# Uncertainty and disruption in the Australian electricity sector

Last month I had the honour of being invited to present at the annual JANA client conference in Melbourne. What follows is an edited synopsis of my conference presentation.

As debt investors, we spend a lot of time worrying about the downside risks in projects and sectors. In particular, we try to assess the potential for a range of downside scenarios and then assess the adequacy of the buffers/protections for debt in the face of these scenarios. One of the areas Infradebt particularly focuses on is the potential for structural breaks – as traditional leverage/DSCR covenants provide limited protection against rapid changes in market dynamics.

The emergence of solar and storage is an example of a structural change in the electricity market.

Infradebt launched a detailed research project into the potential impacts of solar at the start of 2015. This specific line of research formed part of our broader and comprehensive analysis of Australia's regulated utilities, and was particularly motivated by the forthcoming sale of the NSW and Queensland electricity networks. Superannuation fund investors have an advantage – compared to banks – in providing longer term debt finance. As longer term investors, we wanted to look out at the potential impact of solar over the next 10 to 20 years and understand the possible implications for the networks business model.

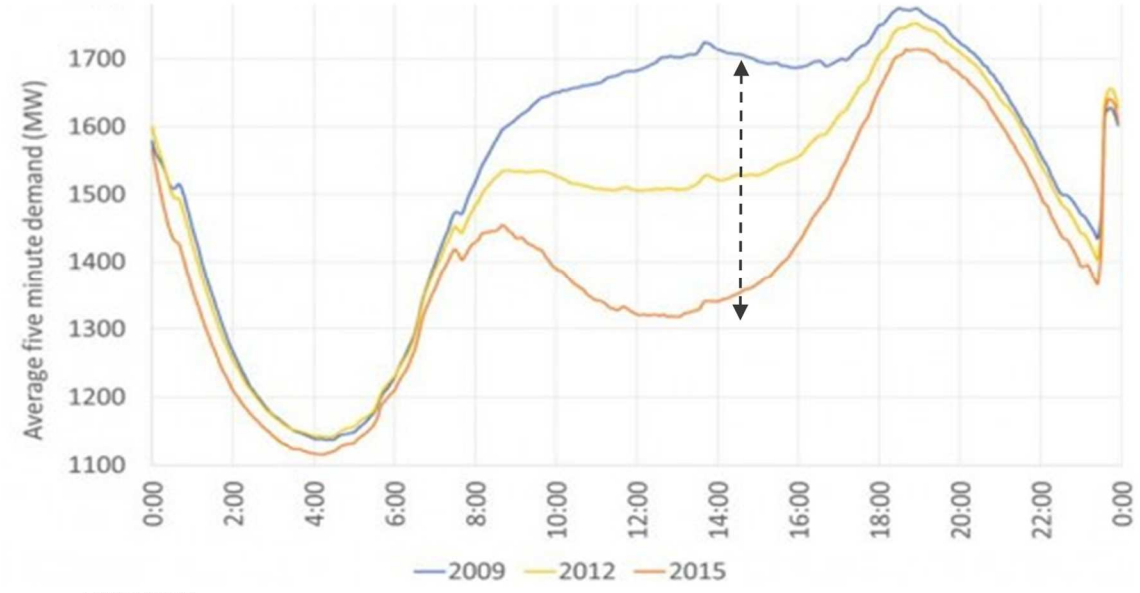
## Disruptive Impact of Solar

Solar is a unique generation technology. It allows users the opportunity to generate electricity at the point of use. This may sound like stating the obvious, but it is an important starting point, because only around a quarter of the cost of electricity to a household or business is the actual cost of the underlying power. The largest single component of cost (~50%) is the cost of the network that transmits power from the power station to the end user – embedded solar offers the opportunity to avoid this cost.

Capital costs of solar panels have fallen rapidly. This fall in cost means that embedded solar is now significantly cheaper, on an average cost basis, than grid based power. Embedded solar has an unsubsidised cost of around 12-13 cents per kWh. This compares with 20 plus cents for grid based power. If you include the value of Renewable Energy Target (RET) certificates, this differential is even larger. For daytime power users, solar is extremely cost competitive. It is this cost saving that is driving uptake, even though subsidised feed-in tariffs have stopped, and having significant impacts on the overall electricity market.

