Infrastructure Capital

Renewable energy: Investing in an evolving generation landscape

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OVERVIEW

Over the past decade, wind and solar have provided the bulk of additional generation capacity to the National Energy Market (NEM), replacing retired coal and gas-fired plants. Despite a significant number of regulatory and policy changes directly affecting the relative economics of the different sources of generation, wind and utility-scale solar generation capacity has more than doubled, from 2.3GW in 2012 to 4.8GW in July 2018, with a strong acceleration over the past 24 months, in particular for utility-scale solar.

Early in 2018 the Clean Energy Regulator (CER) announced that there were enough projects at a sufficiently advanced stage to meet the large-scale Renewable Energy Target (RET). This represents a remarkable achievement considering that just over half of the target had been met at the beginning of 2017.

Notwithstanding the considerable growth, wind and solar generation capacity still represented just 12 per cent of the generation capacity in the NEM as of July 2018. Given that more than 60 per cent of the NEM's existing coal-fired generation capacity will reach the end of its useful life by 2040[1]. It is estimated by Bloomberg New Energy Finance that 90 per cent of the forecast $88 billion to be spent adding power and replacing capacity in Australia until 2040 will come from renewable energy.

Clearly, renewable energy is expected to continue to grow in market share and play an increasingly important role in the Australian energy market.

Three key drivers are supporting this wave of investment in wind and solar generation over traditional generation sources:

1. Compelling economics for renewable energy compared with the cost of alternative sources of generation;
2. Improving grid integration cost and reliability; and
3. Increased availability of capital and offtake contracts to support renewable energy projects.

From its beginnings as a niche sector driving environmental sustainability objectives, wind and solar energy has evolved to become the new-build electricity generation source of choice and is poised to become an even larger proportion of Australia's energy mix.

Given renewable energy's low position on the cost curve, government subsidies will no longer be required to incentivise investment in the sector. In order to optimise outcomes for energy consumers, the government needs to shift its focus from pricing subsidies for renewable output to incentivising the development of dispatchable renewable energy solutions, such as the incorporation of batteries or pumped hydro.

In addition , incentivising investment in the NEM interconnections would also allow a whole of market approach to better leverage generation resources across the country to be leveraged most efficiently.

[1] AEMO ISP 2018 https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2018/Integrated-System-Plan-2018_final.pdf

COMPELLING ECONOMICS

Similar to other developed countries, Australia has historically relied on government support policies in order for wind and solar energy generation to be economically competitive with conventional sources of generation (such as coal and gas-fired generation). A key policy at a federal level, introduced in 2001 and reformed a number of times, is the Mandatory Renewable Energy Target. This scheme currently targets 33 GWh of energy to be generated by renewable energy sources by 2020 by creating financial incentives for utility-scale renewable energy plants. These plants are entitled to generate and sell to retailers and other large industrial energy users renewable energy certificates for the units of renewable energy generated.

At a state and territory level, a number of policies, including state-based renewable energy targets, feed-in tariffs and energy auction schemes, have also supported the uptake of both small and utility-scale renewable energy generation.

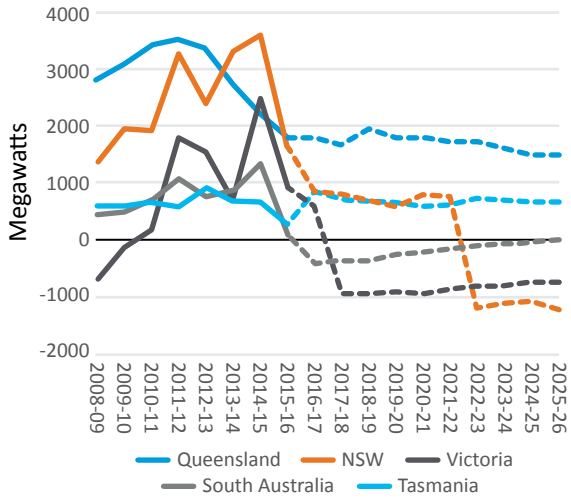
Government support policies were required as a catalyst for investment in renewable generation for two main reasons:

1. The levelised cost of energy (LCoE)[2] of wind and solar generation was previously higher than the average wholesale market prices in the NEM; and
2. The new renewable generation capacity was introduced to a market operating in a significant generation surplus environment.

