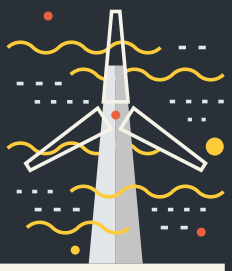
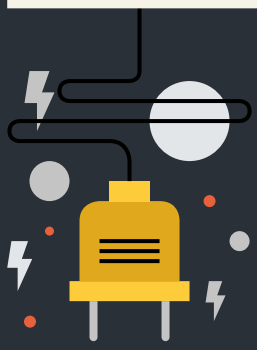


REPORT

SUPERCHARGING AUSTRALIA'S CLEAN ENERGY TRANSITION

How just 7.7% of super could fund 100% renewables by 2030



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ABOUT THE AUTHORS

About Simon Corbell (Lead Author)

Simon Corbell is one of Australia's leading renewable energy advocates. Simon's previous role saw him serve as the ACT's Deputy Chief Minister and Minister for Environment and Climate Change, where he oversaw the implementation of the ACT's 100% renewables agenda. He is now engaged by the public and private sectors to provide advice on renewable energy projects and policy, and is a Renewable Energy Adviser to Future Super.

About ISF (Research Team)

The Institute for Sustainable Futures (ISF) is an interdisciplinary research and consulting organisation at the University of Technology Sydney. It has been setting global benchmarks since 1997 in helping governments, organisations, businesses and communities achieve change towards sustainable futures. ISF utilises a unique combination of skills and perspectives to offer long term sustainable solutions that protect and enhance the environment, human wellbeing and social equity. For further information visit www.isf.uts.edu.au.

Research team: Dr Yohan Kim, Dr Scott Dwyer, Dr Sven Teske, Dr Scott Kelly

Background and Methodology

In 2016 ISF was commissioned by GetUp! and Solar Citizens to investigate a 100% renewable energy economic and technical scenario to provide the technical basis for the Homegrown Power Plan.

To understand how such a transition towards a renewable energy powered economy could be made, ISF developed a scenario model that detailed Australia's current and future energy system. The resultant report was entitled '100% Renewable Energy for Australia – Decarbonising Australia's Energy Sector within one Generation'.[1]

The original model used by ISF was created by the German Aerospace Centre[2] (DLR) who also provided data and assumptions for the specific investment and operation costs of the different technologies. More information on the methodology used for the modelling and assumptions can be found in the chapter 3.3 of the report here: https://www.uts.edu.au/sites/default/files/article/downloads/ISF_100%25_Australian_Renewable_Energy_Report.pdf

[1] Teske, S., Dominish, E., Ison, N. and Maras, K. (2016) 100% Renewable Energy for Australia – Decarbonising Australia's Energy Sector within one Generation. Report prepared by ISF for GetUp! and Solar Citizens, March 2016. Availabe at: https://www.uts.edu.au/sites/default/files/article/downloads/ISF_100%25_Australian_Renewable_Energy_Report.pdf.

[2] DLR Support team: Dr. Thomas Pregger, Dr Sonja Simon, Dr Tobias Naegler. www.DLR.de

CITATION

Supercharging Australia's Clean Energy Transition

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Disclaimer

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REPORT BACKGROUND

ABOUT THIS REPORT

The Institute for Sustainable Futures (ISF) is internationally recognised for producing economic and technical scenarios for countries, regions, and precincts for transitioning to 100% renewable energy. In 2016, it created such a scenario for Australia, modelling a pathway for a 100% renewable energy system by 2050 known as the ISF's 'Advanced Renewables' scenario.[3]

350.org and Future Super have commissioned ISF to build on this modelling to tell the bigger story about how Australia's transition to a 100% renewable energy system can be funded by a proportion of the nation's retirement savings. ISF has combined its modelling with data on Australia's forecast future superannuation funds[4], to define the proportion of Australia's retirement savings that would be needed to support the transition to 100% renewables 2050, including modelling on the transition to 100% renewable power (excluding transportation and industry) by 2030. As part of completing this work ISF's modelling team have developed an investment curve that summarises the capital required to be mobilised in each year between now and 2050.