To show the impact of solar, the chart below shows the average demand profile for South Australia between 2009 and 2015.

**South Australian Daily Average Load Profile – 2009 to 2015**

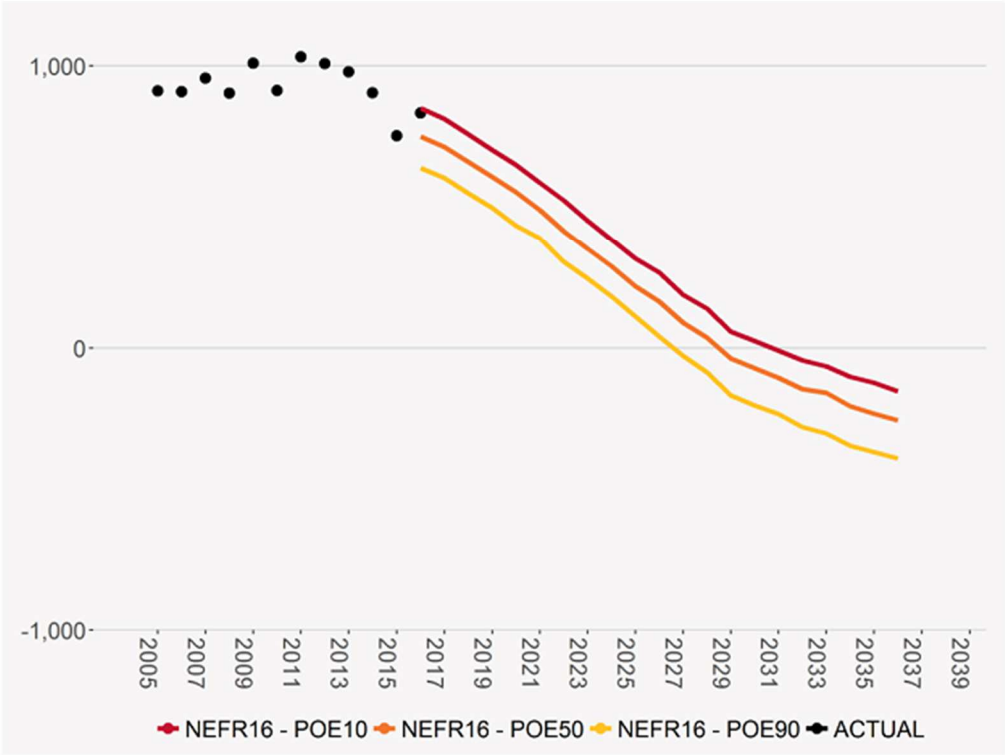



source: AMEO 2015

The take-up of embedded solar shows up as lower demand at noon. Over a six year period, solar has driven a 25%+ fall in lunchtime demand. In the context of electricity infrastructure, where most investments are evaluated over 20-30 year periods, this is significant change.

What does this look like further out? The Australian Energy Market Operator (AEMO) as part of its regular forecasting of electricity demand produces forecasts of demand. These forecasts pick up population and economic growth trends, long-term estimates of energy usage patterns, and energy efficiency. Historically, the focus of these studies has been on maximum demand because networks are sized to meet forecast peak, not average, demand. But AMEO also forecasts minimum demand. Continuing with South Australia, the chart below shows the actual minimum demand over the last 10 years as well as the forecast for the next 20 years (for the electricity/solar geeks, minimum system demand is forecast to occur at noon on Boxing day – when a significant portion of manufacturing is shut down, roof top solar production is at a summer peak, residential air-conditioning is not yet running full blast (that occurs much later in the day) and no one is silly enough to have their oven running full tilt cooking a turkey!) .

**Forecast Minimum South Australian Demand**




source: AMEO 2015

To leave you in no doubt about the above chart, AEMO is forecasting negative minimum net demand from the late 2020s – that is around 10 years from now. What does negative net demand mean? It means that embedded generation from solar is exceeding all the underlying usage from businesses, industry and households. That is, in theory, the SA grid could operate without a single utility scale generator operating. That's not just coal or gas fired power stations. It's also without any output from any of SA's windfarms. This represents significant disruption within the electricity sector.

