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Large Scale Solar and the RET

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TAI

Policy Brief

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Introduction

Since its introduction in 2001, the Renewable Energy Target has provided a policy foundation that has supported the emergence of a growing clean energy sector in Australia. In less than a decade the renewable energy in Australia has evolved into an industry supporting thousands of jobs and over $20 billion dollars in infrastructure investment.

Australia's growth in renewable energy is reflective of a wider global trend. OECD countries are now producing over 600,000 Gigawatt-hours of renewable energy from non-hydro sources each year, meeting 5.5% of the electricity supply. Recently, growth in Australia has stalled due to uncertainty around the RET, with an 88 per cent decline in investment for large-scale projects in 2014.

In recent years much growth in OECD renewable generation has come from solar photovoltaic (PV) generation, which is experiencing rapidly falling costs. The cost of installing large-scale solar PV fell from approximately $4,500 per kilowatt in 2008 to around $800 per kilowatt in 2013. While wind power is already cost-competitive with fossil fuels on a levelised cost basis, solar PV is forecast to reach similar prices in the coming decade.

The RET provides a boost for renewable energy as retailers are required to purchase a proscribed amount of renewable energy each year, certified through Renewable Energy Certificates (RECs). The money renewable generators make by trading RECs to retailers provides a second revenue stream in addition to the sale of wholesale electricity.

Forecasts for wholesale electricity prices are flat due to lower than expected growth in electricity demand in Australia. Even with forecast cost reductions, the most cost effective solar projects are not forecast to be viable receiving wholesale prices alone until after 2030. With the current RET maintained, the lowest cost solar projects could be viable as early as 2018 based on forecasts from the Bureau of Resource and Energy Economics. If large-scale solar is to be built in Australia, the RET is integral.

An extension to a 40 per cent by 2030 target would likely see considerable roll out of large-scale solar generation. Even under a 30 per cent by 2030 scenario, solar increases its profitability, while that of most other energy sources falls, including wind, according to modelling for the Government's RET review.

Complementary policies such as those administered by the Australian Renewable Energy Agency (ARENA) and the Clean Energy Finance Corporation (CEFC), also aid the entry of solar into the Australian market. ARENA has already assisted the commissioning of four major solar projects since its establishment.

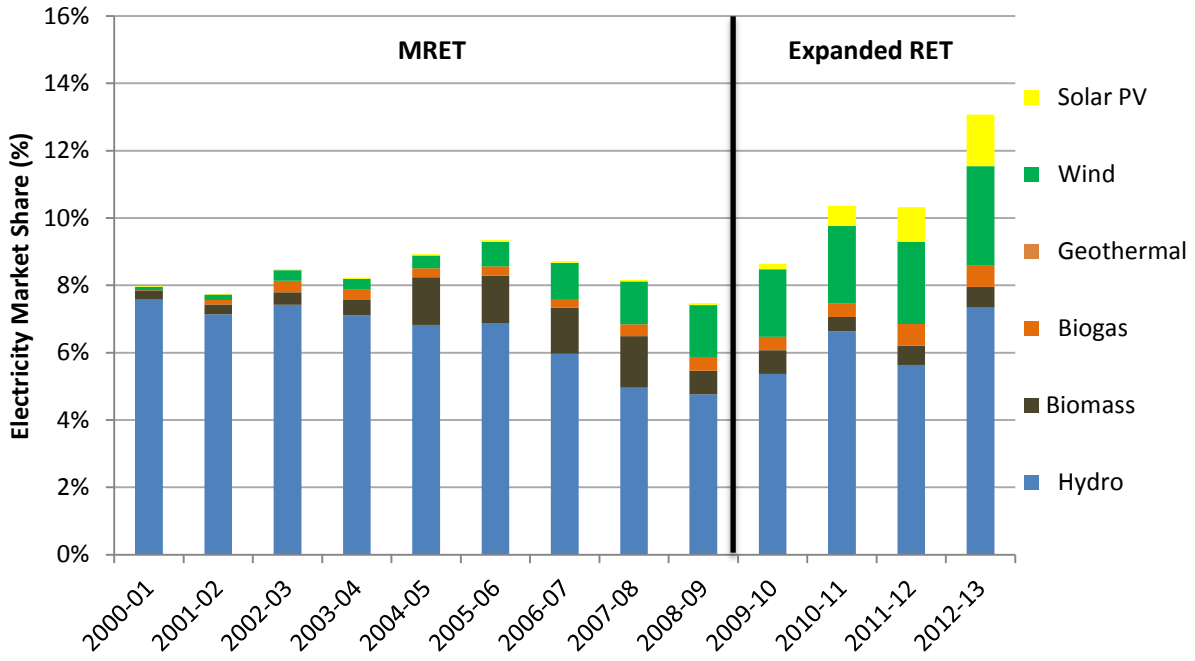
Significant increases in investment in large-scale solar PV projects, in addition to continued growth in wind generation are anticipated in coming years.