About 350.org Australia

350.org is building the global grassroots climate movement that can hold our leaders accountable and demand climate action. 350 uses online campaigns, grassroots organising, and mass public events to oppose new coal, oil and gas projects, take money out of the companies that are heating up the planet, and build 100% clean energy solutions that work for all. 350.org's network extends to 188 countries.

www.350.org.au

About Future Super

Future Super is Australia's first fossil fuel free super fund. Rated 'Best For The World' by B-Corp, Future Super Group is already investing over $500 million on behalf of more than ten thousand Australians.

www.myfuturesuper.com.au

[3] Institute for Sustainable Futures https://www.uts.edu.au/sites/default/files/article/downloads/ISF_100%25_Australian_Renewable_Energy_Report.pdf
[4] http://www.ricewarner.com/wp-content/uploads/2015/10/ageing-and-capital-flows.pdf

IN SHORT:

A NATION BUILDING OPPORTUNITY: 100% RENEWABLE ELECTRICITY FUNDED WITH LESS THAN 8% OF SUPERANNUATION.

The transition to a 100% renewable energy future will involve a major reengineering of processes across the Australian economy. Some elements, such as replacement of thermal fossil fuel generation in the electricity supply sector, and the electrification of transport fleets, are immediately available. Elements of the electrification of industrial processes and the decarbonisation of primary energy sector have been identified as technically and economically feasible throughout the period to 2050.

This task is significant yet is also realisable in terms of our technical capacity and knowledge, and our nation's economic and financial resources. Australia's superannuation resources are expected to be worth the equivalent of more than 160% of our nation's total annual GDP by mid century. Just 12.4% of this resource, $788 billion worth of investment over a 32-year period from 2018 – 2050, will enable our nation to completely decarbonise it's electricity, transport, industrial and primary energy sectors, and will deliver savings worth $A20 billion every year to the Australian economy.

As a nation, Australia could achieve a 100% renewable electricity sector (for stationary power) by 2030 with investment of just 7.7% of total superannuation holdings. This is a nation building objective, which is worthy of our attention and focus if we are to realise a safe climate future for current and future generations.

INTRODUCTION

THE INTERNATIONAL RENEWABLE ENERGY AGENCY (IRENA) ESTIMATES THAT OVER US$1.7 TRILLION IS NEEDED BY 2030 TO IMPLEMENT RENEWABLE ENERGY TARGETS CONTAINED IN NDCS (NATIONALLY DETERMINED CONTRIBUTIONS) WORLDWIDE

At least 1.3 terawatts (TW) of renewable power capacity will be added globally by 2030 because of NDC implementation, amounting to a 76% increase in capacity.[5]

In the Asia Pacific region alone, USD 1.1 trillion in investment will be required.[6] As the cost of renewable energy deployment continues to fall, NDC's are to date insufficient to keep global warming below a 2 degrees increase and have not kept pace with the low-cost abatement opportunity presented by renewable energy. This highlights the significant additional potential growth in the sector that could occur.

Australia's superannuation funds could play a key role in underpinning future growth in clean energy technologies and thereby capture the value in renewable energy infrastructure growth for their members.

The transition to a 100% renewable energy future in Australia presents a clear and increasingly low-cost pathway for Australia to meet its Paris commitments, particularly when compared to the decarbonisation challenges in other sectors of the Australian economy.

This report finds that with an allocation of just 7.7% of accumulated superannuation funds between now and 2030, the power sector could be 100% renewable in just 12 years.

Full decarbonisation of the Australian economy will also require the electrification of Australia's transport and industrial sectors. Modelling commissioned as part of the development of this report found that 12.4% of accumulated funds invested between now and 2050 would be required to meet this larger challenge.

