SOLAR REPORT

FIRST HALF 2024

Australian Energy Council

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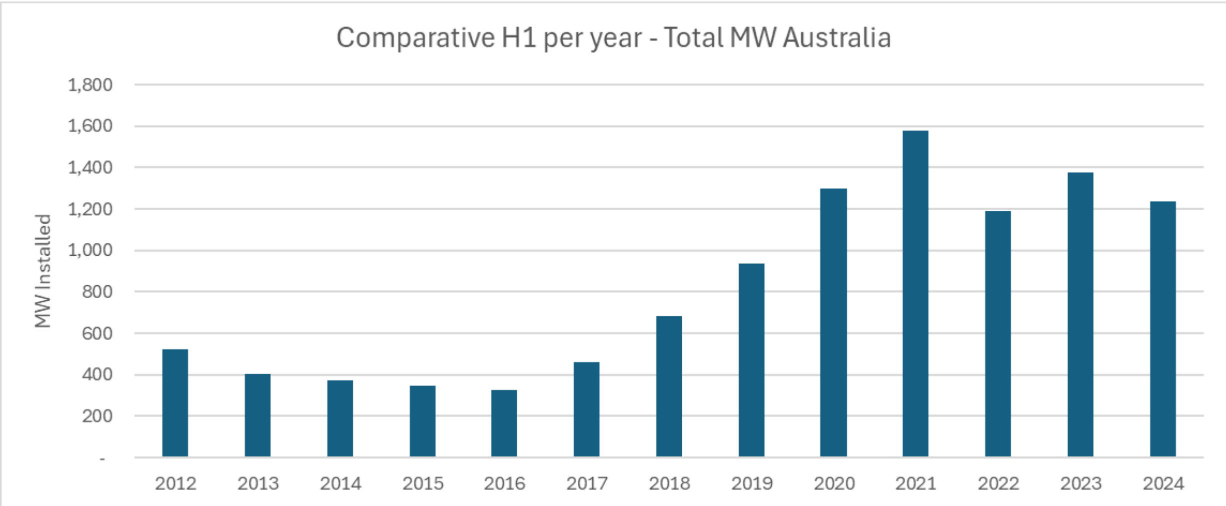
SECTION I: STATE OF SOLAR IN AUSTRALIA

Rooftop Solar Installations:

Australia's rooftop solar capacity continued to expand in the first half of 2024.The country added 1,238 MW of new rooftop solar installations with New South Wales adding 427 MW, Queensland 340 MW, Victoria 216 MW, Western Australia 116 MW, South Australia 95 MW, Tasmania 20 MW, Australian Capital Territory 19 MW, and the Northern Territory 4.5 MW. As of June 2024, Australia's cumulative rooftop solar capacity had reached 23,650 MW and the total units installed reached 3,853,965 among households and businesses.

Figure 1. Total installations in H1 per year Australia.

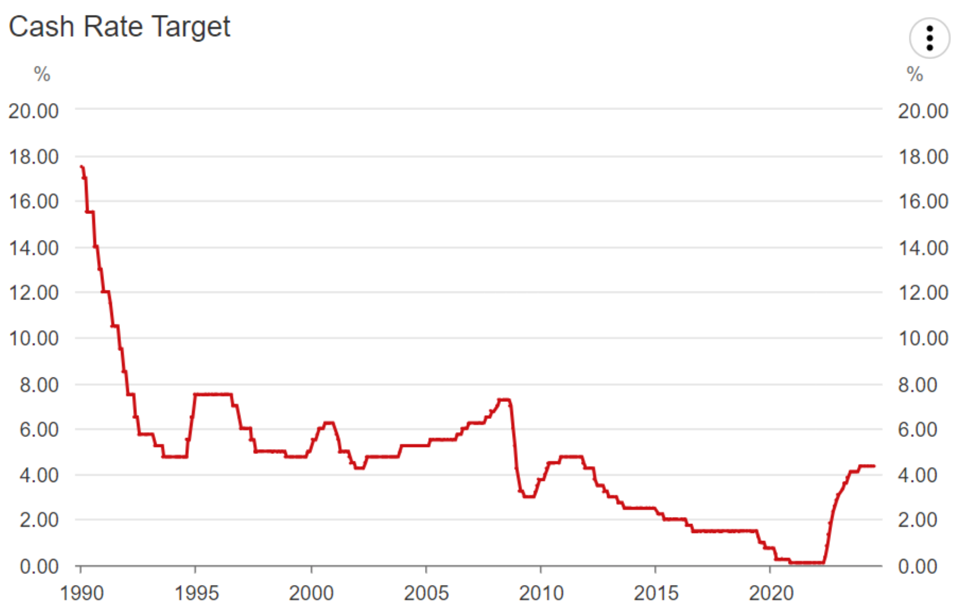


Source: AEC Analysis with data from CER

The 2024 trend:

The capacity of new solar systems installations in the first half decreased relative to the previous corresponding period last year as shown above. This is possibly due to the impact of increased cost of living pressures and interest rates. In general, the first half in previous years accounted for between 41 and 45 per cent of total installations for the full year, except for 2021 when a record 49 per cent of installations occurred in the first half. This trend again may be linked to interest rates - in 2021 cash rates were at their lowest (see figure below). Based on current data, there is a real possibility the total capacity installed during 2024 may end up lower than in 2023.

Figure 2. Interest rate from Reserve Bank of Australia.

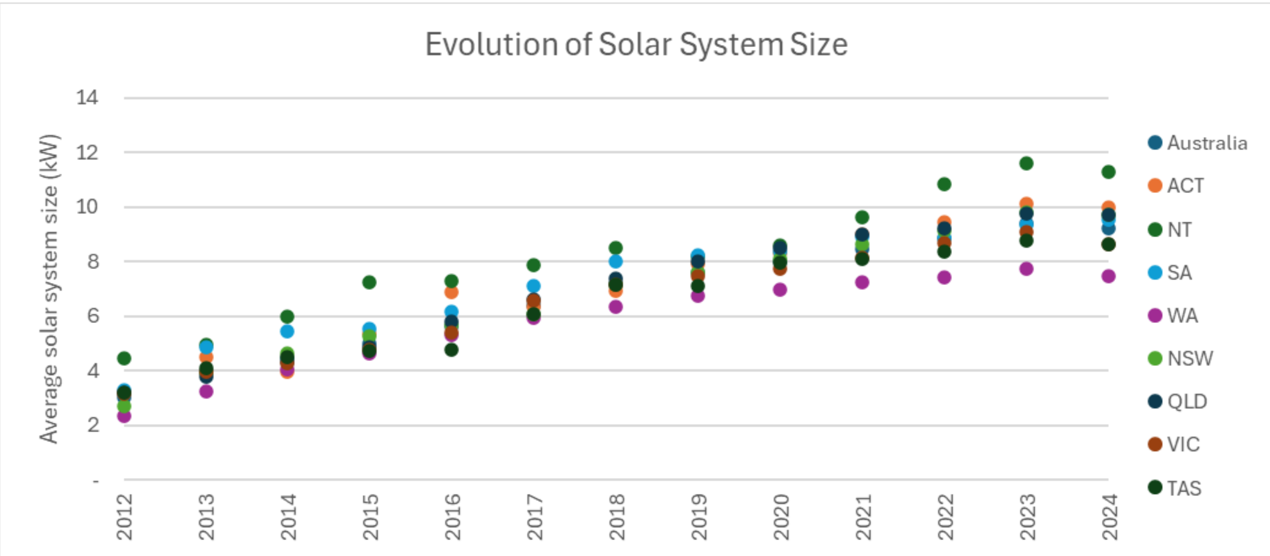


Source: RBA

Regional Insights:

The national average solar system size has stabilised at 9.23 kW. Western Australia installed the smallest system size on average, at 7.48 kW per system, followed by Victoria and Tasmania in a tie at 8.62 kW. The Northern Territory continues to lead system-size installations and, as shown in Figure 3, they have been installing the largest systems on average since 2021.

Figure 3. Solar system size per jurisdiction and national figure.