Renewable energy investment and the Renewable Energy Target

Investment in renewable energy in Australia has exceeded $20 billion between 2001 and 2014.[1] Prior to this period nearly all renewable energy came from hydroelectricity projects built decades ago. This new investment has driven an increase in the market share of renewable energy, from various sources, as shown in Figure 1 below:

[1] Clean Energy Council (2014) *The Renewable Energy Target – the Facts*

Figure 1: Renewable Electricity market share under the RET



Source: Bureau of Resource and Energy Economics

The considerable increase in market share from around 2009 relates to the more ambitious renewable energy target adopted by the Rudd Government, with bipartisan support. The revised target aimed for 20 per cent market share of renewable energy by 2020. Nominally, the target required 41,000 GWh of new large-scale renewable energy generation, while also providing targeted support for small-scale technologies.

Despite previously enjoying bipartisan support, uncertainty around the future of the scheme has persisted over the last few years. The Abbott Government openly considered reducing or abolishing the target and commissioned a review of the policy headed by former fossil fuel industry boss and self-identified climate change sceptic, Dick Warburton.

Investors in capital-intensive projects, such as large-scale electricity generators, require a level of certainty with respect to the relevant revenue streams available to the project. The uncertainty around the future of the RET creates too large a risk to allow confident investment in Australia's clean energy sector at this point in time.

While investment in renewable energy projects was still considerably higher than it was a decade ago, in 2014 the industry recorded a 35 per cent decline in new renewable energy finance. This included an 88 per cent decline in investment for large-scale projects.[2]

International context

In an international context, market analyst Bloomberg New Energy Finance estimated that global investment in clean energy projects grew by 16 per cent in 2014[3], to $310 billion. Positive growth in clean energy projects was observed in almost every major economy, being especially driven by increased investment in China, USA, Japan, Canada and Brazil.

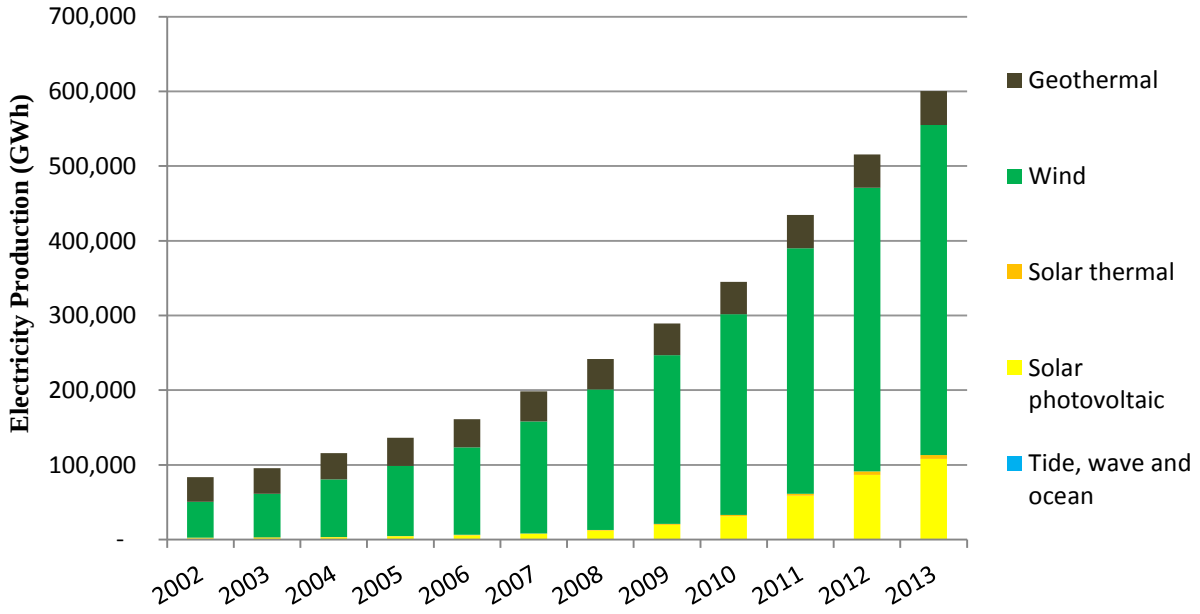
[2] Clean Energy Council (2014)

[3] Bloomberg New Energy Finance (2015) *Rebound in Clean Energy Investment in 2014 beats expectations*

Figure 2 below highlights the strength of this trend within OECD countries, with the majority of new growth seen in increased deployment of wind generation technologies.

