's support, supplies more than 65 per cent of King Island's energy needs and, when the conditions are right, can deliver 100 per cent renewable energy to the island.

The renewable energy solution has proven to be so successful that it is being applied to other isolated locations in Australia.

Last year ARENA committed funds to establish renewable energy hybrid systems based on that created for King Island in the remote opal mining town of Coober Pedy (South Australia) and on Rottnest Island (Western Australia). A similar ARENA-supported project is already underway on Flinders Island.

Up to $3 million of ARENA's $4.8 million funding for the Rottnest Island project may be recouped over the life of the $7.3 million project if it is successful.

Case study: Virtual Power Plant project (South Australia)
Lead organisation: AGL
Technology: Storage
Location: South Australia
ARENA funding: up to $5 million
Total contribution to project: $20 million

This year ARENA worked with energy retailer AGL to develop the largest battery storage Virtual Power Plant (VPP). The project will boost grid stability and reduce power price volatility in the State.

AGL will install 1,000 centrally-controlled batteries in South Australian homes and businesses. It is hoped the project will point to solutions to South Australia's grid challenges and reduce the risk of power price shocks in the state.

The batteries will be installed with solar PV systems and linked with centralised monitoring and management software. Together they will have the capacity of a 5 megawatt power station that can quickly deliver enough energy to power 1,000 South Australian homes.

This approach can ease local network constraints, displace gas power and complement the Victorian interconnector, especially during times of peak demand.

ARENA expects virtual power plants to play a significant role in the future as more renewable energy is connected to our power networks.

Case study: Redeployable solar hybrid (Queensland)
Technology: Hybrid
Location: Qld
ARENA funding: $450,000
Total contribution to project: $1.8 million

The world's first fully-redeployable large-scale solar-diesel hybrid power plant was successfully piloted with $450,000 in ARENA support during 2015-16, and has since been commercialised.

The hybrid power plant consists of containerised modules, including a control centre and inverters with external, pre-wired connections to allow fast, easy set-up and pack down. It can be delivered, unpacked and fully-functional in a week, with the solar panels being re-used over their lifespan. This solution is suitable for a range of off-grid applications where temporary power is required, such as construction sites, mine operations and disaster relief.

ARENA provided Laing O'Rourke with funding for the feasibility and design work before supporting the demonstration project. The successful pilot gave Laing O'Rourke the confidence to commit to further developing the technology, and was a crucial step in proving the technical and commercial viability of moveable, modular renewable energy concepts more broadly.

ARENA's support for the project demonstrated that funding for early-stage renewable energy solutions can pave the way for new products and companies to enter the Australian market.

Barcaldine Remote Community Solar Farm
Lead organisation: Elecnor Australia Pty Ltd
Technology: Solar PV
Location: Qld
ARENA funding: $22.8 million
Total contribution to project: $69 million

Late in 2015, ARENA committed to support the construction of a 20 megawatt single-axis tracking solar plant in Barcaldine to demonstrate how renewables can provide network benefits in locations at the edge of electricity grids. The Barcaldine area experiences voltage and frequency control issues as well as load management challenges.

The solar farm will help to alleviate peak demand pressures and provide voltage control, resulting in more reliable power supply to customers in the region.

The potential to add battery storage to create additional network benefits will also be explored, which would allow the solar plant to work in tandem with the existing gas plant during a line outage, operating as an “island” network independent of the main grid.

The project will be a test case to show how network benefits from distributed renewables can improve network efficiency, and potentially enable solar plants to access an extra revenue stream through network support payments.

It will also use the solar tracking technology already installed at the Moree Solar Farm, providing a further benchmark for the technology and additional information on its installation and operation that will be shared with the industry.

ARENA’s funding for the project is partly recoupable.

Case study: RayGen PV Ultra technology (Victoria)
Lead organisation: RayGen
Technology: Solar PV
Location: Vic
ARENA funding: $2.9 million
Total contribution to project: $5.8 million

ARENA provided Victorian company RayGen with a $2.9 million recoupable grant towards a $5.8 million project aimed at developing a utility-scale solar system utilising its PV Ultra technology.

PV Ultra differs from typical large-scale solar photovoltaic (PV) arrays in that it relies on low-cost mirrors to track and reflect the sun onto an ultra-efficient solar PV receiver atop a central tower. The technology is particularly effective in locations with strong, direct sunlight.

The funding will allow RayGen to take its system to the next level, building on the success of its world-first pilot plant in Newbridge, Victoria.

Over the course of this project, RayGen will develop a cheaper and more efficient commercial product, and scale up operations through a newly developed 8 megawatt per year manufacturing line for its highly-efficient PV receiver at its facility in Blackburn.

The project has already attracted interest from Chinese investors. ARENA’s funding agreement with RayGen means that success in the Chinese market will lead to funds being returned to Australian taxpayers.