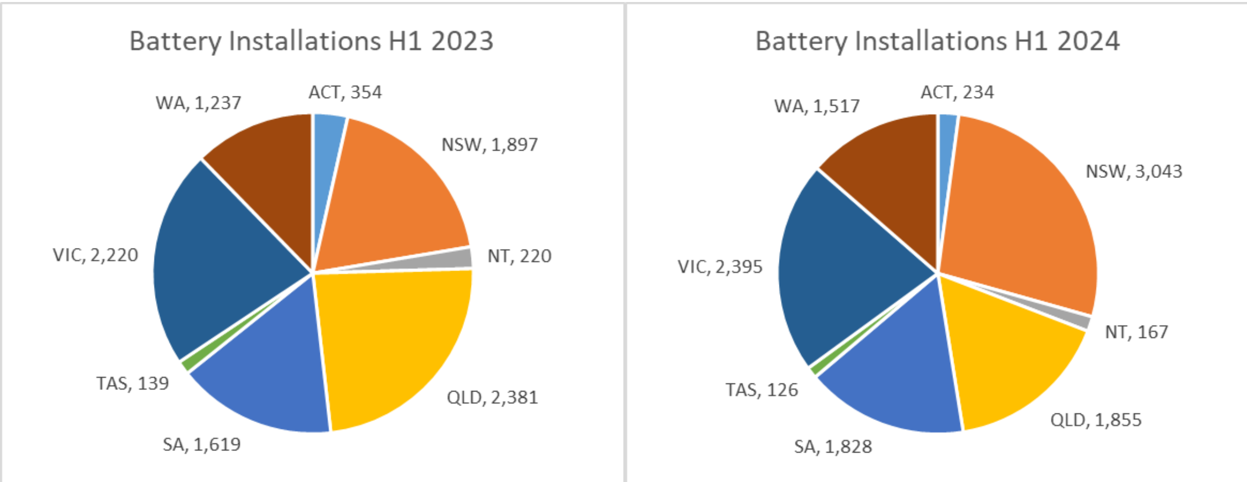
Source: AEC analysis with data from CER

Battery Installations with Rooftop Solar:

In the first half of the year, battery storage with solar system installations have demonstrated significant uptake. New South Wales maintained its leadership with 3,043 SGUs (Small Generation Units) installed with batteries in H1, followed by Victoria with 2,395 SGUs, and Queensland with 1,855 SGUs. These figures point to a growing trend towards installing energy storage solutions with rooftop solar.

Australia registered 11 per cent more battery installations in H1 compared to the same period last year. This overall positive figure nationally was driven by an increase in installations in NSW, SA, Victoria, and WA, while the other jurisdictions actually saw reductions in installations of batteries, with solar PV of up to 66 per cent compared to the previous half (albeit off low numbers).

Figure 4. Battery installations H1 in 2023 and 2024 in Australia



Source: AEC analysis with data from CER

There have been some changes in incentives since the last report, being new support in Tasmania and the conclusion of previous support programs in New South Wales.

Current government policies

State/ Territory	Policy Incentive (Solar & Battery)	Energy target
Australian Capital Territory	• Sustainable Household Scheme[1] provides zero-interest loans to help with the costs of energy-efficient upgrades, including solar panels and batteries. Participants can get a loan from $2,000 to $15,000, if eligible.	• Net zero by 2045
New South Wales	• No specific policy for new solar or battery installations.	• 70 per cent cut in emissions by 2035 compared to 2005 levels. • Net zero by 2050
Northern Territory	• Home and Business Battery Scheme allows residents to buy and install batteries and inverters with a maximum grant of $5,000.	• 50 per cent by 2030
Queensland	• No specific policy	• 50 per cent by 2030 • 70 per cent renewable energy by 2032 and • 80 per cent by 2035.
South Australia	• No specific policy	• 100 per cent by 2030
Tasmania	• Energy Saver Loan Scheme will provide no-interest loans up to $10,000 over three years to eligible households, residential landlords, small businesses and community organisations for the purpose of funding investment in energy efficient products.	• 21,000 gigawatt hours of electricity in one year by 2040. This is 200% of 2020's demand.
Victoria	• Rebate of up to $1,400 for the installation of solar panel (PV) systems. • Solar battery loans: Interest-free loans of up to $8,800 are available for eligible households.	• 65 per cent by 2030 • 95 per cent by 2035[2]
Western Australia	• No specific policy	

[1] Sustainable Household Scheme

[2] Victorian renewable energy and storage targets, page last updated 24 November, 2023

SECTION II: UTILITY-SCALE BATTERY PERFORMANCE

The National Electricity Market (NEM) has welcomed the connection of multiple utility-scale batteries since the first one was installed at the end of 2017. With the continuous introduction of Variable Renewable Energy (VRE), the decommissioning of synchronous generation, and the reduction in battery costs, the market operator and investors see utility-scale batteries as an important part of the energy transition.

The first ideas about how the economics of a battery would work were centred around the arbitrage of electricity. Batteries charge during periods of low-cost electricity while they dispatch (or sell) electricity at times of high demand/price. Batteries are also seen as a potential solution for the need for reserve in the electricity system—this is, a backup unit for system security.

Currently, the NEM provides economic incentives for electricity arbitrage and frequency services but not for reserves. Given these market rules, most batteries have adjusted their operations to produce revenues in this setting. However, due to the fast response capabilities, some BESS have also acquired offtake or bilateral agreements that provide revenues to secure the system and use the FCAS market. We can detect these BESS through their behaviour in market dispatching and charging and their overall battery utilisation, and we discuss them further in this report.

Batteries can soak up surplus generation from VRE and be used when renewables are unavailable. This increases efficiency in renewable assets by minimising curtailment and replacing carbon-intensive generation at other times. These latter two benefits, which can increase the share of renewables in the system, are, in fact, a consequence of electricity arbitrage. In a competitive energy market, like the NEM, batteries are incentivised to charge when there is a large amount of lower cost electricity being supplied. In the NEM the lowest cost generation is dispatched first. At times of high demand when higher cost electricity is dispatched, batteries are also incentivised to discharge.

Battery charging will also follow solar output, and with rooftop solar output reducing operational demand, it also helps reduce power prices at certain times. For example, we are actually seeing an increasing number of negative price events, particularly as a result of the amount of rooftop solar in the system. Batteries are able to take advantage of these periods and, theoretically, it allows them to charge at lowest cost.

Following the energy-only market

Now that we have described the incentives to dispatch and charge for a battery supplier, we take a look at the statistical data from some of the batteries in the NEM. In this section, we depict a BESS's average charge or discharge and the time of the day. We describe the behaviour of a battery based on the equation that the energy used to charge the battery equates to the total energy discharged to the network (we recognise that some energy will be used in charging, but have simplified the model for the purposes of this assessment). We have sought to build *a loop of the charge and discharge of an average day* for each battery to better understand the signals or market strategies behind their operational patterns.

We have used a year of data for each battery and added to the figures an annual solar profile closest to each battery's charging profile in the middle of the day. This solar profile is drawn from the rooftop solar production in the year in the market region where individual batteries are located.

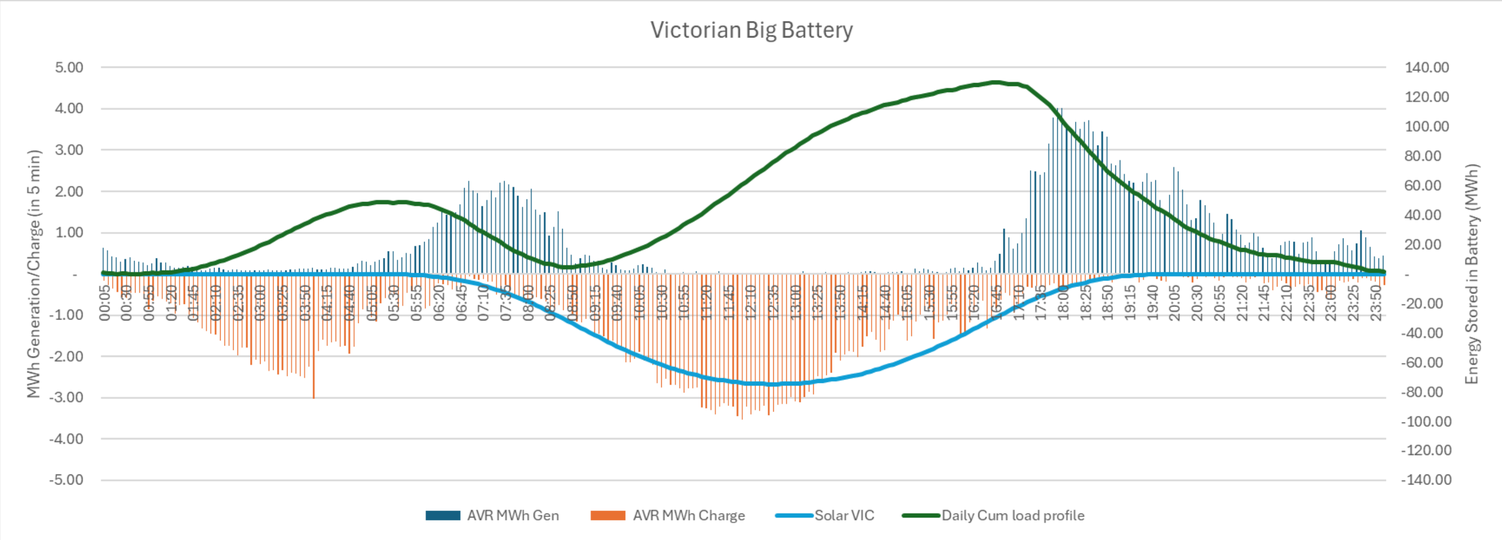
The following analysis represents an average day battery usage and it is worth noting day-to-day strategies or drivers will differ.