Notably, the rate of adoption of solar PV has also increased considerably with new capacity being installed at a rate comparable to wind in recent years.

Figure 2: Electricity production from renewables in OECD Countries (excluding hydro)[4]



Source: International Energy Agency

Australia was a rare exception to this trend. While investment in renewable energy projects was still considerably higher than it was a decade ago, in 2014 the industry recorded a 35 per cent decline in renewable energy finance. This included an 88 per cent decline in investment for large-scale projects, attributed to policy uncertainty created by ongoing reviews of national renewable energy policies.

The rise of solar

The emergence of solar in the global electricity market, as shown in Figure 2 reflects the rapid cost reductions that the technology has achieved in recent years. The cost of solar PV modules has fallen by as much as 77 per cent over the last five years.[5] The International Renewable Energy Agency estimated that the cost of installing large-scale solar PV fell from approximately $4,500 per kilowatt in 2008 to around $800 per kilowatt in 2013.[6]

Costs for power generation are most commonly expressed as “levelised cost of energy” (LCOE). This is the average price required over the entire operational life of a power station required for the project to breakeven.[7] Wind has had a dominant share of new generation to

[4] IEA (2015) *Electricity and heat generation*

[5] IRENA (2015) *Renewable Power Generation Costs in 2014*

[6] IRENA (2015)

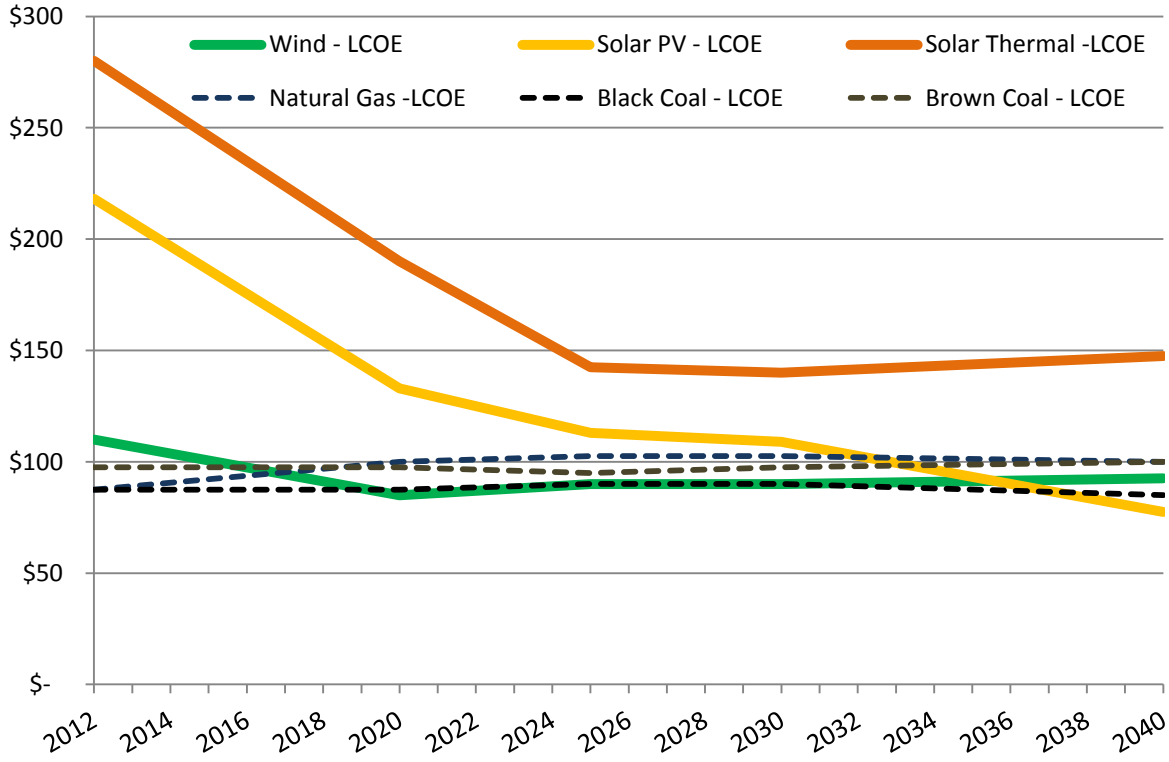
[7] Levelised cost is inclusive of the capital cost of the power station, the cost of operating and maintaining the equipment, the cost of fuel and the cost of finance. Externalities, such as the cost of pollution, may also be factored while calculating the LCOE. This measure is applied predominantly when assessing the feasibility of commissioning a new power station.