DeGrussa renewable mining project
Lead organisation: Neoen
Technology: Solar + storage
Location: WA
ARENA funding: $20.9 million
Total contribution to project: $40 million

The DeGrussa off-grid renewable mining project was successfully completed during the reporting period.

More than 34,000 solar PV panels were installed at the copper-gold mine in remote Western Australia alongside 6 megawatts (1.8 megawatt hours) of new battery storage, making it the largest off-grid solar PV system in the world and one of the largest solar plants providing peak power load to a mining operation.

The project was constructed in ten months and delivered on budget, despite being located in remote Australia. It involves cutting-edge technology, with advanced lithium-ion batteries to store the solar power, sun-tracking solar PV panels to maximise output, and smart control systems linking these with the existing diesel plant.

Solar PV will provide the majority of the mine's daytime electricity requirements, offsetting around five million litres of diesel currently being used by the mine each year, or more than 20 per cent of its annual diesel consumption.

The inclusion of battery storage was a vital piece of the puzzle, guaranteeing reliable supply to the mine when clouds pass over.

ARENA supports first-of-a-kind projects like this to increase experience within industry, and the confidence of project developers, investors and financiers. Performance data from the project will make it easier for mining companies to evaluate the risks of integrating renewables with existing diesel generation and illustrate the potential diesel and cost savings that can be achieved.

The mine's owner, Sandfire Resources, has already fielded inquiries from other miners looking to take advantage of renewable energy in their own operations and tap into Sandfire's experience.

Power is being provided to the mine under a six year power purchase agreement. If the mine continues operating past this point, ARENA funding will be paid back as the power plant continues to generate solar energy.

Perth Wave Energy Project
Lead organisation: Carnegie Wave Energy
Technology: Ocean/wave
Location: Western Australia
ARENA funding: $13 million (CETO 5), $13 million (CETO 6)
Total contribution to project: $32 million (CETO 5), $46 million (CETO 6)

Work continued this year on two Carnegie Wave Energy projects supported by ARENA.

The first, involving the design, deployment and testing of three CETO 5 wave energy units off the coast of Garden Island in Western Australia, further cemented Australia's position as a leader in the development of wave power. The CETO 5 project is the world's first commercial-scale wave energy array connected to an electricity grid.

The CETO 5 units were retrieved after being deployed off-shore for twelve months, breaking a world record for completing 14,000 cumulative operating hours, and providing electricity and potable desalinated water to Australia's largest naval base, the HMAS Stirling.

Carnegie completed the conceptual design phase of the next generation CETO 6 units during 2015-16, incorporating data collected from the CETO5 units, as well as information from wave testing in Scotland, internal design and modelling studies, and design work undertaken with Carnegie's supply chain.

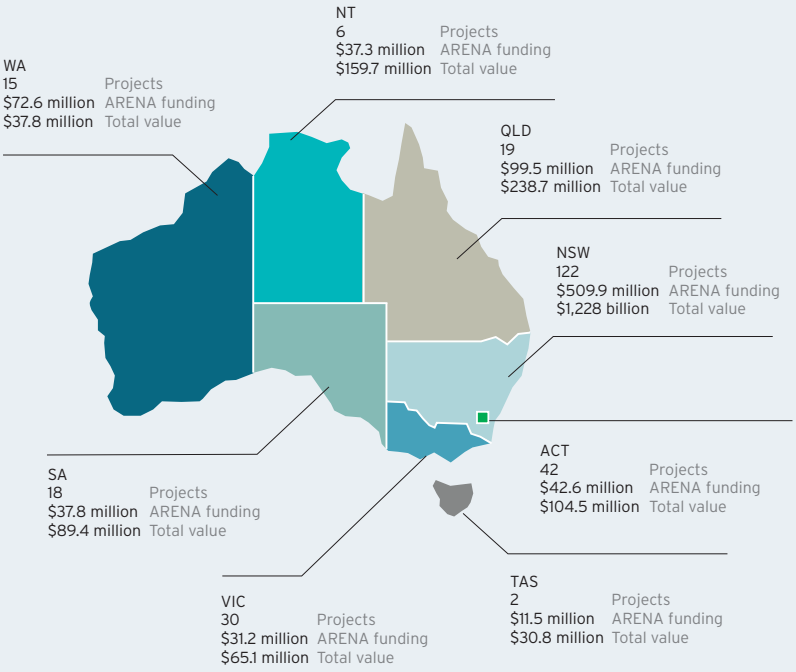
The CETO 6 design has four times greater rated capacity than its predecessor at one megawatt, simplified installation and maintenance, and more advanced control systems.

The project is a prime example of how, with the right stewardship and support, improvements can be made on previous iterations of a technology to progress it along the innovation chain towards commercialisation.