[5] Untapped Potential for Climate Action, Renewable Energy in Nationally Determined Contributions, IRENA, November 2017.
[6] ibid

100% Clean Energy Transition is Feasible and Fundable

The task of transitioning to a 100% renewable energy future is not insignificant, yet it is also technically and financially achievable.

The ISF's 'Advanced Renewables' scenario identified that by 2050, all elements of Australia's power and energy sectors could be decarbonised, with electrification by renewable energy the major component across the power, transport, industry and primary energy sectors.[7]

This involves maintaining firm capacity across the power sector at 75% during the entire transition period to 2050 with the electrification of industrial and transport sector being major elements of the 100% transition.

This report identifies that the investment required in clean technologies to fund this transition in today's dollars is $A788 Billion out to 2050. A large part of the additional investment in renewable power generation capacity goes towards meeting increased demand from the transport and heating sectors (as those sectors switch over to electricity), and towards generating synthetic fuels for use in those sectors.

Super could play a significant role

To finance the transition to a 100% renewable energy powered future, this report identifies the potential to deploy a relatively small part of the capacity of Australia's accumulated superannuation fund holdings, conservatively estimated to be worth $6.5 trillion by 2050.[8].

By 2050, Australia's superannuation holdings are estimated to be 160% of Australia's predicted GDP, a substantial increase from 2011 when they were 100% of national annual GDP.[9]

By utilising just 12.4% of Australia's accumulated superannuation fund holdings over the period 2018-2050 (an investment worth A$788 billion over that period), Australia could achieve a 100% renewable energy future across the economy by the middle of this century.

[7] ISF https://www.uts.edu.au/sites/default/files/article/downloads/ISF_100%25_Australian_Renewable_Energy_Report.pdf
[8] Rice Warner, http://www.ricewarner.com/wp-content/uploads/2015/10/ageing-and-capital-flows.pdf
[9] Gruen & Sodling, Australian Treasury 2011, ABS Catalogue Numbers 5206.0, 5232.0, APRA and Treasury

WHEN CONSIDERING THE 100% DECARBONISATION OF POWER (EXCLUDING THE ELECTRIFICATION OF TRANSPORT AND INDUSTRY), OUR MODELLING SUGGESTS THAT AN ALLOCATION OF 7.7% PER ANNUM FROM 2018 TO 2030 COULD ACHIEVE A 100% RENEWABLE ENERGY OUTCOME FOR THE POWER SYSTEM BY 2030.[10]

The task of decarbonising the economy is significant but Australia has both the renewable energy resources and financial capacity to realise this objective, which is vital for a safe climate future.

Assuming a return on investment of just 7%, Australian superannuation can effectively fund the deployment of renewable energy infrastructure and renewable energy fuels that are needed to remove fossil fuel energy sources from Australia's electricity, transport, industrial and primary energy sectors.

The assumption on the return on investment is conservative, as renewable energy assets are routinely delivering returns of approximately 10%.[11]

[10] The modelling that derives the investment curve required to meet this challenge assumes a 7% p.a. return on average, and across asset classes, from renewable energy investments

[11] Insurance Commission of WA, (ICWA) 2017

Australia's clean energy transition

Renewable energy development has grown substantially since 2014/15. Despite the Federal Government revising the Federal Renewable Energy Target (RET) in 2015 (from 41,000 GWh to 33,000 GWh), on the grounds the target was "unachievable"[12], renewable energy deployment has significantly increased.

Mid-2017 it was estimated that 25,485 GWh[13] was in development or committed, up from 17,500 GWh in 2016. In January 2018, the Clean Energy Regulator, responsible for the administration of the Federal RET, confirmed that sufficient new renewable energy generation had been committed or under development to enable the 33,000 GWh target to be met.[14]

Recent analysis has further confirmed that not only will the Federal RET be achieved, but also that the original Federal RET objective of 41,000 GWh is set to be exceeded, with projections indicating that by 2020, 41,381 GWh of renewable energy will be deployed nationally.[15]

Driving this change is the significant level of demand for new build energy generation to make up a shortfall in the Australian electricity sector caused by the closure of thermal coal generation.