date because of its lower levelised cost. Onshore wind has LCOE of $90 to $130 per Megawatt-hour (MWh), which is competitive with fossil fuel sources such as combined cycle gas turbines which range from $110 to $130/MWh.[8]

Solar PV is the prime candidate to provide competition to wind as the next low-cost source of large-scale renewable energy generation. Continued investment in research and development of solar energy technologies, and the ramping up of production capacity in China, Taiwan, Japan, Germany and the United States continues to drive down costs.[9]

The Australian Bureau of Resource and Energy Economics (BREE) predicts solar PV to achieve the lowest unsubsidised cost of all new generation sources before 2040, ahead of wind and all fossil fuel technologies, with the potential for some solar PV projects to be cheaper than comparable wind projects sometime earlier.[10] A comparison of the changing LCOE of solar and wind technologies is shown in Figure 3 below.

Figure 3: Forecasts of levelised cost of different electricity sources in Australia



Source: BREE 2013 (Mid estimates)

As Figure 3 shows, only solar PV is projected to achieve reductions on a scale necessary to join wind in becoming cost competitive with established fossil fuel sources.

Cost projections for solar thermal technologies are widely variable. Some analysts predict that solar thermal could join solar PV in offering a new source of competitively priced renewable energy, with the added benefit of its ability to be combined with storage. Solar thermal has however yet to achieve the same level of market maturity achieved by wind and solar PV.

[8] BREE (2013) *The Australian Energy Technology Assessment 2013: Update*

[9] IRENA (2015)

[10] BREE (2013)

Other renewable energy sources

Geothermal energy holds a similar market position to that of solar thermal; however the factors influencing the feasibility of geothermal generation are quite different.

While solar thermal is a developing technology, and subject to a high level of research and development, geothermal generation is a mature technology. It meets more than a quarter of electricity demand in some countries such as Iceland, the Philippines and El Salvador.[11] While geothermal resources exist in Australia, access to them is limited by location, with the best resource found in remote areas. The extraction and delivery of geothermal energy is capital intensive, and is likely to require significant investment in new transmission network infrastructure to ensure adequate access to the National Electricity Market.

Biomass based generation also offers a low cost source of generation. Projects utilising waste streams, such as landfill gas, sewage and sugar cane waste all rank amongst the lowest cost sources of energy. These resources are well developed under the current RET, and while low cost, are limited in their ability to supply additional electricity on a large-scale.

Renewable Energy Target

The RET works by requiring electricity retailers to purchase electricity from renewable sources. In practice, the retailers must acquire and surrender a certain number of Renewable Energy Certificates (RECs) to the Government each year. RECs are awarded to renewable generators for each megawatt-hour of electricity generated. Trading these certificates provides a second source of revenue for eligible renewable energy projects, comparable to the wholesale price of electricity. This improves the financial viability of renewable energy projects.

Two distinct markets for clean energy technologies have emerged, and supported by different components of the Renewable Energy Target scheme; the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES). Investment in large-scale renewable energy projects, predominantly through wind has been complemented by the emergence of a rapidly growing market for small-scale distributed solar generation projects.

The LRET has seen investment in clean energy projects made at a utility scale, allowing renewable technologies to compete with incumbent generators. The SRES has assisted individuals to make direct investment in renewable energy for their homes and businesses.

The compliance cost of the RET is passed through to the end consumers of electricity, with some exemptions provided to trade-exposed industries, as a component of their retail electricity bill. This component was estimated by the Australian Energy Market Commission[12] to represent just 4 per cent of the average Australian residential electricity price in 2014/15.

However, this cost is offset by reductions in the wholesale price of electricity, the component of electricity costs paid to generators. This is because the RET is leading to increased supply of generation capacity, driving down prices. Several projections, including those prepared for the Abbott Government commissioned Warburton RET Review, suggest that the reduction in wholesale electricity prices will more than offset the RET compliance costs, with the cost reductions increasing with higher renewables targets.

Once they have been built; renewable energy technologies have negligible operating costs, not requiring the purchase of fuels, generating energy more at a lower marginal cost than

[11] IPCC (2011) *Special report on renewable energy sources and climate change mitigation - Geothermal*

[12] AEMC (2014) *2014 Residential electricity price trends*

coal or gas-fired generators. The National Electricity Market operates by generators who have the lowest prices being dispatched first. This means wind and solar can squeeze higher priced fossil fuel energy sources out of the market.