Why focus on SA? SA has the highest uptake of embedded solar in Australia, and is seen by many market analysts as a portent for the nation in the years to come.

## What about Batteries/Storage?

Batteries allow surplus solar power to be stored for to offset the night-time peak and will have a significant impact on the electricity supply chain.

Batteries are not currently economic. The 7 kWh Tesla Powerwall, with an installed cost of $8,000-10,000, has an implied cost of around $0.50/kWh. This is clearly higher than the cost of power for the majority of consumers. Thus, at this price, Powerwalls are for early adopters rather than users pursuing a cost saving. But battery prices have, and are expected to continue, to fall significantly. Predicting future price falls is hard, but the history of solar may be analogous. Solar module costs fell by a factor of 100 between 1977 and 2013 – in no uncertain terms this is a massive fall.

What will drive this fall in battery prices? One area is the auto sector – the take-up of electric cars will drive manufacturing scale and thus lower production costs. To provide a real example of this, the Chevrolet Bolt will be released later this year, it has a 60 kWh battery at a reported cost of US$145 per kWh. If this pricing were able to matched for a battery for home use, it represents a per kWh cost of 7 cents. At this pricing, solar and storage is cheaper than grid based electricity.

A 60 kWh battery represents three days usage for the average Australian household. It provides real potential for many detached dwelling households to go fully off the grid.

## Network Response

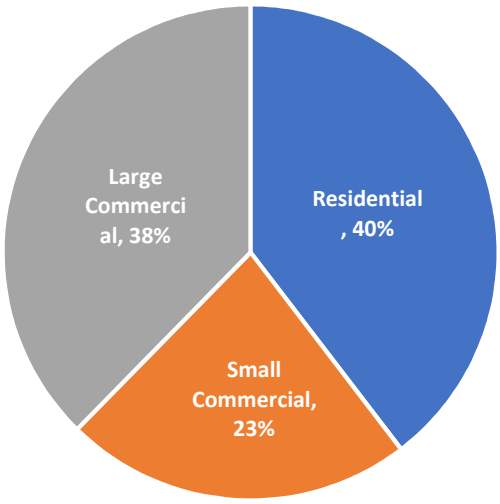
Embedded generation and storage is a significant challenge for the networks – what will they do in response?

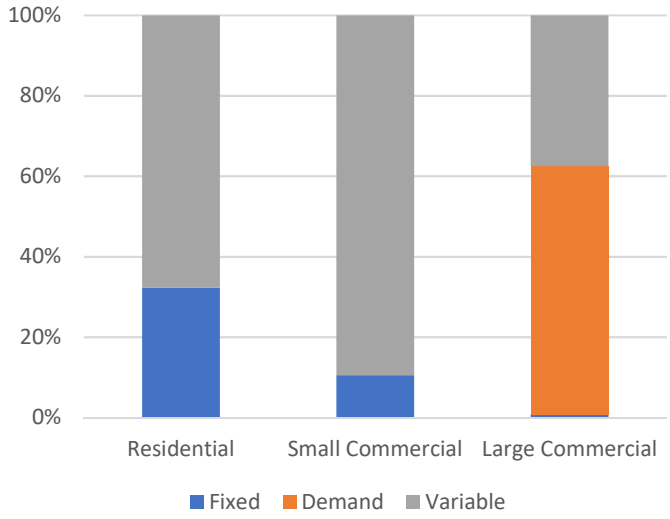
Fundamentally networks will need to earn more of their profits from fixed charges and less from volume based charges. This would reduce the impact of declining grid volumes. This also allows networks to capture the value to consumers of the reliability of grid based electricity.

But the maths of a switch to higher fixed charges is not easy.

First, a very substantial portion of network charges is paid by residential and small commercial users.

If we use the ActewAGL customer base as an example (see chart below), you can see that two thirds of revenues come from small commercial and residential customers. For these customers, you will note that a very small proportion of grid charges are fixed (Residential: 33%, Small Commercial: 9%) – the rest of network revenues is recovered from volume charges. For a material portion of these user groups embedded solar and storage is a viable option subject to cost.