This trend is expected to continue as coal fired generation assets continue to reach the end of their operational life. Since 2010, 5,000 MW of coal fired generation has been taken offline and out of the National Electricity Market[16], with a further 8,000 MW of generation capacity expected to reach the end of operational life by 2030, and the remaining 19,000 MW of generation capacity to be closed by 2050 if Australia is to meet its NDC commitments under the Paris climate agreement.

[13] Clean Energy Council, https://www.cleanenergycouncil.org.au/policy-advocacy/renewable-energy-target.html May 2017

[14] Clean Energy Regulator, http://www.cleanenergyregulator.gov.au/Infohub/Media-Centre/Pages/Media%20updates/NewsItem.aspx?ListId=19b4efbb-6f5d-4637-94c4-121c1fg6fcfe&ItemId=468

[15] http://www.abc.net.au/news/2018-04-18/renewable-energy-capacity-to-exceed-impossible-target/9667870

[16] Senate Environment and Communications References Committee "Retirement of coal fired power stations" March 2017

Renewable Energy now the most cost competitive form of generation

Between 2010 and 2015 solar technology emerged dramatically across global markets, with increasing market share and a significant drop in investment costs. Solar photovoltaic (PV) at the household level is now cheaper than retail electricity prices (tariffs) in most industrialised countries. As such, it is now cost-effective for many households to produce their own power.

Wind power is now the cheapest technology worldwide for new power plants. This has led to a huge global market for wind with 63,000 MW of capacity added during 2015 – equivalent to installing a new turbine every 10 minutes.[17]

In Australia, wind generation is also the cheapest source of new build electricity generation, with wholesale prices in the $53-$75 MW/h range. Large scale solar is fast approaching this mark, with projects regularly sitting in the $75-$90 MW/h range.

Underpinned by a strong development pipeline, these costs can be expected to continue to decrease. The importance of strong policies to support renewable energy development are central to this continuing prospect of price reduction.

"...IS NOW COST-EFFECTIVE FOR MANY HOUSEHOLDS TO PRODUCE THEIR OWN POWER"

Future policy settings and trends

Renewable energy development in Australia has been substantially supported by a combination of State/Territory and Federal policy settings for the past decade and a half.

The Federal RET has provided a market for tradable certificates to allow large energy users and retailers to acquit their greenhouse gas abatement obligations. State and territory schemes, such as the ACT, Victorian and Queensland reverse auction programs, have provided long term contractual offtake agreements to allow renewable energy projects to be financed and built. These long-term arrangements with strong credit counter parties have enabled the cost of renewable energy projects to fall due to cheaper finance being available.

However, the development of the proposed National Energy Guarantee (NEG) has introduced significant uncertainty into the policy and economic landscape. This is principally a result of the substandard level of emissions abatement the NEG is proposed to enable from renewable energy development, currently estimated to be 26% of total electricity generation capacity by 2030.

This level is well below the contribution estimated to be required from the electricity supply sector in Australia to meet its NDC's under the Paris climate agreement. In the absence of a sufficiently robust target for renewable energy growth through the NEG, state and territory based renewable energy targets, reverse auctions and corporate Power Purchase Agreements (PPA's) will continue to underpin growth in renewable energy generation in the medium term.

[17] Global Wind Energy Council (GWEC), February 2016: www.gwec.net/global-figures/wind-energy-global-status/

SHIFTING TO A 100% RENEWABLE ENERGY ECONOMY

While it is estimated that Australia will achieve at least 28% renewable energy by 2030, the long-term objective for the Australian economy, if the objectives of the Paris Agreements are to be realised, must be the decarbonisation of all energy sources.

The transition to a 100% renewable energy system by 2050 is both technically possible and financially viable in the long term.