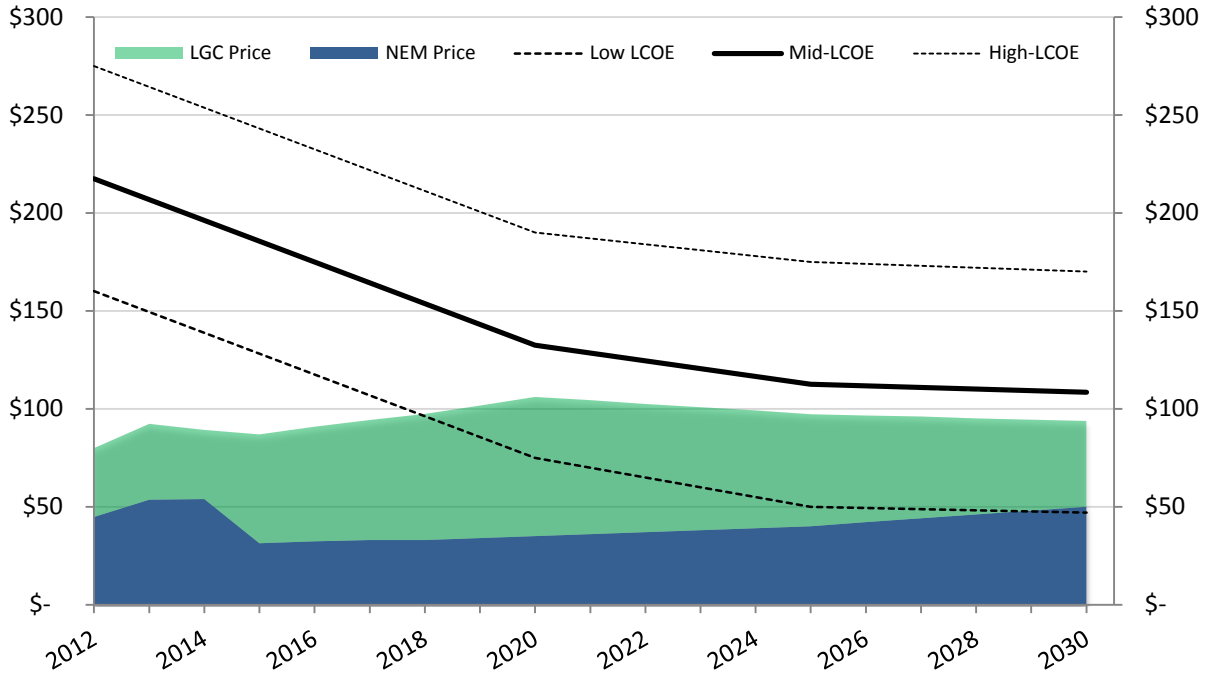
The losers from these wholesale cost reductions are existing generators, mainly fossil fuel generators facing the prospect of lower wholesale power prices. This dynamic also ensures that increased adoption of renewable energy works to reduce the overall greenhouse gas emissions from the electricity sector.

Importance of the RET for large scale solar PV

The costs of solar energy are declining faster than that of any other energy source. Any reduction in the RET would make the adoption of large-scale solar energy in Australia much more difficult.

Currently, levelised costs of solar energy are substantially above both the wholesale price of electricity in the National Electricity Market and the incentive provided by sale of Large-scale Generation Certificates, the relevant type of REC. Even the most cost effective solar projects require assistance from other initiatives. BREE forecasts suggest this will continue for the foreseeable future, as shown in Figure 4 below.

Figure 4: Comparison - Forecast levelised cost of solar PV and available revenue



Source: Bureau of Resource and Energy Economics, ACIL Allen

Figure 4 shows that with the current RET in place, providing revenue on top of that provided via the National Electricity Market, the most efficient solar projects with the lowest levelised costs will begin to become viable under the scheme from 2018. Without the RET, the only source of revenue is the NEM wholesale price. if projects were reliant on this revenue alone, large scale solar will not be viable until 2030, when the lowest cost projects may start to become viable.

Abolishing or reducing the RET at this stage would mean that solar projects are reliant on support from programs such as the Clean Energy Finance Corporation (CEFC) and the Australian Renewable Energy Agency (ARENA), discussed below. Very little solar would be developed if the RET is abolished or reduced.

Potential changes to the RET

The design of the Renewable Energy Target has supported the increased adoption of mature renewable energy technologies. As a market based mechanism, accessibility to incentives under the RET is technology neutral, facilitating the deployment of the lowest cost technology eligible under the scheme.

Wind energy has long held the position of lowest cost renewable energy source for large-scale projects. Along with several small biomass projects, wind has dominated the market for new renewable energy generation since the introduction of the RET.