Table 1. Main observations on battery performance

	Charging cycles/day	Discharging cycles/day	Solar charge profile accuracy	Excess charge	Max MWh cumulated (A)	Storage Capacity (MWh) (B)	Average battery utilisation = A/B	Time of lowest charge	Comments
Victorian Big Battery	2	2	87.05%	12.95%	130.09	450	28.91%	00:20	
Ballarat Energy Storage System	1	2	87.04%	12.96%	3.23	30	10.75%	10:20	
Adelaide Desalination Plant	2	2	92.41%	7.59%	2.90	12.5	23.16%	09:15	
Hazelwood BESS	2	2	85.13%	14.87%	28.30	150	18.87%	01:05	
Hornsdale Power Reserve	2	2	91.06%	8.94%	4.37	193.5	2.26%	08:40	
Torrens Island BESS	1	1	81.35%	18.65%	70.11	250	28.04%	08:35	Arguably two charge/discharge cycles, but one can be neglected
Wallgrove Grid Battery	2	2	89.25%	10.75%	16.96	75	22.62%	23:45	
Capital Battery	?	?	80.69%	19.31%	0.05	200	0.02%	13:35	
Wandoan South BESS	2	2	85.47%	14.53%	77.35	150	51.57%	22:40	
Dalrymple ESCRI battery	2	2	79.55%	20.45%	4.10	8	51.22%	22:30	
Gannawarra Energy Storage System	2	2	93.81%	6.19%	11.95	50	23.91%	08:20	

Source: AEC Analysis with data from NEOExpress

- **Victorian Big Battery**



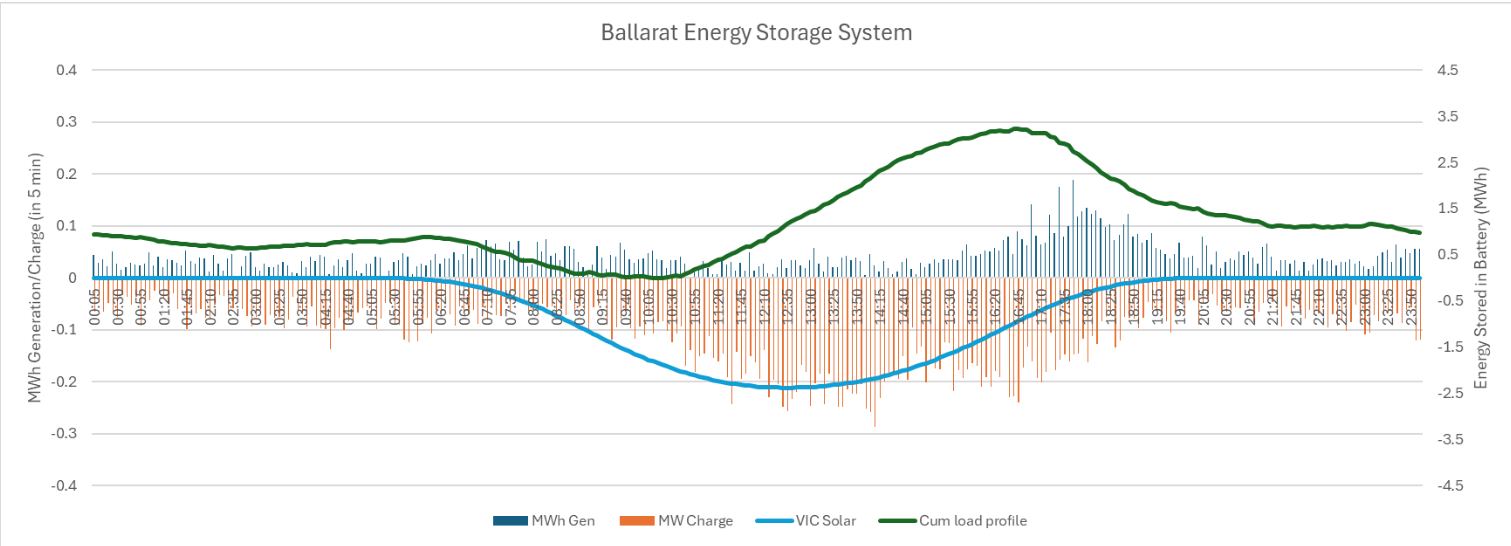
Looking at the daily profile of the Victorian Big Battery, we see that the lowest point (or the time with the lowest charge) is near midnight, at 00:20 hrs. From this time until 5:15 am, the battery collects energy to start a first dispatch period from 5:15 am until 8:45 am to reach almost complete discharge during the morning peak demand period. A new charging cycle starts and the battery increasingly collects energy during the middle of the day. This is consistent with lower operational demand and prices, as well as higher solar energy production in the system. The charging pattern aligns with rooftop solar output in Victoria (note: this profile has been scaled down and adjusted). Past midday, the battery decelerates charging and by 16:45, the battery has cumulated its maximum charge of the day and is ready to dispatch during the night peak time. There is an explicit accelerated dispatch by 18:00 hrs. Finally, discharge continues at a lower rate during the early evening to deplete the battery storage to its lowest level at 00:20 hrs, where a new day starts to repeat.

Through a day's description, we identify two charging cycles for the Victorian Big Battery. One is used at the start of the day to produce revenues at the morning peak, and the second one for the evening peak. However, prior to the morning peak, it accumulates less energy, and during the early peak, it dispatches less energy than the evening peak. Bear in mind that we are looking at an annual average of operations and this could vary on several days. For example, it will not capture days when the battery was not economically incentivised to charge and discharge in the morning peak.

For the times when the battery's charge follows the solar profile without exceeding it, we grant a percentage to see how similar both profiles are. In the case of the Victorian Battery, there is an 87.05 per cent similarity during the day. All excess charges (compared to the VIC solar profile) also receive a percentage, and we compare it against the energy that should have come from the profile. For this battery, there is a 12.95 per cent excess charge. Finally, the battery cumulates on average 130 MWh in a day, which will be fully discharged. This means that the average utilisation of the battery is nearly 29 per cent of its total capacity.

It is worth noting that the Victorian battery has agreements to operate as a virtual transmission line from November to March.[3] This means that the battery has 50 MW available to participate in the market during the summer period mentioned and the entire 300 MW at other times. Consequently, the battery utilisation is limited, which we appreciate in the < 30 per cent battery utilisation figure.

- **Ballarat Energy Storage System**



The Ballarat ESS shows a clear charging cycle in the middle of the day; however, during times when solar is unavailable, the battery charges and discharges a similar magnitude of MW. This net value is close to zero and is represented in the aggregate cumulative energy stored in the battery as an almost horizontal line. Nonetheless, in real life, the battery charges at night some days while on others it discharges. Another way to see it is that both events (charge/discharge) are almost equally likely to occur on an average day.

