

Will they go their own way?

Those interested in distributed generation and storage will find the situation in South Australia fascinating. For various reasons, South Australia is at the leading edge of developments in this area. Rooftop photovoltaic (PV) is ubiquitous, and recent battery price reductions are likely to mean that distributed storage moves from intriguing novelty to commercial proposition. It seems pretty clear now that grid-supplied electricity has a serious competitor. The innovators and entrepreneurs that have made this happen are alert and motivated. They have made much quicker progress than many expected.

Background

South Australia is one of Australia's six states with a landmass a little over seven times that of England. Three quarters of its 1.7 million people live in its capital city, Adelaide, Australia's fifth largest city (and whose population is 20% higher than Birmingham, Britain's second largest city).

One in four Adelaide households have rooftop solar PV. Generous federal and state government subsidies initially promoted rooftop solar but they faded when it became clear they were not needed. Only a federal capital subsidy remains. The subsidy per Watt is now one twentieth that in California (the most generous in the United States) and one third of that in Georgia (the least generous in the U.S.).

Average PV system size is 3.3 kW, having grown from around 1.5 kW for those installed six years ago, to 5 kW today. At its peak in the early afternoon on a cloudless day in a South Australian summer, the 700 MW of total rooftop PV can meet about half the average grid demand in South Australia. Over a year, these rooftop systems provide about a third of the electricity used by the houses they shade, and the surplus is exported to the grid, providing 6% of the total electricity distributed in the state. Rooftop PV accounts for a large part of the 20% reduction, over the last 8 years, in average grid supply per household in South Australia.

The average cost of rooftop solar in South Australia is around 6 cents per kWh, less than a fifth of the typical variable price of grid-supplied electricity. Consequently even if a rooftop PV system can displace just a third of household grid purchases, it pays for itself. Unsurprisingly, demand for rooftop PV is robust in the residential market and now also in the commercial customer market.

Batteries arrive

Lead-acid batteries have had a long history in remote off-grid supply and as back-up to grid supply for essential services in urban areas, but the introduction of lithium-ion has delivered small, reliable, low maintenance devices. Tesla's Powerwall lithium-ion battery was offered in Australia in 2015, at an installed price of around \$7500 (before inverter) and with storage capacity of 6.4 kWh. But last month Tesla announced its 13.5 kWh "Powerwall 2" with integrated inverter for \$8,800 pre-installation. Per kWh stored, this is cheaper than the battery price forecast for 2040 used by the Australian Energy Market Operator.

Our assessment is that typical Adelaide households consuming 4,800 kWh per year will now be better off with a battery and rooftop PV and the grid for back-up and to export surplus PV production, than they would be with grid-only supply. For example, a 4,800 kWh household supplied by South Australia's incumbent retailer (which supplies around 60% of all households) pays between \$1,682 and \$1,985 per year for grid-only electricity (the lower amount reflecting conditional discounts). After

installing a 5 kW PV plus battery, the household can expect to reduce their grid purchases to around 200 kWh per year and to export around 3,800 kWh of surplus PV production to the grid. The income from the export (\$256 per year) almost covers the fixed retail charge (\$255 per year) plus the variable charges for the remaining grid purchases (\$62 per year). After annualising the capital outlay for PV and solar, the typical household that installs PV and battery will be \$27 to \$300 better off each year, than they would be if they stuck to grid-only supply.

Even if households selected the cheapest grid-only retail offer, we calculate they will still pay less for their electricity by installing PV and a battery and selecting the best retail offer to cover their residual grid purchases and to export their PV production surplus.

Implications

Residential electricity prices in South Australia more than doubled over the last eight years and consequently there is no love lost between customers and retailers. Now that it is viable for households to install batteries and thereby achieve a high degree of self-sufficiency, it would be surprising if batteries do not become popular. Further declines in battery costs are likely to bring batteries into view for commercial and agricultural electricity users.

The installation of batteries is likely to expand demand for rooftop PV even further. Centrally dispatched generators will lose market share to distributed generators. But distributors and retailers are the biggest losers from distributed batteries: whereas a rooftop PV system will typically reduce grid purchases by a third, the installation of a battery will reduce grid purchases by around 95% for a typical household.

Elon Musk, Tesla's Chief Executive has down-played the impact of distributed storage on the demand for electricity from grids. While the electrification of transport promises additional electrical demand, since electricity in South Australia is so much cheaper to produce at the point of use than to buy from the grid, there are powerful incentives to meet new demands through distributed production.

On top of this, grid costs in South Australia are surely set to rise. Tornadoes recently toppled the 275 kV backbone of the South Australian power system resulting in a state-wide black-out. And, following the recent closure of large amounts of coal generating capacity and a commensurately large increase in wind generation, proposals to strengthen interconnection are being hastened. This will cost many hundreds of millions. And, as if this was not enough, the state's distributor is seeking judicial review of the regulator's decision to award it \$700m less than it sought, having failed to convince a tribunal in its review of the merits of the regulator's decision.

The federal energy minister recently expressed concern that households that install solar and batteries should pay their way for their use of the grid, and federal regulators have been instructed to consider how network regulation should evolve in this new world.

Increasing the proportion of fixed charges in customers' bills has been debated extensively already. But fixed charges in residential retail offers in South Australia are already more than twice the fixed charges in network tariffs, and both are already higher, as a proportion of network and retail bills, than we see in other countries.

Regulators in Australia have so far preferred cents per kilowatt per day demand charges and two distributors and a handful of retailers are now offering them. But a customer with a battery will surely defeat such demand charges and pay even lower grid bills, which is no doubt the opposite of what the distributors and retailers have in mind.

Furthermore increasing the proportion of the bill that is fixed might backfire by stimulating entrepreneurs to find ways to help customers completely abandon the grid. Is this really what distributors and retailers would want? A diminished role as provider of back-up supply might not be a role that retailers and distributors covet, but they might think it preferable to losing the customer altogether.

The association representing distributors has discussed a departure tax for those customers that leave the grid, presumably with the intention of discouraging departure or capturing some value if customers leave. But some customer groups say that the grids should try to make themselves more attractive to customers by writing down their assets as penance for past profligacy and to reflect the new realities. It would be interesting to know what economists make of this.

These issues will be pored over by stakeholders for many years to come and it will take time for the penetration of batteries to reach significant levels. But if they do, and if they stimulate further distributed production, the impact on distributors, retailers and large scale producers will be severe. For Australia's governments concerned to keep the lights on at affordable prices, the rise of batteries might be seen as a godsend, at least for those customers able to take advantage of them. Governments will be less enamored of the difficult adjustments for the existing industry that will be theirs' to decide – unless distributors voluntarily swallow the bitter pill that is probably coming their way.

Who knows what the future holds, but for now we can say that households in the market for PV and batteries have found some unexpected bargaining power and they might be starting to feel that the boot is on the other foot.

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