Various forecasting exercises, including modelling completed by ACIL Allen for the 2014 Warburton RET Review,[13] and modelling completed by SKM MMA for the Climate Change Authority's RET Review in 2012,[14] predict that wind will continue this dominance under the current 20 per cent Renewable Energy Target.

However, it is increasingly likely that beyond 2020, solar energy will begin to gain significant market share for large-scale generation, as the cost of solar photovoltaics (PV) and solar thermal technologies continues to fall at rates faster than that of wind and other renewable energy technologies.

Reforming the RET

The current RET aims to generate 41,000 GWh of new renewable electricity each year by 2020 and beyond. As of 2013, around 16,000 GWh renewable electricity was generated towards this target.

If the rates of annual increases mandated by the current RET until 2020 were extended to 2030, it would lead to renewable generation of around an additional 80,000 GWh in 2030, leading to a renewable electricity market share of around 40 per cent of electricity by 2030.

As part of the Warburton RET Review, commissioned by the Abbott Government, a "real 30% by 2030" renewable energy target was explored as a modelling scenario. This target was defined on the basis of reaching 52,500 GWh of renewable electricity generation by 2030, representing approximately 30 per cent of supply based on updated electricity consumption projections.

The most recent projections of electricity demand from the Australian Electricity Market Operator (AEMO) predict future electricity consumption to be lower than the corresponding projections made at the time when the current 20 per cent target was introduced. Falls in demand are the result of several contributing factors, including a response to increasing electricity prices, a decline in manufacturing activity, and general improvements in energy efficiency throughout the economy.[15]

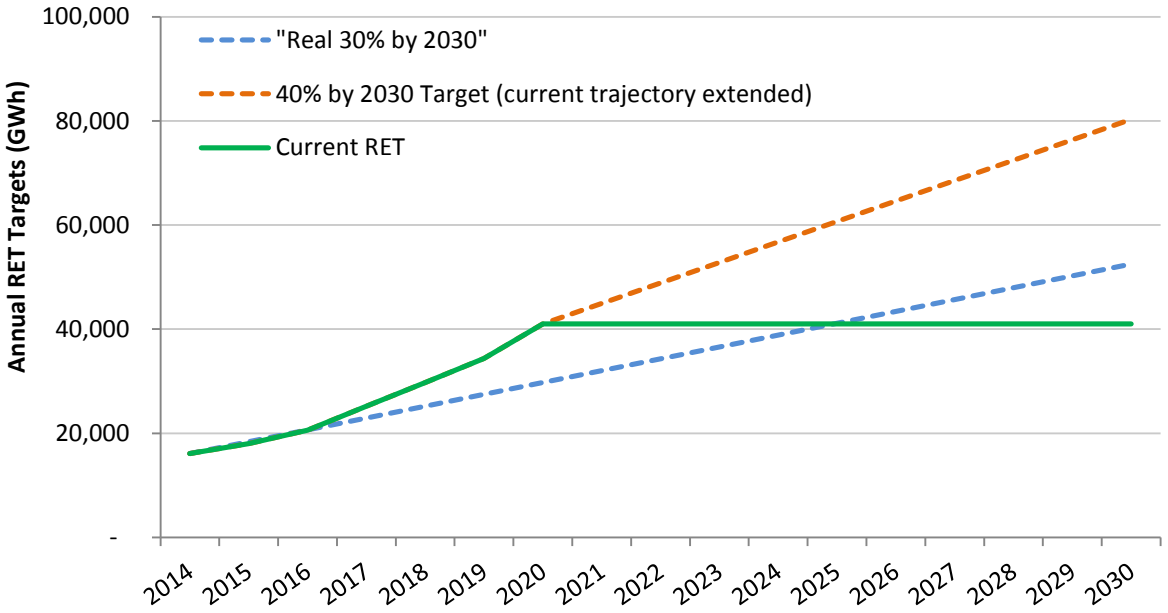
Due to the revised estimates for future electricity consumption, while the peak in this target is higher, the ramp up trajectory of year-to-year targets is shallower than that of the current RET targets.