The trend for both of these factors has been reversing over recent years.

With the NEM having experienced withdrawals of over 5GW of capacity since 2012, including large baseload coal-fired power such as Hazelwood (1.6 GW) in 2017, Northern Power Station (540MW) in 2016 and Wallerawang (1GW) in 2015, the NEM is currently operating much closer to a generation/demand-neutral position. A number of states are already experiencing or expected to experience near-term generation deficit positions.

CHART 1: SURPLUS GENERATION CAPACITY



Source: *State of the Energy Market*, Australian Energy Regulator, May 2017

[2] The levelised cost of energy (LCoE) is a measure of the average cost of producing electricity from a specific generating technology. It represents the cost per MWh of building and operating a generating plant in order to break even over an assumed financial life. Key inputs to calculating the LCoE include capital costs, fuel costs, fixed and variable O&M costs, financing costs, and assumed usage rates for each technology type. The LCoE does not include transmission or distribution costs.

Along with the increase in gas prices, withdrawal of capacity from the NEM has been a key driver in wholesale electricity price increases, with annual average spot prices in the NEM increasing from $62 per MWh in 2013-14 to $91 per MWh in 2017-18. Concurrently, the LCoE for wind and solar assets has fallen materially, driven by a reduction in equipment and operating costs, an improvement in operational performance and increased useful life of the key equipment components.

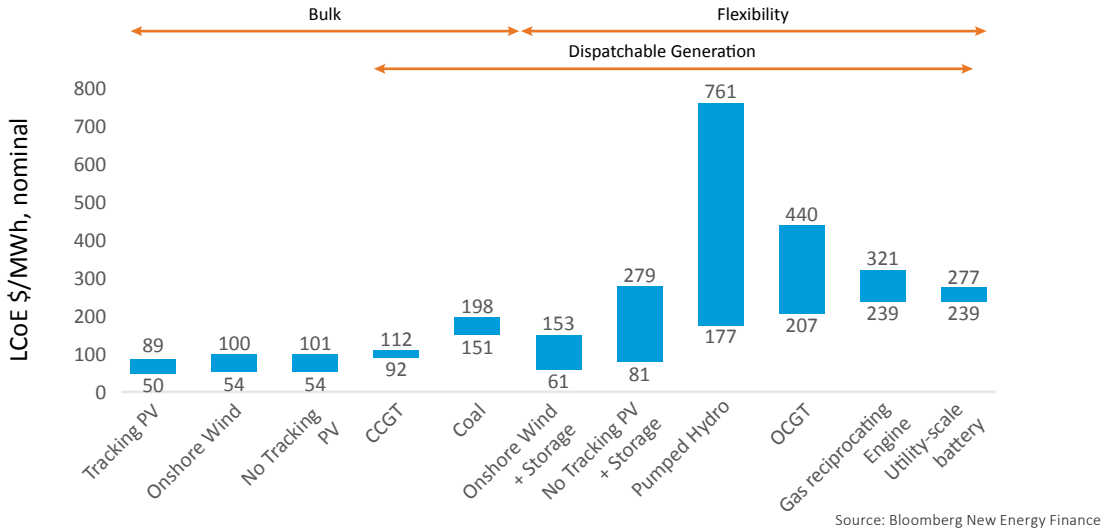
With an additional 16.4GW of coal- and gas-fired generation capacity in the NEM expected to be retired and replaced by 2040, wholesale electricity prices are expected to closely track the LCoE of new generation capacity introduced to the market.

As shown in Chart 3 below, wind and solar generation is now established as the cheapest sources of new-build energy generation. LCoE for onshore wind and solar projects have reached levels as low as $50 per MWh and $54 per MWh, respectively.