Looking at the battery agreements, Ballarat supports the frequency and ancillary services of the NEM. This is noticeable in the dispatch times at any time during the day and the higher dispatches at peak times. Obligations with other parties determine the available capacity (as reserve) the battery should meet. This reduces the operation and revenues it earns from the energy-only market but delivers revenues from the FCAS market.[4]

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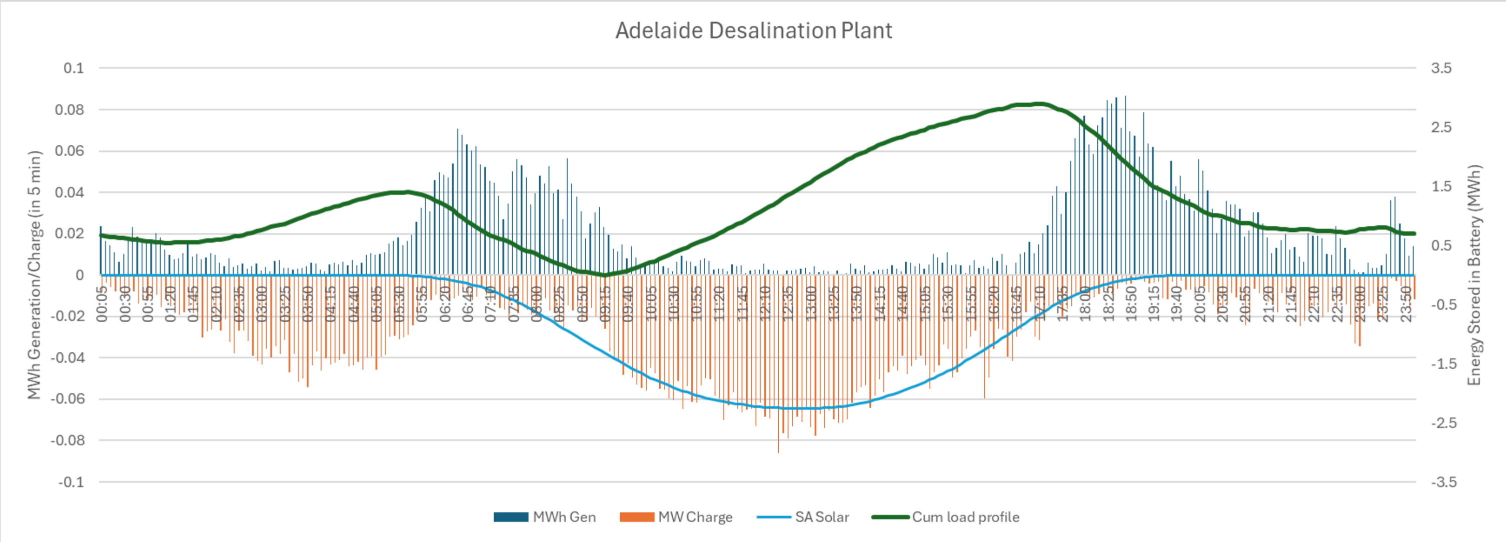
[3] https://www.energy.vic.gov.au/renewable-energy/batteries-energy-storage-projects/victorian-big-battery

[4] https://www.energy.vic.gov.au/__data/assets/pdf_file/0037/591598/Ballarat-battery-energy-storage-system-final-knowledge-sharing-report.pdf; See table 4, page 17.

Subsequently, the battery's usage is low relative to its total capacity. On average, charging and discharging consume around 10 per cent of the available storage capacity.

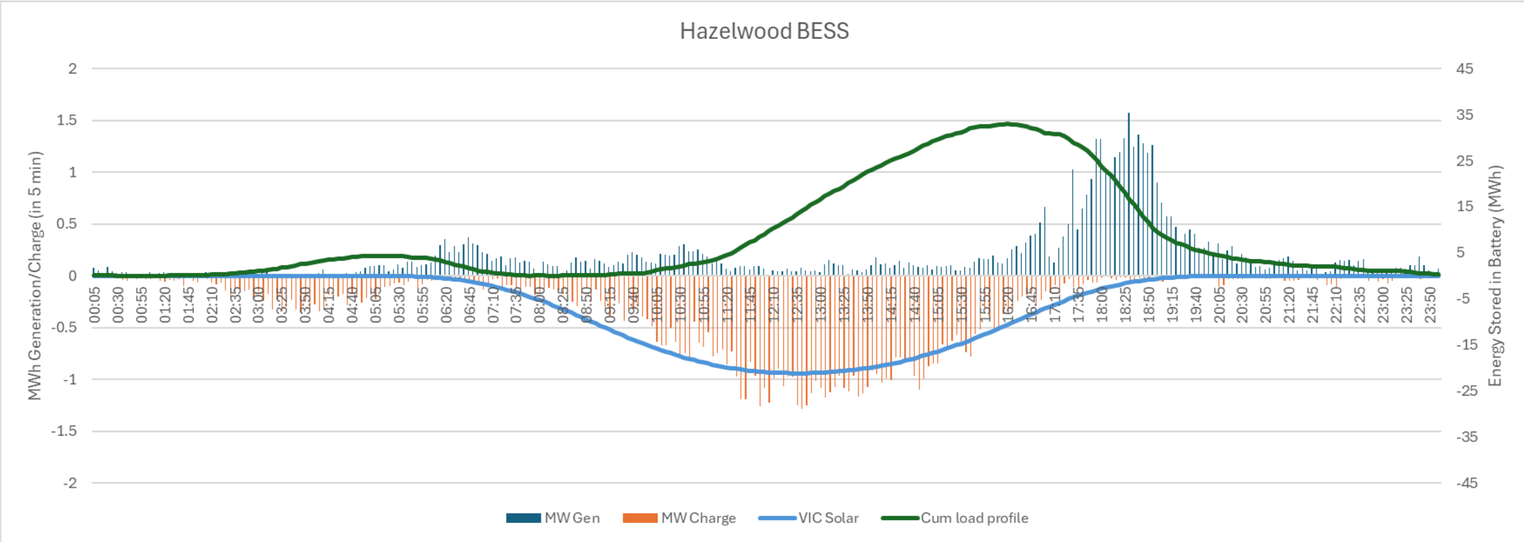
- **Adelaide Desalination Plant**



The constant, although sometimes minimal, output of electricity during the day suggests this battery constantly participates in the FCAS market.

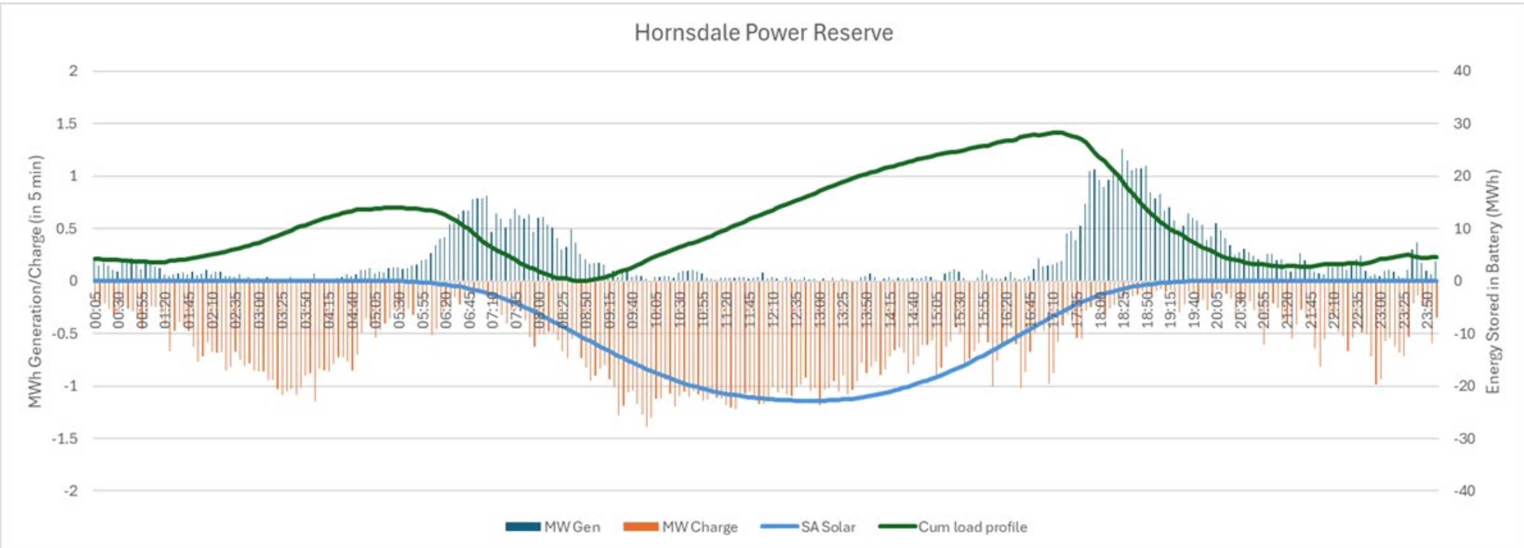
The battery at the desalination plant has one of the best scores for following a solar profile. With 92.41 per cent accuracy, this is the second-best outcome in the batteries we revised. This battery shows a second charge/discharge cycle for the morning peak but, surprisingly, keeps nearly 75 per cent of the battery unused on average at all times, possibly due to the preference to hold charge for FCAS events.