[13] ACIL Allen (2014) *RET review modelling*

[14] SKM MMA (2012) *Modelling the Renewable Energy Target: Report for the Climate Change Authority*

[15] AEMO (2014) *National Electricity Forecasting Report 2014*

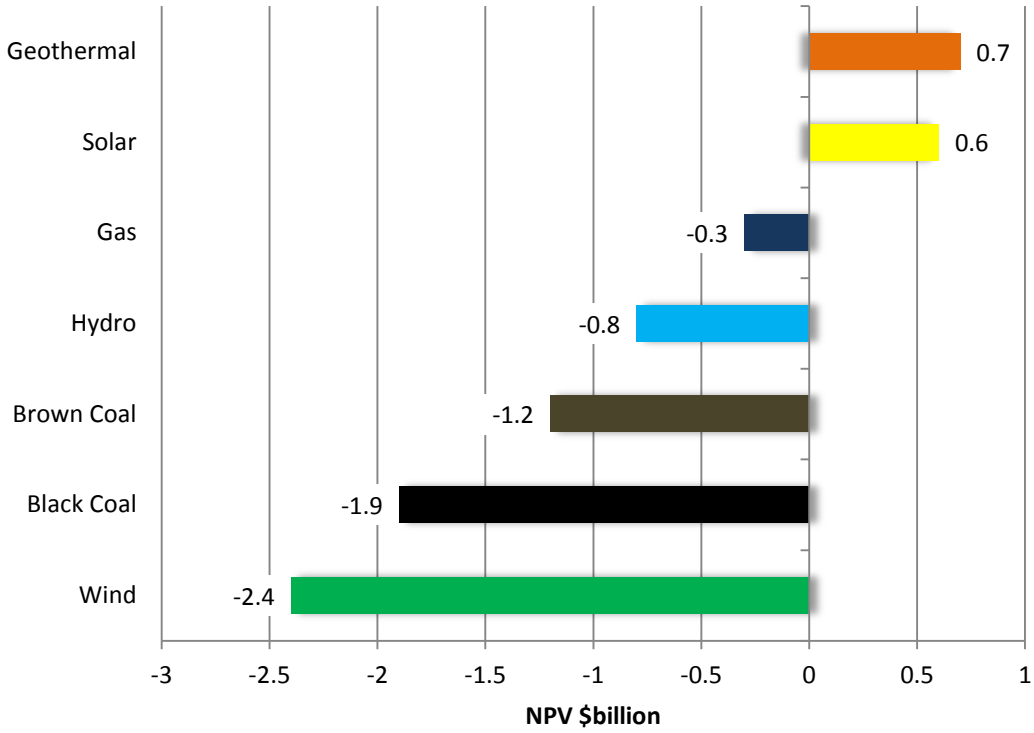
Figure 5: Comparison of LRET targets under different reform scenarios



For comparison purposes, Figure 5 highlights the differences in the target trajectories explored by the Warburton RET Review, along with an additional scenario where the current RET trajectory is extended through to 2030, which would result in approximately 40% of electricity being generated from renewable sources.

In modelling the "real 30%" scenario, ACIL Allen predicted that such a target would lead to changes in profitability of different energy sources, as demonstrated in Figure 6 below:

Figure 6: Change in profitability with RET change to "Real" 30% by 2030



Source: ACIL Allen

An extended target trajectory offered by the "real 30%" RET scenario provides incentives for growth in renewable energy generation during a period when solar PV has achieved greater cost reductions. This would allow solar PV to enter the Australian energy market on a larger scale, and to some degree, take market share away from both wind and fossil fuel energy sources.

The impact on fossil fuel and hydro generation reflects the combination of reduced demand for electricity from these sources, having been displaced by renewable energy, and reduced returns through wholesale electricity prices, suppressed as a result of the RET.

Reductions in the profitability of wind generation is largely a result of suppressed Large-scale Generation Certificate prices, resulting from the slower ramp up in annual RET targets under the "real 30%" scenario. The lower annual targets reduce demand for Large-scale Generation Certificates in the short term. With a projected decrease in generated profits, the "real 30%" scenario results in a reduction in the amount of investment in wind technologies, falling by $200 million[16] through to 2030. However, this is offset by significant increases in large-scale solar investment (increasing by $1.3 billion to reach $3.1 billion), and allowing an opportunity for $1.4 billion to be invested in geothermal projects.

It is likely that a more ambitious, post-2020 target, would fortify investment in wind technologies, while also further strengthening investment in solar and other renewable technologies. A target of approximately 40% renewable electricity by 2030 would provide a target trajectory with a similar rate of increase as the current target. Both wind and solar would significantly benefit from such a scenario.

A reduction to the RET, or its outright repeal, would be detrimental to the renewable energy sector, essentially crippling its ability to attract new investment. Without the RET in place, investment in renewable energy is unlikely to occur on a large-scale until after 2030. Likewise, a diminished RET would undermine the effectiveness of other targeted support programs administered by State and Federal Governments.

An extension to the RET, while allowing for a proportional increase in the amount of non-wind renewable energy projects, may also provide additional cost benefits for consumers. Additional deployment of renewable energy projects would result in further suppression of wholesale electricity prices across the whole of the National Electricity Market; likely to more than compensate for any increase in RET compliance costs.