CHART 2: VOLUME-WEIGHTED SPOT PRICES

Source: Australian Energy Regulator: https://www.aer.gov.au/wholesale-markets/wholesale-statistics/annual-volume-weighted-average-spot-prices

CHART 3: LEVELISED COST OF ELECTRICITY



Source: Bloomberg New Energy Finance

IMPROVING GRID INTEGRATION COST AND RELIABILITY

The significant rollout of renewable energy nationwide is not surprising, given Australia benefits from the significant wind and solar resources. As highlighted on the accompanying charts, Australia has some of the best solar irradiation levels in the world, and wind resources spread around the country well located near major population centres.

One of the most common criticisms of wind and solar generation has been their intermittency and inability to provide a scheduled generation output, creating increased volatility in wholesale electricity prices and pressure on the grid when the renewable energy and baseload power generation outputs overlap.

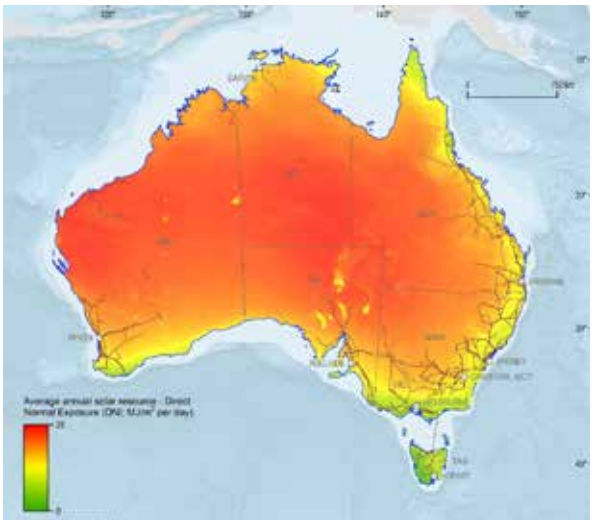
The integration of renewable energy generation sources in the more mature renewable markets has not been as complex or costly as anticipated. This is due to several meaures that can improve the flexibility in the way all sources of generation operate together to enhance the overall reliability of the network.

Battery storage is becoming an increasingly competitive solution to manage power plants' energy loads and the network's ramping and frequency control requirements. The cost of battery storage is rapidly reducing, driven by technology progressing further along the maturity curve, manufacturing volumes increasing and utility scale installations becoming more common. It is expected to become the cheapest solution to deliver firming capacity alongside hydro. Other options include the retro-fitting of coal and gas-fired plants, that can enhance the ability to ramp-up and down generation requirements, with limited capital expenditure, as well as new digital technologies which are improving the communication and coordination of networks in neighbouring balancing areas.

The Australian Energy Regulator has recently introduced a mechanism that allows network operators to recover research and development costs linked to the development and adoption of network optimisation technologies (not directly linked to network expansions).

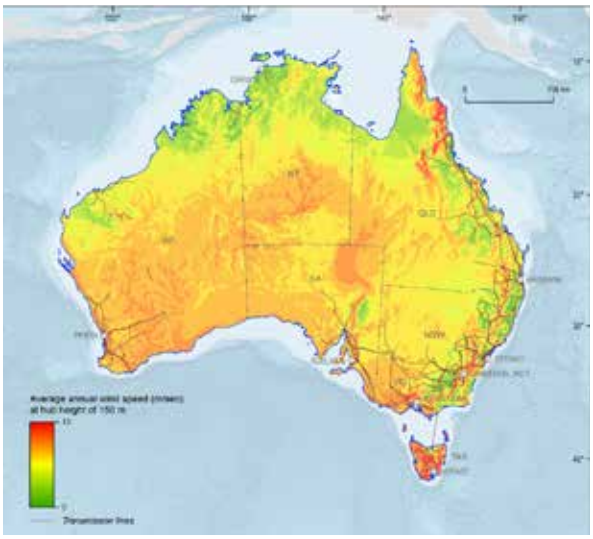
Enhancing the interconnectivity of the electricity network will assist in reducing the impact of intermittent generation on specific regions. Regions with a higher proportion of renewables that can then be utilised across a broader area allowing all to benefit from the cost and environmental advantages.