- **Hazelwood BESS**



The Hazelwood BESS farms most of its energy from solar generation, as seen in the charging pattern of the figure above. With an 85 per cent charge accuracy as a solar profile, the battery discharges mainly at night peak times and in some periods during daytime. Discharges of the latter time are relatively small and represent FCAS discharging. The morning peak charging/discharging cycle is minimal, indicative of only a few events in the year when its output is needed and/or maintaining a small output at this time.

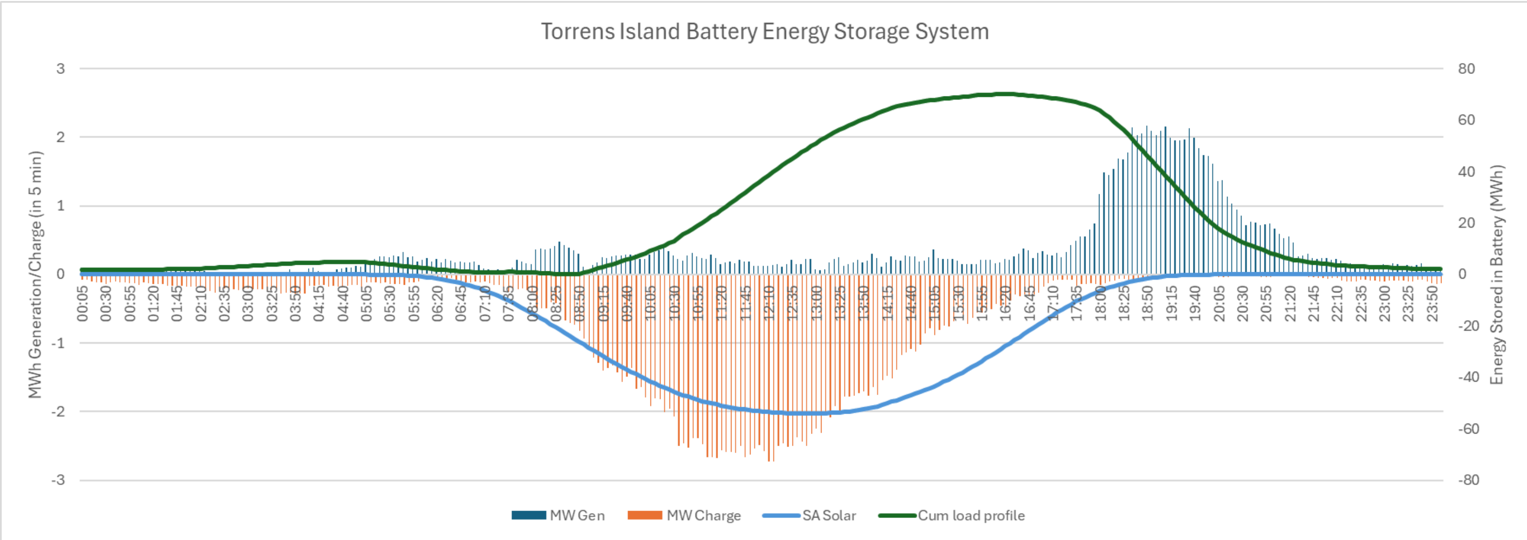
- **Hornsdale Power Reserve**



The battery shows two (perhaps three) charging cycles during the day, the most important following a solar profile with 91 per cent accuracy and the other(s) of shorter duration at night. Interestingly, the battery has an excess charge compared to the solar profile in the morning, at around 9:00 am.

This battery aims to provide essential grid-support services, which reduces its participation in arbitrage and distorts charging cycles.[5]

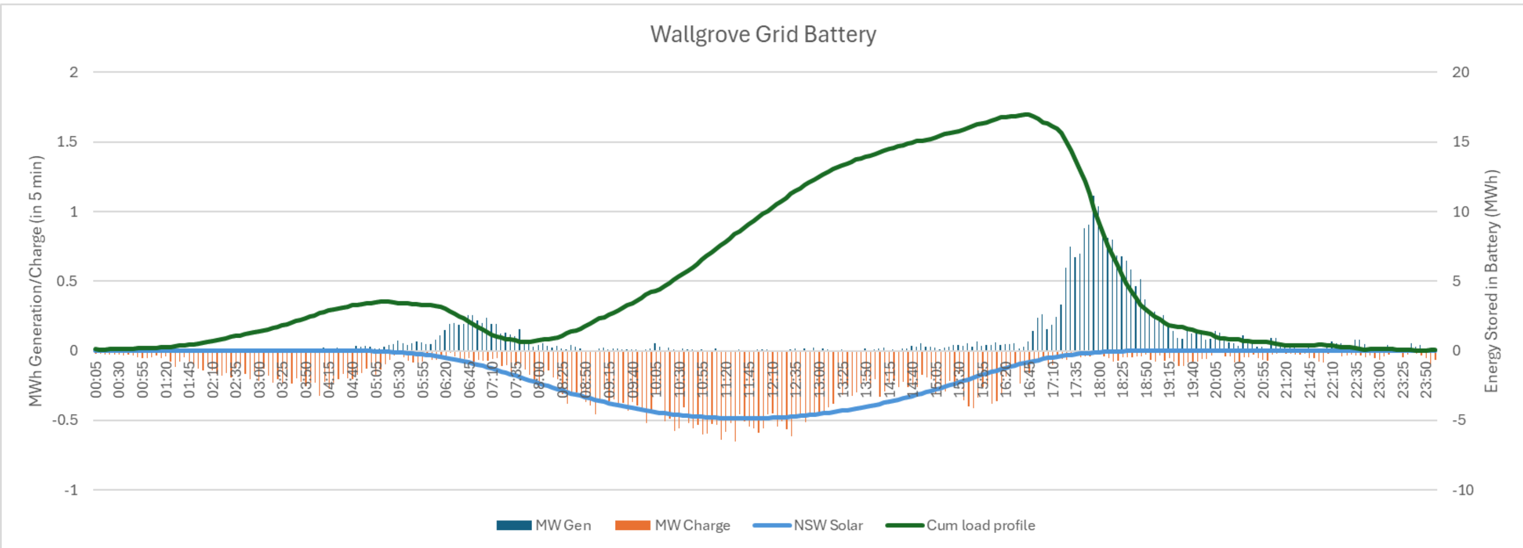
- **Torrens Island BESS**



With a clear tendency to charge only during the day and a shape similar to the available solar output, the Torrens Island BESS prefers to charge in excess during the middle of the day. This allows it to take advantage of lower charging costs when solar is available.

This battery rarely dispatches at morning peaks, and most of the energy dispatched is allocated to evening peaks and FCAS during the day.