This report builds on the work of the ISF 2016 study which outlined an Advanced Renewables scenario for Australia.[18]

This scenario is the focus of this report, as it is the most ambitious scenario, resulting in a renewable energy electricity system by 2030 (for stationary energy).

The key elements of the Advanced Renewables scenario are outlined to the right::

The Power Sector

- The supply of electricity is 100% renewable by 2030 for stationary power.
- By 2035, 97% of total electricity demand (including electrified transport) is supplied by renewables.
- Energy productivity doubles by 2030.
- All coal power plants shut down by 2030.
- Firm capacity remains at today's level of approximately 75% throughout the entire scenario period.

The Transport Sector

- The supply of energy is 41% renewable by 2035, 64% by 2040 and 100% by 2050.
- Australia is independent from oil imports within one generation.

The Industry Sector

- The supply of energy is 50% renewable by 2035 and 100% by 2050.
- Electricity use doubles by 2050 to replace direct fuel consumption.

Primary Energy

- 41% of energy use across all sectors is renewable by 2030, 59% by 2035, 75% by 2040 and 96% by 2050.

[18] Teske, S., Dominish, E., Ison, N. and Maras, K. (2016) 100% Renewable Energy for Australia – Decarbonising Australia's Energy Sector within one Generation. Report prepared by ISF for GetUp! and Solar Citizens, March 2016.

The potential for superannuation funds to drive 100% renewable scenario

It is estimated that by 2050 that the total volume of funds under management in Australia's superannuation funds will be $6.5 trillion, amounting to more than 160% of Australia's estimated GDP.[19]

SUPERANNUATION FUNDS ROUTINELY INVEST IN LONG LIFE, LARGE SCALE INFRASTRUCTURE THAT DELIVER CONSISTENT, LONG TERM RETURNS ON INVESTMENT.

However, in the Australian renewable energy sector there has only been limited investment from Australian superannuation funds. This is not the case for overseas based superannuation and pension funds, who have recognised the long term and consistent returns available from investment in large scale renewable energy generators.

Capital investment in renewables delivers net savings across Australian economy

Based on the ISF 'Advanced Renewables' scenario, as outlined above, it is estimated that complete decarbonisation of the energy sector in Australia will require a capital investment of $788 Billion by 2050. This represents a significant upfront capital cost, approximately $650 Billion more than Business-as-Usual (BAU). However, this new capital investment delivers an average of $20 Billion in fuel cost savings every year between now and 2050 ($9 Billion a year on power sector fuel costs and $11 Billion a year on transport fuel costs). These savings overcome the capital cost difference of the two scenarios compared in the 2016 ISF Report and deliver a total net saving to the Australian economy of $90 Billion over the period to 2050.

New capital investment of $788 Billion for the 100% 'Advanced Renewables' scenario amounts to 12.4% of estimated total Australian superannuation fund holdings over the period 2018 – 2050.

[19] Rice Warner, http://www.ricewarner.com/wp-content/uploads/2015/10/ageing-and-capital-flows.pdf

100% renewable electricity by 2030 - for just 7.7% of superannuation holdings

The task to achieve 100% renewable energy generation in the power supply sector is even more achievable. With the deployment of just 7.7% of accumulated superannuation funds over the next 12 years, Australia's power (electricity) sector could be fossil fuel free by 2030.

The table below shows the annual cumulative amount invested in 100% renewable energy from superannuation funds. By 2050, investment of $788 Billion AUD (in 2018 dollars) is needed to achieve 100% renewable energy generation for Australia.[20]

As the ROI of the renewable energy sector will influence the stream of annual revenue for the superannuation fund, it will also influence the percentage of investment required.

Should the 7% return on investment (ROI) of renewable energy be on par with the projected average return of a fund, it is estimated that 12.4% of total superannuation funds will be required for funding Australia's pathway to 100% renewable energy system.