In addition to the economic benefits, an increased RET target would drive additional greenhouse gas abatement reductions, with greater long-term improvements to the emissions intensity of the electricity sector.

The RET and other Federal Policies

As a market based mechanism, the RET is unlikely to incentivise new renewable projects using technologies other than wind generation as it is currently designed. Directed financial support, in the form of grants or concessional finance, is currently necessary to get projects using solar or geothermal energy off the ground.

The Australian Renewable Energy Agency (ARENA) currently provides the largest amount of direct support for large-scale solar in Australia, allowing such projects to be commissioned. ARENA has an allocation of $2.5 billion to provide funding, in the form of grants, for projects and research.

[16] ACIL Allen (2014)

The Clean Energy Finance Corporation (CEFC) may invest up to $10 billion in renewable energy, energy efficiency and other clean energy technologies. The CEFC works in much the same way as a private financier, ensuring that a positive return on its investments are achieved, but operating with a specific mandate to leverage new investment in Australia's clean energy sector.

The interaction of these three key government policies, support provided through the RET, ARENA and the CEFC, play distinct and complimentary roles in supporting increased renewable energy adoption. Each of these programs works to shape the emergence of the renewable energy sector in different ways.

The investments made by both ARENA and the CEFC serve to address barriers faced by emerging technologies in entering the market. ARENA recognises the benefits of investing in innovative technologies, and the cost reductions that can be created by proactive investment. The CEFC provides support for these projects by seeing the Government become a co-investor in pioneering projects, helping to facilitate private finance for projects.

Four major solar PV projects approaching commissioning have been supported by ARENA with significant funding support so far. This funding provides over $300 million in grants, leveraging over $700 million in large-scale solar investment, and the construction of 270 Megawatts of solar generation capacity.[17] An additional $59.55 million in ARENA funding has been allocated to the Cooper Basin Enhanced Geothermal Systems Heat and Power Development.

Table 1: Large-scale projects supported by ARENA as at January 2015

Project	Source	Size	ARENA Grant (million)	Total Capital Value[18]
Moree Solar Farm	Solar PV	56 MW	$101.7	$164
Nyngan Solar Farm	Solar PV	100 MW	$75.8	$300
Broken Hill Solar Farm	Solar PV	53 MW	$40.2	$150
Kogan Creek Solar Boost Project	Solar Thermal	44 MW	$35	$105

On average, ARENA has provided grants covering approximately 40 per cent of the capital cost of the project. Grants of this scale are generally sufficient to make the projects commercially viable for the proponents providing the remaining investment. Some projects have also received co-investment from the CEFC. This support has facilitated the early entry of large-scale solar projects into the Australian electricity market.

The ability for these projects to enter the market is underpinned by the RET. The repeal of the RET, or a significant reduction in the targets mandated by the scheme, would undermine the support provided by these complementary schemes.

The RET and State policies

As of 2015, there are few additional policy measures that provide support for large-scale renewable energy technologies at other levels of Government.

[17] ARENA (2015) *Projects*

[18] BREE (2014) *Major Projects: Projects List*

With the implementation of a reverse auction feed-in tariff scheme, the ACT is currently the only State or Territory jurisdiction with a legislated mechanism for supporting large-scale renewables. The ACT Feed-in tariff provides a guaranteed, fixed rate for electricity generated, with a modest cost passed on to electricity consumers.

As part of the Renewable Energy Action Plan, the NSW Government has committed to providing directed support and grants for the development of renewable energy projects within the state.

South Australian Government has sought to proactively facilitate additional private investment, with a target of $10 billion, in new renewable generation by 2025, with an aim of achieving a 50% renewable electricity target.

Conclusion

The emergence of renewable energy as a major player within the Australian electricity market, assisted by the RET, is reflective of a wider global trend. Cost reductions driven by increased global investment in both the research and development, rapid increase in the scale of manufacturing of renewable energy technologies, is reflective of its potential as a clean and affordable source of energy.

The RET can therefore be seen as a tool to be used to shape the electricity sector in Australia, providing support for mature technologies to enter the market. With this in mind, reforms to the RET should be used to ensure the mechanism best serves Australia's strategic interests and the interests of electricity users. This includes both supporting mature technologies entering the market in the short-term, while also being forward looking and responsive to the arrival of new technologies in the future.

This is particularly important for solar technology at this point in time. While a mature technology in many respects, it is still experiencing rapid reductions in costs. Without the RET, deployment of large scale solar would be unlikely before 2030.

A stable, ambitious and achievable Renewable Energy Target would provide necessary confidence for project proponents and sustain continued growth in the deployment of low-cost and low-emission energy sources in Australia.

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