- **Wallgrove Grid Battery**

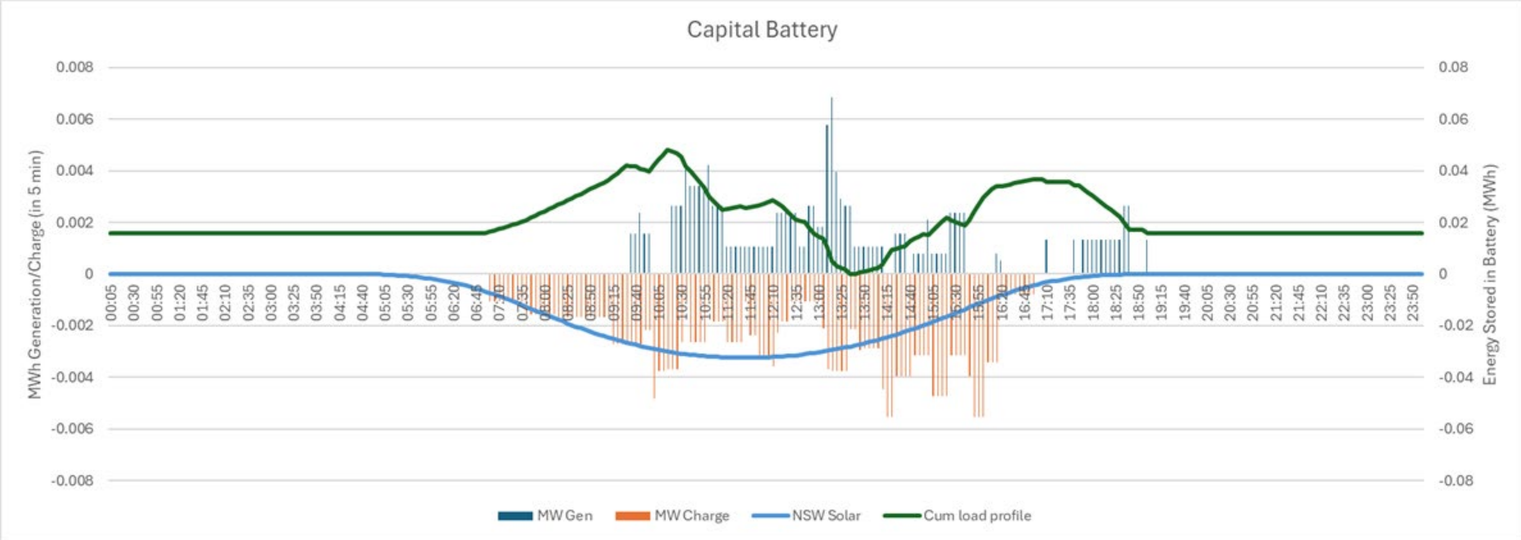


[5] https://hornsdalepowerreserve.com.au/learn/#what-does-a-big-battery-do

With two charging and discharging cycles during the day, this battery mainly accumulates energy during the day when solar is available. The average maximum dispatch at night is more than three times the average maximum dispatch at the morning peak, so the energy stored during the day is more than triple that drawn at night. This is noticeable in the graph above.

With a low battery utilisation of nearly 20 per cent, this battery's functions are mainly fast frequency response and as a synthetic inertia provider.[6]

- **Capital Battery**



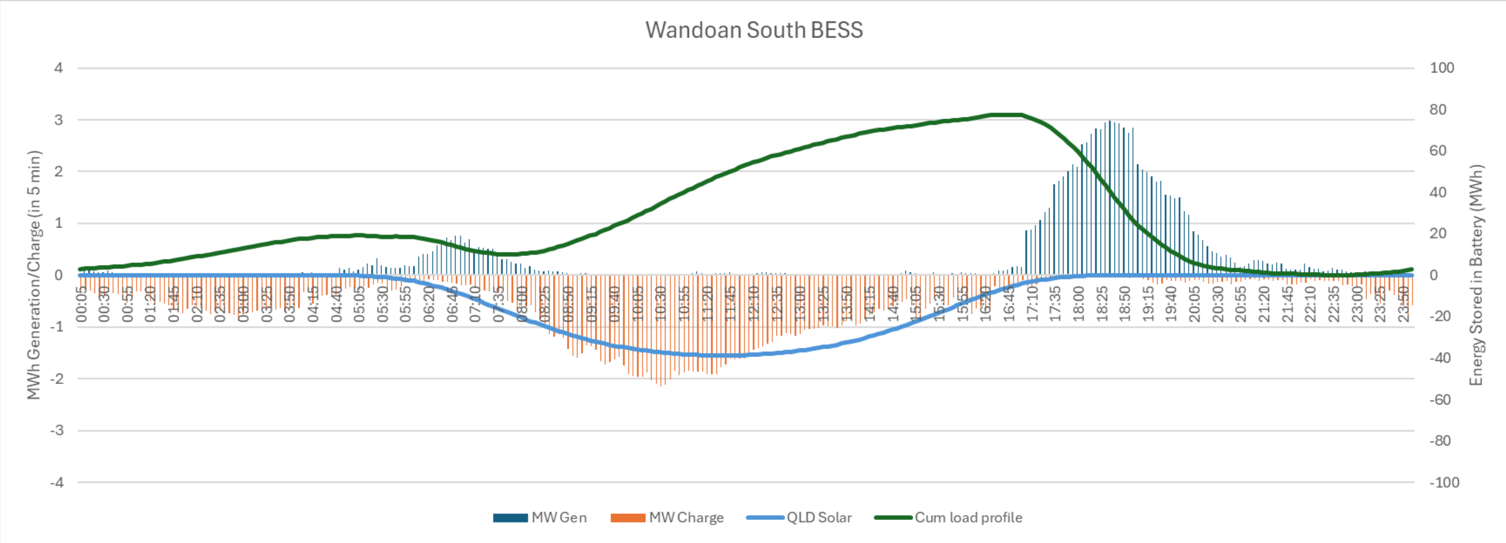
The Capital Battery is a clear example of a battery not incentivised by the NEM rules, and we appreciate this in the dissimilarity of the daily charging cycles. Although most of the energy used for charging occurs during the day, there is a comparable magnitude of dispatch at the same hours (occurring on different days). This means the battery sometimes dispatches or charges regardless of the price signals. Moreover, the battery utilisation is only 0.02 per cent of its total capacity. This means that at a 100 per cent charge, it only dispatches 0,02 per cent of its capacity on an average day to provide frequency services for the ACT.

With ongoing contracts for available capacity and frequency services, this battery mainly provides a reserve for the ACT electric system.[7]

[6] https://www.transgrid.com.au/projects-innovation/wallgrove-grid-battery

[7] https://capitalbattery.com.au/our-battery/

- **Wandoan South BESS**

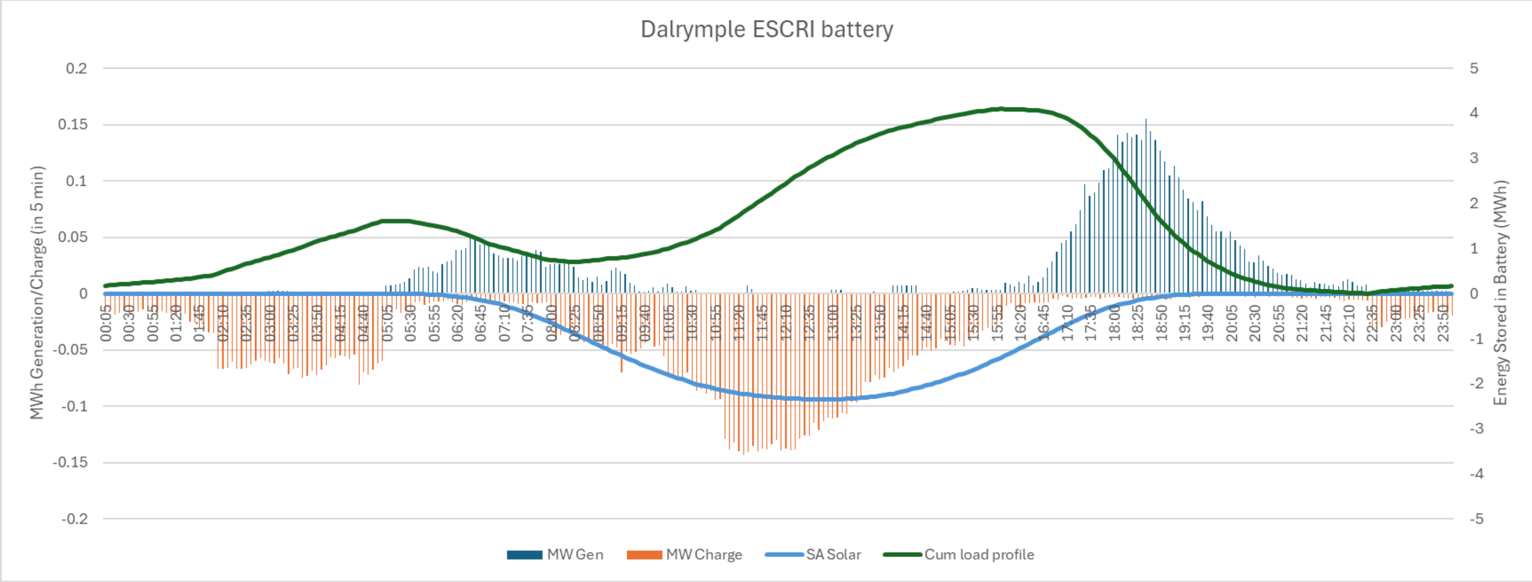


This battery has a similar profile to that of the Wallgrove Grid Battery. One main difference is the excess energy charged in the late mornings. While the Wallgrove battery has 89 per cent accuracy with a solar profile, the Wandoan BESS is only 85 per cent.