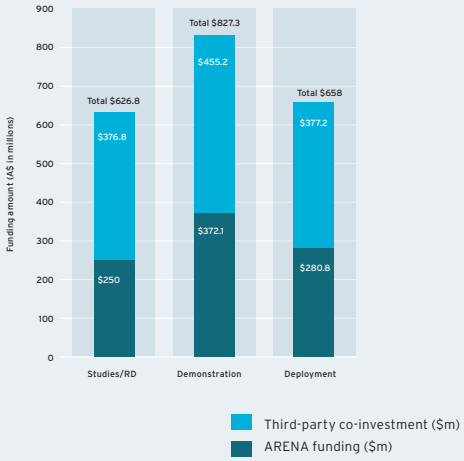
The learning and experience gained from both projects is being shared with the rest of the industry to help reduce hurdles facing other wave energy projects.

2012 - 2016 ARENA investment across Australia*

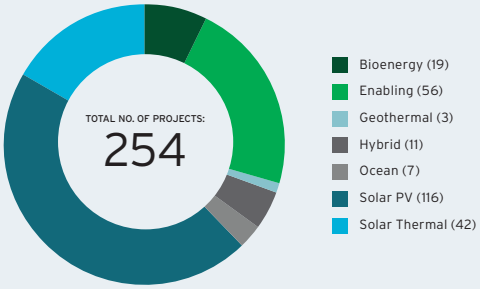
$1 billion in funding catalyses $1.2 billion in funding from other sources **



Total investment across the innovation chain



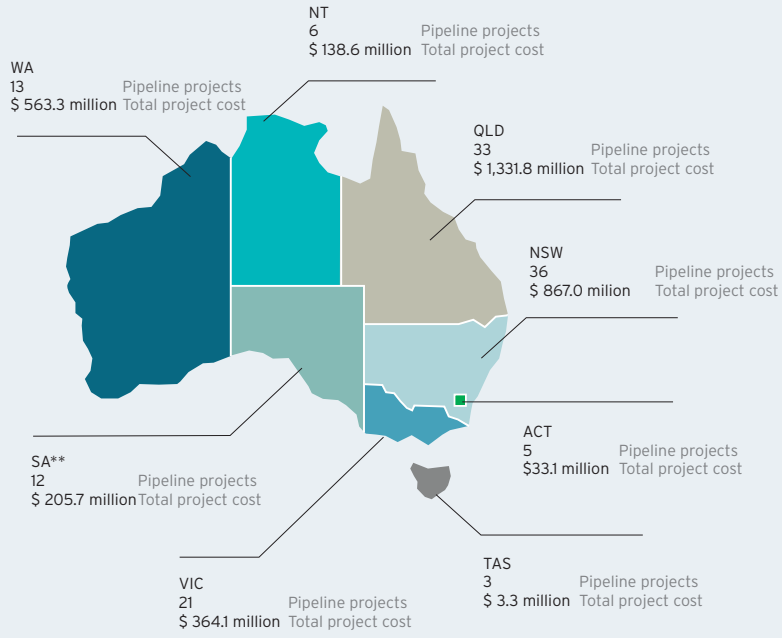
Portfolio of new renewable energy technologies



* July 2012 - June 2016
** Accurate as of 30 June 2016
*** All data accurate as of 30 June 2016. Active & complete projects only. Closed projects not included.

2016 ARENA pipeline*

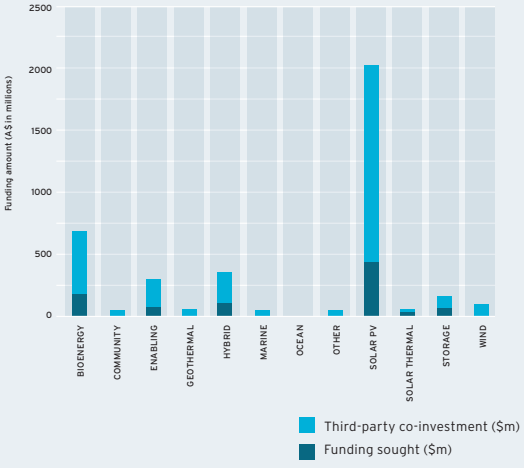
Full of new potential - Total pipeline project cost is $3.5 billion.
ARENA grant ask is $804 million.