CHART 4: SOLAR RESOURCE (AUSTRALIA)



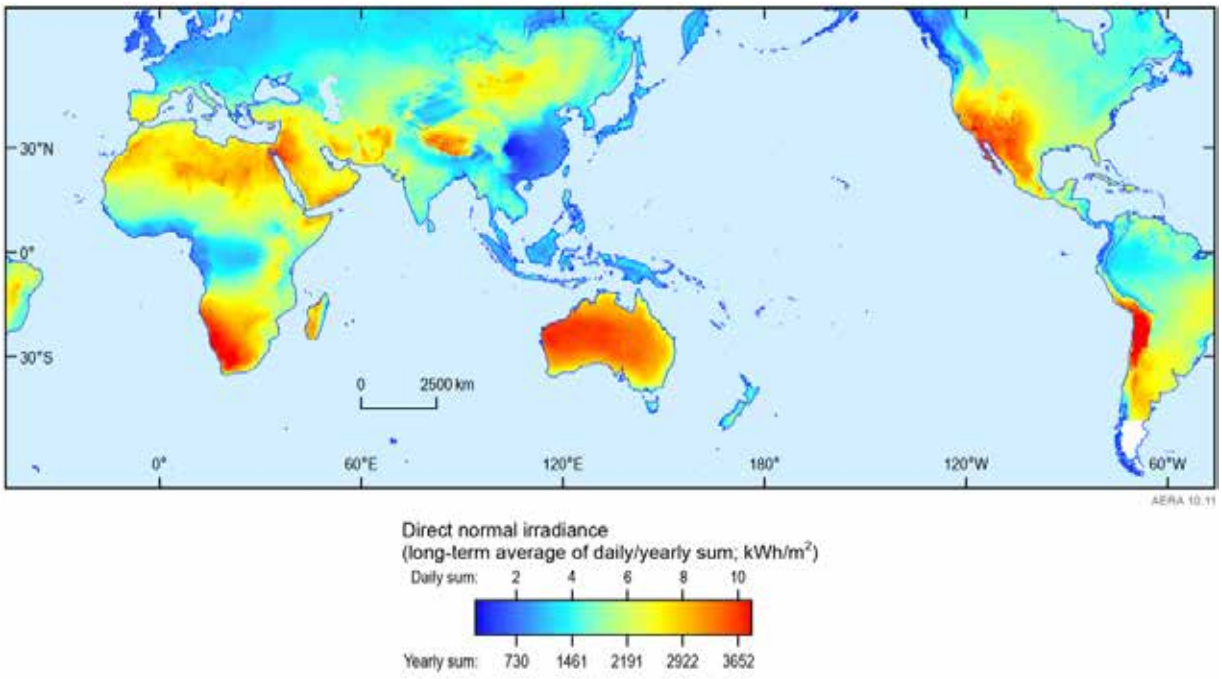
Direct natural exposure (DNI; MJ/M² per day).
Source: Bureau of Meteorology, 2016.

CHART 5: WIND SPEED (AUSTRALIA)



Average annual wind speed (m/s) at hub height of 150m.
Source: DNV GL, 2016; reprojected Geoscience Australia, 2017.

CHART 6: SOLAR RESOURCE (GLOBAL)



Source: World Bank 2017. Global Solar Atlas

For example, renewable rich South Australia has become a net exporter of electricity via the Hazelwood interconnector to Victoria. A new 900km interconnector has also been proposed between South Australia and New South Wales which is forecast to lower power costs and improve network and energy security. This is similar to Europe where some countries such as Germany have an extremely high proportion of renewable energy but maintain system security using a combination of dispatchable power and imports via interconnectors with other countries such as France.