The most significant difference, however, exists in the total usage of both batteries. The Wandoan South BESS, of the batteries we reviewed, has the highest utilisation capacity on average, reaching 51.57 per cent. That is, by starting at full charge, this battery dispatches more than 50 per cent of its capacity to then fully charge on the same day – on an average day.

There is minimal dispatch during the day recorded, meaning some participation in the FCAS market. Potentially, this battery mixes strategies with FCAS and arbitrage participation.

- **Dalrymple ESCRI battery**



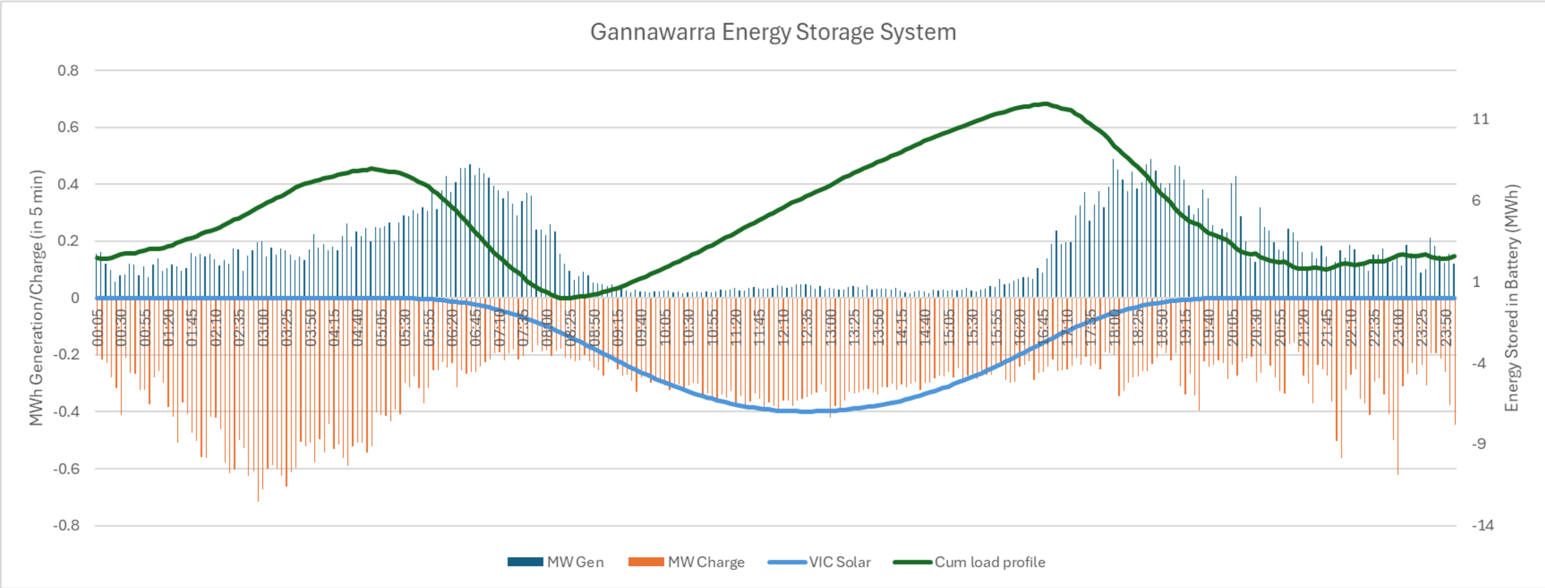
Dispatch times for the Dalrymple battery are predominantly at evening and morning peaks and rarely in the middle of the day. This requires two charging cycles. The charging cycle during the daytime accrues extra energy near midday.

The Dalrymple battery takes second place on average battery utilisation, scoring 51.22 per cent. Back in 2021, the battery's primary purposes were (in order of priority) "Islanded operation to enhance local reliability of supply, Fast Frequency Response, Network support, Frequency Control Ancillary Services, and Arbitrage."[8]

The relatively high score in battery utilisation suggests higher-than-average usage in arbitrage compared to other reviewed batteries, and it is consistent with the role assigned to the battery usage. As stated in ARENA's report[8], "During commercial operation, AGL is required to operate the BESS between 10% and 90% of the installed battery capacity. This is to ensure that the BESS always has the capacity to respond to a network event." That is, 80 per cent of the battery is assigned to arbitrage and FCAS, and the utilisation score is nearly 50 per cent, meaning a 64 per cent utilisation in arbitrage realistically.

[8] https://arena.gov.au/assets/2021/04/escri-sa-battery-energy-storage-final-report.pdf; see page 15 of 39.

- **Gannawarra Energy Storage System**



The Gannawarra battery follows a solar profile with the highest accuracy from the reviewed batteries, at 93.81 per cent. However, the total energy charged is not mainly during the daytime. Surprisingly, this battery charges primarily during the first hours of the day and at nighttime. Also, battery dispatch occurs at any interval, with a more pronounced discharge at peak and during evenings. This behaviour suggests there is no incentive from price signals in the market.

In the first two years of use of the battery, the main revenues came from FCAS and, to a lower extent, arbitrage.[9] The pattern above clearly relies on FCAS rise (dispatch) revenues.

[9] https://arena.gov.au/assets/2021/11/gannawarra-energy-storage-system-final-report.pdf; see page 14 and 15.

Conclusion

Unsurprisingly, batteries are incentivised by price signals in the energy market as to when they charge and discharge, with the rooftop solar shape correlating to at least one charging cycle during the day. Each battery, however, has different levels of incentives for when they charge and discharge. As shown above, morning and evening peak charging cycles at dispatch events, but still, morning cycles are consistently smaller in volume for all batteries – similarly, electricity prices are not as high in the morning as those in the evening given demand levels. A charge/discharge cycle occurs less frequently in the morning because the price is insufficient to motivate a cycle. Batteries willing to produce at lower prices dispatch energy more often than those that produce only at higher demand events in both morning and evening – we appreciate this in the relativity between the sizes of the two charging cycles of a battery, which also varies among batteries. One potential factor here is the contractual arrangements a battery may have to provide support services.

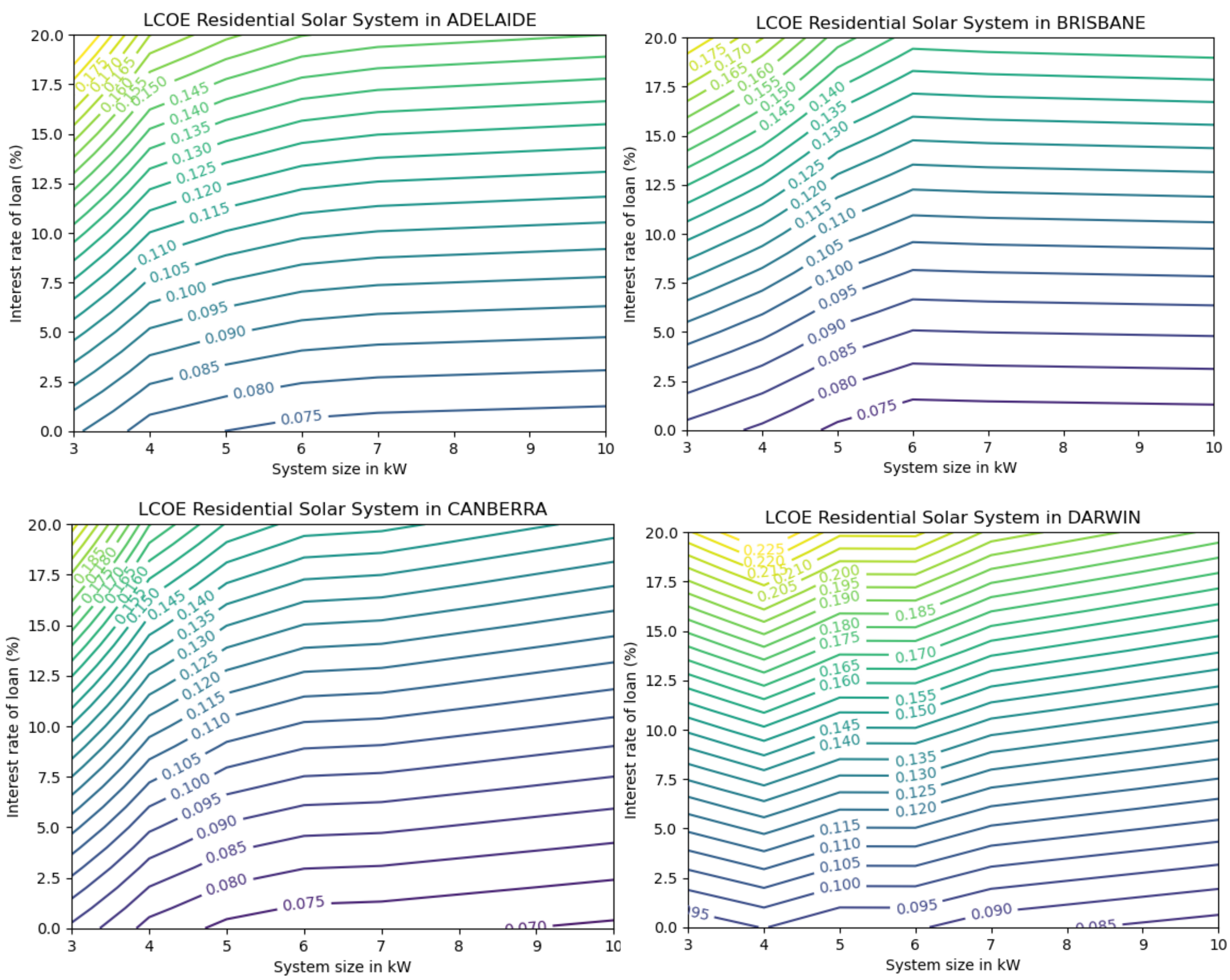
Side contracts discourage battery utilisation in the electricity market for arbitrage, as we have seen low battery utilisation across all batteries, but this metric is not relevant to the value of the asset. We appreciate a low utilisation rate for almost all batteries (i.e. <50 per cent), but in general, these batteries have agreed to provide services outside of the market with other parties, such as the provision of reserve or frequency services. We detected that medium-low battery utilisation (10 – 30 per cent) means the batteries have optimised their opportunities by allowing arbitrage in the NEM while meeting side contracts. Ultimately, battery managers have secured revenues by separating a portion of the battery for specific usage as part of those contracts. At the same time, the remaining portion of the battery is used to produce revenues in the dynamic electricity market.