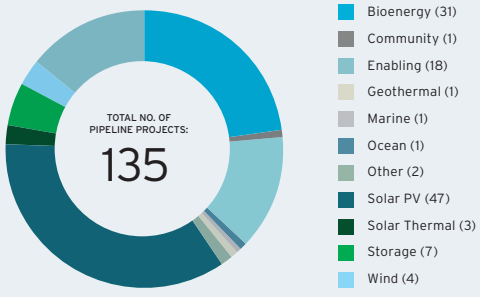
Other
1 Pipeline projects
$ 0.7 million Total project cost

All States
5 Pipeline projects
$ 5.4 million Total project cost

Potential opportunities for new renewable energy

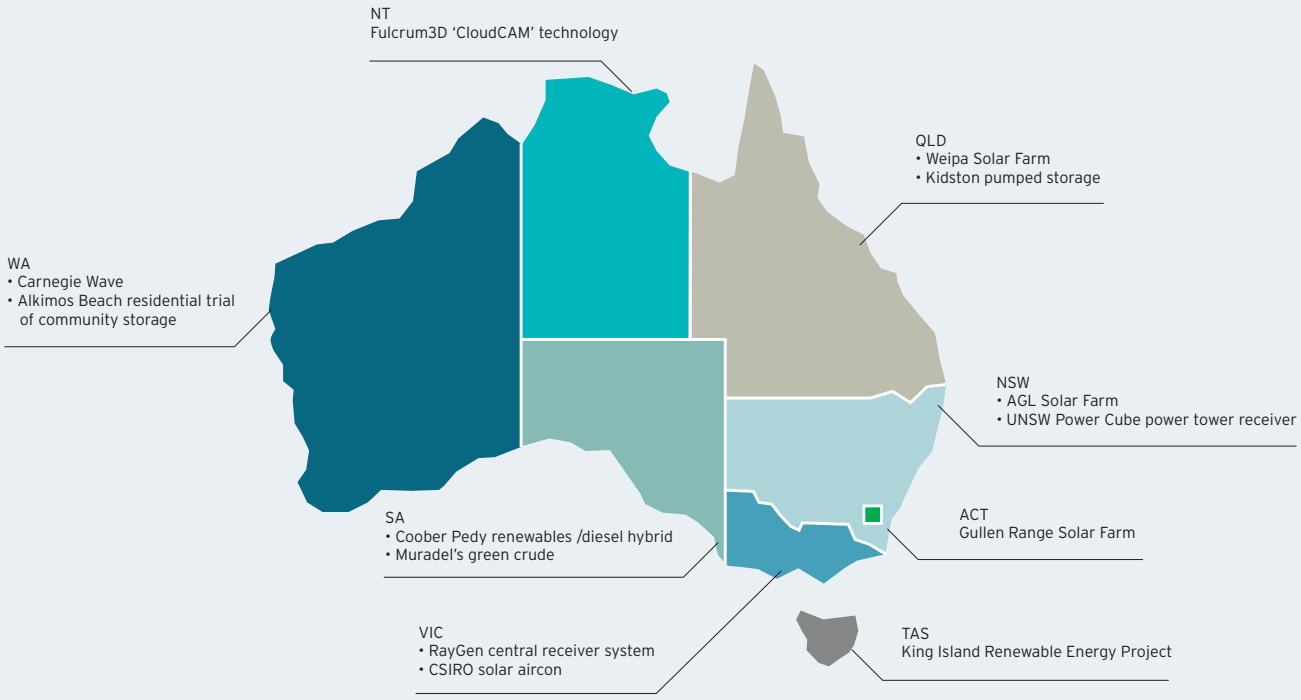


Potential opportunities for new renewable energy in Australia



* All data accurate as of 30 June 2016.
** Data excludes significant Port Augusta projects occurring outside reporting timeframe of 30 June 2016.

ARENA Showcase Projects



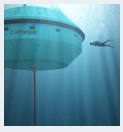
NORTHERN TERRITORY

Fulcrum3D 'CloudCAM' technology
Enables cloud prediction and tracking for PV optimisation. This technology improves reliability and integration of solar farms.

QUEENSLAND

Weipa Solar Farm
Australia's first renewables-powered mine and township.

Kidston pumped storage
First in the world to use two disused mine pits for hydroelectric generation.



WESTERN AUSTRALIA

Carnegie Wave
World first array of wave power generators connected to a grid.

Alkimos Beach residential trial
Australia's first large-scale community battery storage & residential solar.

AUSTRALIAN CAPITAL TERRITORY

Gullen Range Solar Farm
First large-scale solar farm in Australia to be co-located with existing turbines.

NEW SOUTH WALES

AGL Solar Farm
Australia's biggest solar farm.

UNSW Power Cube power tower receiver
World record for sunlight-to-electricity conversion efficiency using unfocussed sunlight.

SOUTH AUSTRALIA

Coober Pedy renewables/diesel hybrid
Using Hydro Tasmania's world-leading hybrid solution.

Muradel's green crude
Australia's first integrated demonstration-scale plant to sustainably convert microalgae into green crude.

VICTORIA

RayGen central receiver system
World first pre-commercial pilot of CSPV technology.

CSIRO solar aircon
World-first high-efficiency solar thermal desiccant air conditioning system.

TASMANIA

King Island Renewable Energy Project
World leading off-grid renewable energy solution.