However, a ROI of 5% and 10% will result in investment allocation of 13.5% and 11.6% of total funds respectively. In 2017 the Insurance Commission of Western Australia (ICWA) expected a return of 10% per annum from their renewable energy assets.[21] Other evidence exists that suggests return on investment from renewable energy assets are likely to remain around 10% for at least the short term.[22] The baseline case for the development of this report is a more conservative 7% average return on investment from renewable energy assets, across asset classes..

[20] This calculation also assumes that all investments necessary for 100% renewables have already been ongoing since 2013 outside of superannuation funds.
[21] http://www.afr.com/business/investment-funds-plugging-into-renewable-energy-assets-for-big-returns-20171013-gz0ivf
[22] https://medium.com/irene-energy/impact-investing-and-renewable-energy-1c922fc5aebf

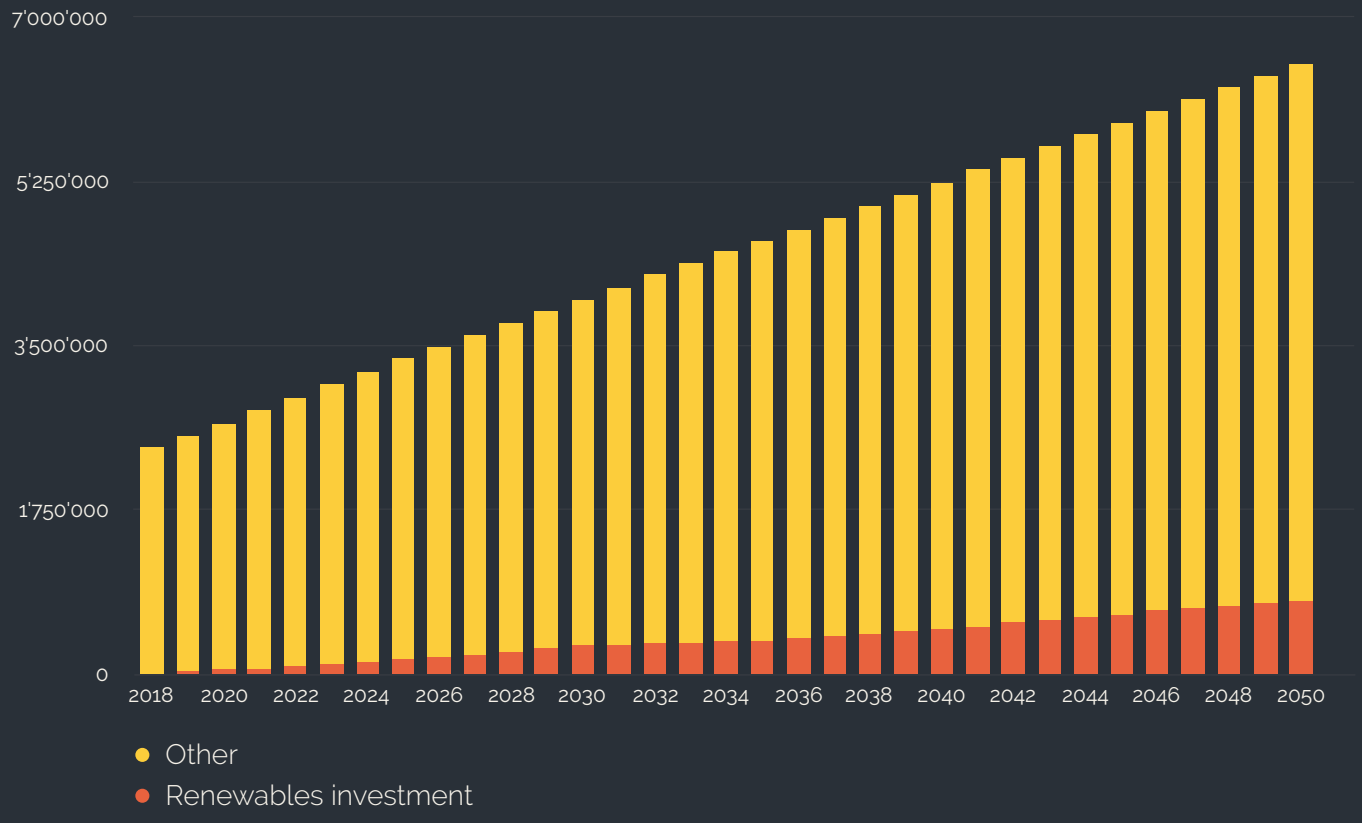
Table 1.