Thus to ensure network revenue stability in the face of increased embedded technology, requires a switch from volume to fixed charges. In practical terms this would require an increase in fixed charges by around a factor of five. While this might seem easy to an economist, at a social and political level it would be extremely difficult to implement as increased fixed charges hits some of our poorest community members, including:

1. Pensioners

2. Low income earners
3. Renters
4. Current beneficiaries of solar subsidy schemes

You need only drift your mind back to the 2013 federal election to see how politically charged electricity prices can be. One key element of the LNP's 2013 electoral platform was the removal of the Carbon Tax –much of the campaigning and justification for removal of the Carbon Tax focused on the cost to electricity users.

## Implications for Infrastructure Investors

As a debt investor we focus on the downside. A key part of our investment process is identifying key risks for a project and then testing the buffers/protections for debt investors, ensuring they are appropriate for the potential consequences of identified risks.

What are the implications of the rise of solar and storage on the electricity sector? Dealing with each of the segments of the sector in turn:

**Generation assets**

Investors should think very carefully about pool prices.

Australia has a significantly oversupplied generation market – there is currently 7,400 MW of excess capacity or 15%-20% of total generation capacity. At the same time, demand has been flat for a number of years. There are additional forces that are likely to exacerbate this situation.

The RET has the potential to drive the creation of 5,000 to 6,000 MW of additional renewable generation. The RET mechanism provides an effective subsidy on top of pool prices – thus it encourages new generation to enter the market even through it would not be viable on the basis of pool prices alone.

On top of this, rooftop solar is expected to continue to grow strongly. While the residential segment has slowed down due to end of subsidies, commercial solar is starting to take off. Depending on your source, rooftop solar is expected to add a further 7,000 to 10,000 MW of capacity over the next decade.

While Australia has a significant fleet of old coal fired power stations that are near the end of their economic lives, in the short term, the only driver of closures of these plants – which would help offset the new renewable generation – is low pool prices.

In addition, smart technologies, the continued drive by manufacturers to make consumer durables more energy efficient, and the exit of large energy intensive industries, results in power consumption forecasts being relatively flat over the medium term.

In summary, we would encourage investors to be quite cautious about pool price assumptions – particularly for solar. That is not to say pool prices will be consistently low – in fact quite the reverse, I would expect volatility of pool prices will be higher as an increasing proportion of power is sourced from renewables. It is just that the spikes in prices will, on average, occur when renewables are not generating, and the troughs in prices will occur when they are.

**Networks**

The networks unassailable monopoly is under threat. In my view the world where networks could automatically capture additional revenue through expansions in their capital base is gone. That said, I don't think networks will disappear. In particular, sizeable segments of the market will struggle to supply their power needs with embedded generation. Those who live in apartments, operate within central business districts, or are heavy commercial users are unlikely to ever be able to operate on an off-grid basis. Furthermore, there are significant efficiency benefits from the operation of a network as a network allows the pooling of individual spikes in usage such that a smaller total level of redundancy is required across the pool.

In summary, networks will need to recover more of their costs from fixed charges. For smaller users this will mean paying more to access the grid. Larger users, and in particular, those users with the physical space and load profile to tap into the potential of solar and storage, have an alternative. As this alternative falls in price, it puts a ceiling on the prices networks can charge. We believe networks will be wedged between political/community reactions against higher fixed charges versus competitive pricing pressures from new alternatives.

**Storage**

Our view is that batteries will eventually overtake gas peaking plants as the source of flexible supply.

Batteries will be able to benefit from periods of excess generation – whether that's excess solar at lunchtime or excess wind generation in the middle of the night. Batteries will effectively become distributed peaking plants and be able to trade the volatility in pool prices and, hence, increased volatility will actually help battery economics.

Savings in network charges mean that batteries have better economics on an embedded basis rather than utility scale. This means mass take-up will occur on an embedded basis first.

## Conclusion

Let me apologise for the focus on risk throughout this piece. That is the nature of a debt investor's mindset. I don't want to discourage investors from involvement in the electricity sector. The next decade will bring a raft of investment opportunities as renewable and storage technologies are embraced and the structure of electricity supply is fundamentally changed. In fact, if Australia is to meet our emission reduction commitments it is unavoidable. However, in participating in this flow of opportunities, I would encourage investors to have their eyes open to the range of risks and uncertainties involved.