Network reliability is not simply interconnection between states, but also the fundamental design of the network and the generation mix. The network is currently designed with very strong transmission links into historically high thermal generation areas (for example the La Trobe Valley in Victoria), and smaller links to regional areas which were historically demand driven by consumers of electricity. As electricity generation is decentralised due the increase of renewables, there needs to be greater capacity built throughout the network to accommodate new generation and the volatility inherent with renewable energy.

This is a key issue currently being experienced in weaker transmission and distributions lines in the network. Renewable energy projects face curtailment risks if they are generating in an area of the network that does not have sufficient capacity to accommodate multiple projects exporting at the same time. Network upgrades, network augmentation, non-correlated generation and the use of energy storage devices such as large scale batteries all help to alleviate curtailment risk.

AVAILABILITY OF CAPITAL AND OFFTAKE CONTRACTS TO SUPPORT THE PROJECTS

Renewables are rapidly becoming the energy generation solution of choice, both for investors and consumers. As at the end of 2017, a pipeline of close to 4GW of wind and solar projects were committed and due to reach commercial operation over the next 24 to 36 months, requiring more than $5 billion of investment.

In light of expected withdrawals of conventional generation by 2040, up to 54GW of capacity is expected to be introduced in the market over this timeframe, of which more than 85 per cent is expected to come from renewable sources. As the quality, performance and economics of the projects improve, institutional investors' appetite to invest in these projects has increased, including during the development phase.

Since June 2017, A$13 billion of equity and debt funding has been provided by investors including international and domestic pension and superannuation funds, as well as domestic and international lending banks' projects. Sources of lending are expanding across the domestic and international loan, bond and private placement markets, with strong support for both development and operational projects.

This behaviour reflects an increased level of comfort about the robustness of the economics of wind and solar projects beyond the portion of electricity output contracted with offtakers.

In addition to traditional offtakes underwritten by energy retailers, corporates are increasingly procuring energy directly from renewable projects. This trend is driven by an increased scrutiny of a corporate's social licence as well as from attractive economics, given the opportunity of locking-in wholesale rates which are cheaper than those available from electricity retailers.

Over the past 18 months, a number of corporates across a variety of sectors, including ANZ, AB InBeV, Coca Cola Amatil, Coles, Telstra, Universities (Melbourne, Monash UNSW, Queensland), SIMEC and Sun Metals have committed to offtakes backed by renewable projects for close to 1 GW of capacity. Other large corporates are currently in the market to procure similar offtakes.

State governments have also been supporting renewable projects with state-based policies, including the 2017 Victorian RET Reverse Auction (supporting the delivery of up to 650MW of new renewable projects); Queensland's reverse auction (the earlier Solar 150 tender and the more recent 400MW Renewables 400 program); and South Australia (12 new wind and solar farms totaling 1050MW of capacity to the grid, including 500MW of large-scale solar). these programs have trebled the amount of large-scale solar in the system.

CONCLUSION

Solar and wind power will play an increasingly important role in the evolution of the energy landscape in Australia. As existing conventional power generation capacity reaches the end of its useful life and is retired, wind and solar power generation is expected to fill the gap, with an additional capacity of up to 54GW expected to be introduced to the market by 2040. This is being driven by the realities of economics, rather than ideology.

Renewable energy generation has established itself as the cheapest sources of new-built energy generation and there appears to be potential for further improvement. Equipment and operational costs continue to fall; technologies to allow successful integration in the grid are rapidly improving and becoming more cost effective; and demand is growing as these sources are able to deliver a compelling alternative satisfying economic viability, reliability and environmental sustainability.

Now that renewable energy is competitive from an economic and operational performance perspective, the challenge for the market is to find economically competitive solutions to address intermittency. For Federal and State governments to best lower energy prices, they need to focus on the integration of renewable energy into the broader energy market and enhancing grid stability and network issues. This will allow for the continued buildout of the lowest cost form of generation, and have the added benefit of transitioning Australia to a renewable-centred energy market.