Impact of 100% renewable energy investment on Superannuation fund, by ROI of renewable energy sector

	5% ROI	7% ROI	10% ROI
Net % investment of super fund for fully decarbonized power sector in 2030	7.72%	7.66%	7.57%
Total superannuation fund by 2030 (in 2018 dollars)	3.96 TRILLION AUD	4.00 TRILLION AUD	4.05 TRILLION AUD
Change in 2030 Superannuation fund (vs. BAU scenario)	(-0.9%)	(no change)	(+1.4%)
Net % investment of super fund for renewable energy system in 2050	13.0%	12.4%	11.6%
Total superannuation fund savings by 2050 (in 2018 dollars)	6.18 TRILLION AUD	6.50 TRILLION AUD	6.99 TRILLION AUD
Change in 2050 Superannuation fund (vs. BAU scenario)	(-5.0%)	(no change)	(+7.5%)

FIGURE 1 HIGHLIGHTS THE INVESTMENT CURVE FOR THE TRANSITION TO A FULLY RENEWABLE ENERGY SYSTEM FOR AUSTRALIA.

It demonstrates that for a reasonable long term return on investment of 7% , only 12.4% of Australia's superannuation funds could deliver a fully decarbonised energy solution for Australia.



Cumulative Investments in renewable energy
(2018 AUD, in million)

Figure 1. Cumulative Investments in renewable energy, in relation to cumulative growth of superannuation fund (2018 AUD, in millions). By 2050, 12.4% (under the RE ROI of 7% scenario) of Australia's superannuation fund will need to be invested towards renewable energy to achieve a 100% renewable energy system for Australia.[23]

[23] Assumptions on technology cost projections: The pathway to a 100% renewable system utilises the deployment of various renewable energy technologies in differing periods of time, mainly driven by the maturity and cost of each technology. The cost projection is based on 2015 data from the German Aerospace Centre (DLR) Institute for Technical Thermodynamics, Technology and System-Analysis.

WIND & SOLAR

The main technologies for investment

THE KEY RENEWABLE ENERGY TECHNOLOGIES FOR ATTRACTING INVESTMENT UNDER THE 100% 'ADVANCED RENEWABLES' SCENARIO BY 2050 ARE PV AND WIND POWER (66% OF THE COMBINED TOTAL), AS SHOWN IN BELOW CHART.

Solar PV is the largest recipient of investment, at 39% of the total. This reflects the long term price competitiveness of large scale and roof top solar and its increasing pervasiveness across the energy sector.

Large scale wind (onshore and offshore) amounts to 27% of the total, with biomass and hydro also recipients of substantial levels of investment (11% and 9%).

Table 2

Investment by Technology Type (to 2050)

