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FINANCIAL REVIEW

Batteries included: fixing the gaps in renewable energy

- Opinion
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Batteries address the big problems with renewables: what to do when the wind drops. *Erin Jonasson*

by **Ross Garnaut**

South Australia is in the forefront of Australia's transition to a low carbon economy. The July 2016 experience in that state has raised questions about the effects of high and increasing proportions of renewable energy, gas policies, and the design of the National Electricity Market. An immediate answer is grid-scale batteries, which are being deployed in other developed countries to balance increasing volumes of wind and solar energy.

The Australian government's participation in the December 2015 Paris agreements implicitly commits us to zero net emissions in electricity by the middle of the century. Some may wish for relief through failure of international co-operation. This is a wish for catastrophic disruption.

Wind and solar PV are important in low-cost paths towards zero emissions in Australian electricity supply. Australia's rich solar and wind resources provide potential for strong comparative advantage in energy-intensive industry in a low carbon global economy.

Irregular supply from solar PV and wind can be balanced by geographic diversification of renewable energy (perhaps but not necessarily with network extensions); by demand management (so that users modify the time at which they use electricity); by zero emissions sources of thermal energy (biomass, solar thermal, nuclear, and fossil energy with capture and storage of emissions); and by storage of electricity in times of strong supply or weak demand for use when electricity is scarce and expensive.

Large-scale storage options are mature, have been implemented in other countries and are ready to apply now in Australia.

New, low-cost pumped hydro options need decisions on deployment now if they are to play a major role in three to six years' time.

Grid scale battery storage is ready for immediate deployment. Decisions now could have large impacts in six to nine months.

Last month's crisis in South Australia came from the interaction of the normal intermittency of wind power with disruption of Victorian interconnection while capacity was being expanded; from the huge increase in the cost of gas for peaking power generation as Queensland LNG exports lifted gas demand to well above supply capacity; and from oligopolistic profit maximisation at a time of systemic stress within highly concentrated gas and electricity markets (see Dylan McConnell's forthcoming paper at the Melbourne Energy Institute). A surge in demand in a cold winter period increased pressure. Price volatility and average wholesale prices rose to unprecedented heights. Meanwhile, resources available to control frequency for grid stability were limited.

The crisis has passed with the restoration and expansion of interconnector capacity. The questions remain.

Price volatility is not a problem in itself. Volatility introduces incentives to invest in storage, demand management, flexible generation capacity and the development of hedging instruments to insulate vulnerable businesses from short-term fluctuations.

July underlined the importance of two reforms, to allow the national wholesale market (NEM) to operate more effectively in response to variation in power supply.

First, contracts in the wholesale markets need to be settled for the five minute periods for which market participants bid on price, rather than averaging prices over half hour periods. The current system introduces opportunities for generators to profit from actions that destabilise prices. Around half of the exceptional gap between South Australian and NEM price averages in July came from a couple of dozen instances of five minute prices rising to or near the cap of $14,000 per MWH. Several of these "$14,000" five minute periods occurred within the same half hour as others with negative prices.

Second, the NEM needs a competitive spot or contract market for fast response frequency control into which all potential suppliers can bid, alongside the eight established markets for frequency control ancillary services.

The grid level battery is highly suitable for stabilising against the short-term variations in frequency and price that were a large part of the July problem. Batteries can respond to the need to add or absorb power in less than a second – much more quickly than gas generators. If optimised to maximise value in provision of grid stability services, the battery can store surplus power from excess generation from the midday sun or overnight wind for use in the evening and morning peaks at total costs that are lower than the prices of wholesale hedge contracts, or than exposure to the wholesale market at these times.

Major industrial users in South Australia have the opportunity to host solar-battery-grid combinations that substantially lower total costs of power. They can remove risks of real electricity prices rising in future. While solving their own power problems in this way, they would incidentally reduce peak and general demand and therefore lower power price and volatility for all other energy users in the state.

Ross Garnaut has participated independently in discussion of Australian energy policy for many decades. He declares his private interest as chairman of ZEN Energy Pty Ltd and as chairman of the IIG Solar Fund.

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