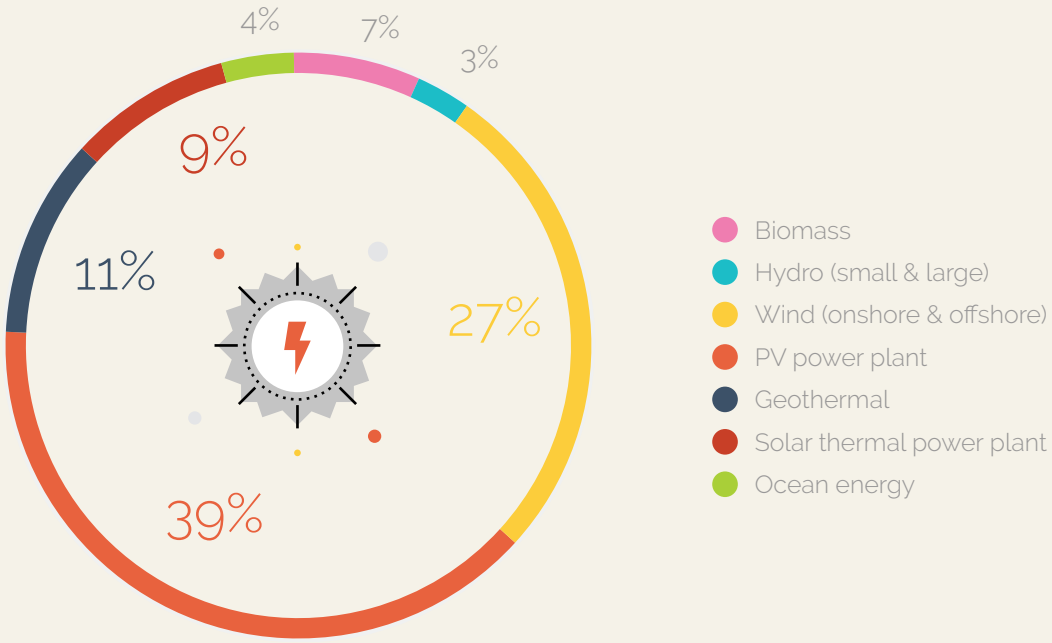


Table 3

Energy Source by Technology Type (in 2050)

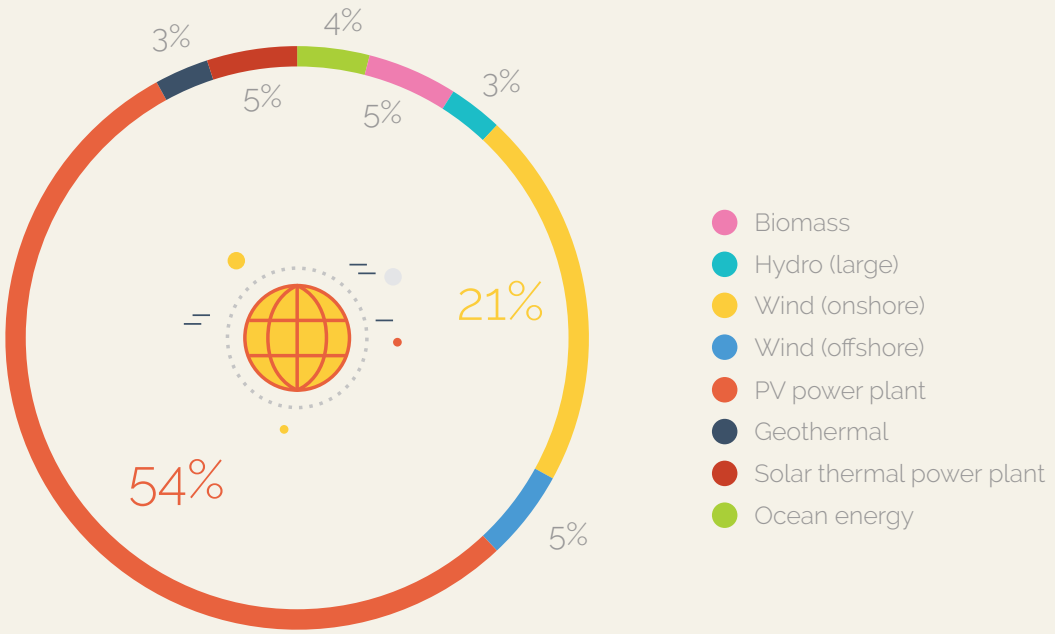


Figure 2. Investment plan for each RE sector to achieve 100% RE in 2050 (in 2018 AUD, in millions)

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