SECTION III: LEVELISED COST OF ELECTRICITY

The Levelised Cost of Electricity (LCOE) is the cost of energy per kilowatt hour (kWh) produced for a type of electricity generator. The LCOE helps to compare costs between different electricity sources like coal, wind, solar, etc. When the cost is equal to or below the price consumers pay directly to suppliers for electricity, this is called grid parity.

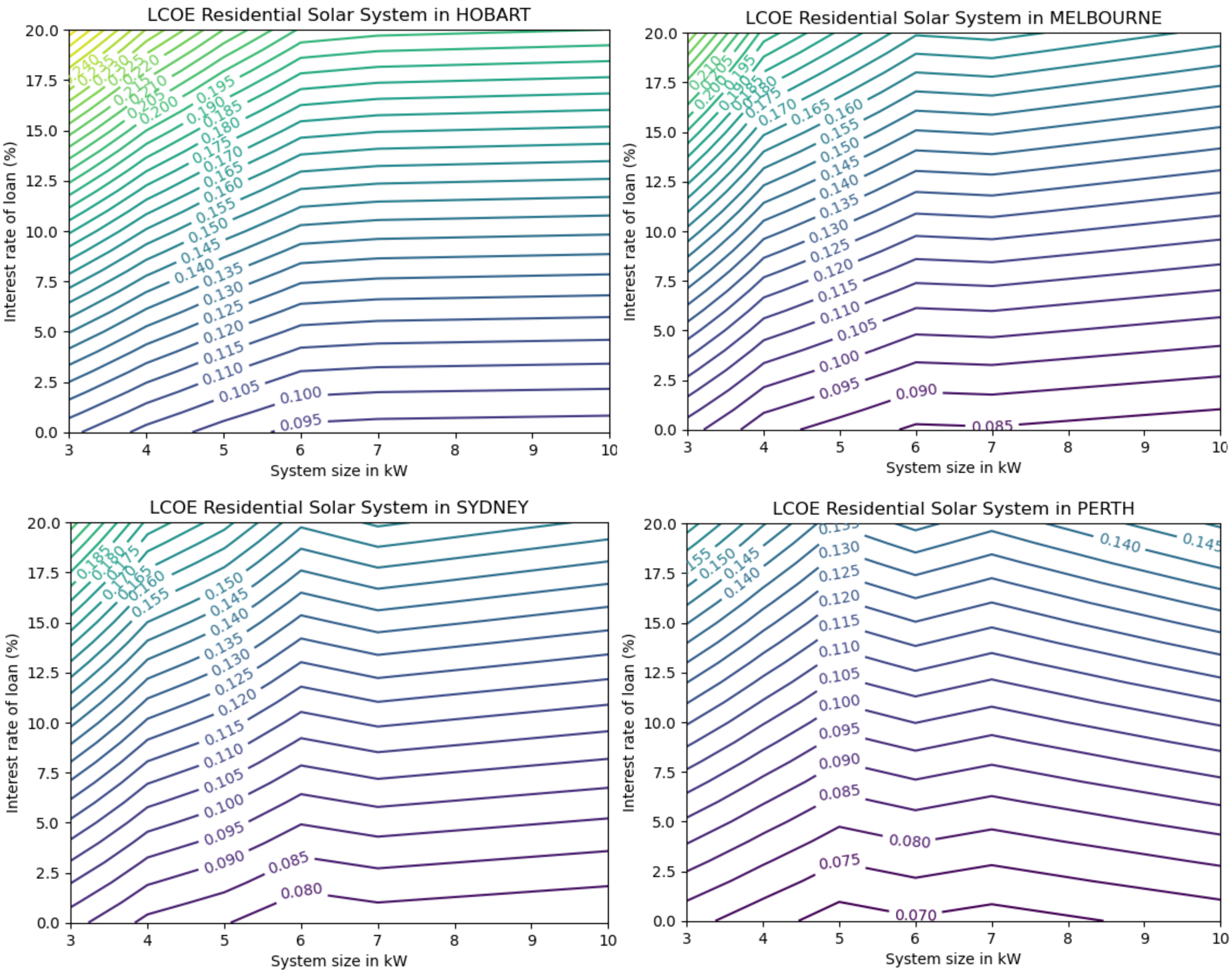
Figure 5 and **Figure 6** depict the LCOE of solar systems for residential solar systems in different capital cities, from 3 kW to 10 kW. Given the wide range of interest rates at which consumers could get a system, we have mapped the cases from 0 to 20 per cent interest rates in this report. These rates represent the cases of a full upfront payment (0 per cent), financing through mortgage (~5 per cent) or personal loans (~20 per cent), and all cases in between. The lines in the graphs indicate the same LCOE in units of AUD/kWh. A detailed methodology on how the LCOE was computed can be found in the Appendix.

Figure 5. LCOE for Residential solar systems – ADE – BNE – CBR – DRW



Source: AEC Analysis with data from SolarChoice and Sunwiz

Figure 6. LCOE for Residential solar systems – HBA – MEL – SYD – PER



Source: AEC Analysis with data from SolarChoice and Sunwiz

Table *2* shows the cost of a rooftop solar system in Australia's major cities, retail costs, as well as current Feed-in tariff (FiT) rates. The FiTs presented in the table are the best minimum tariffs offered in the region.

Table 2. Cost of residential solar systems, retail price, and feed-in tariffs in different capital cities.

	System Size ($AUD)						Retail prices ($/kWh)	FiT ($/kWh)
	3 kW	4 kW	5 kW	6 kW	7 kW	10 kW		
Adelaide	$3,860	$4,140	$4,800	$5,460	$6,230	$8,660	$0.42	$0.09
Brisbane	$3,610	$4,310	$4,640	$5,070	$5,960	$8,630	$0.31	$0.08
Canberra	$4,300	$4,450	$4,880	$5,510	$6,360	$8,340	$0.26	$0.10
Darwin	$4,730	$6,780	$7,760	$9,320	$10,060	$13,060	$0.28	$0.11
Hobart	$4,460	$5,160	$5,760	$6,250	$7,180	$10,120	$0.30	$0.11
Melbourne	$4,000	$4,290	$4,860	$5,260	$6,200	$8,240	$0.31	$0.07
Sydney	$3,800	$4,160	$4,750	$4,960	$6,050	$8,090	$0.35	$0.08
Perth	$3,370	$3,890	$4,210	$5,360	$5,950	$9,760	$0.31	$0.06

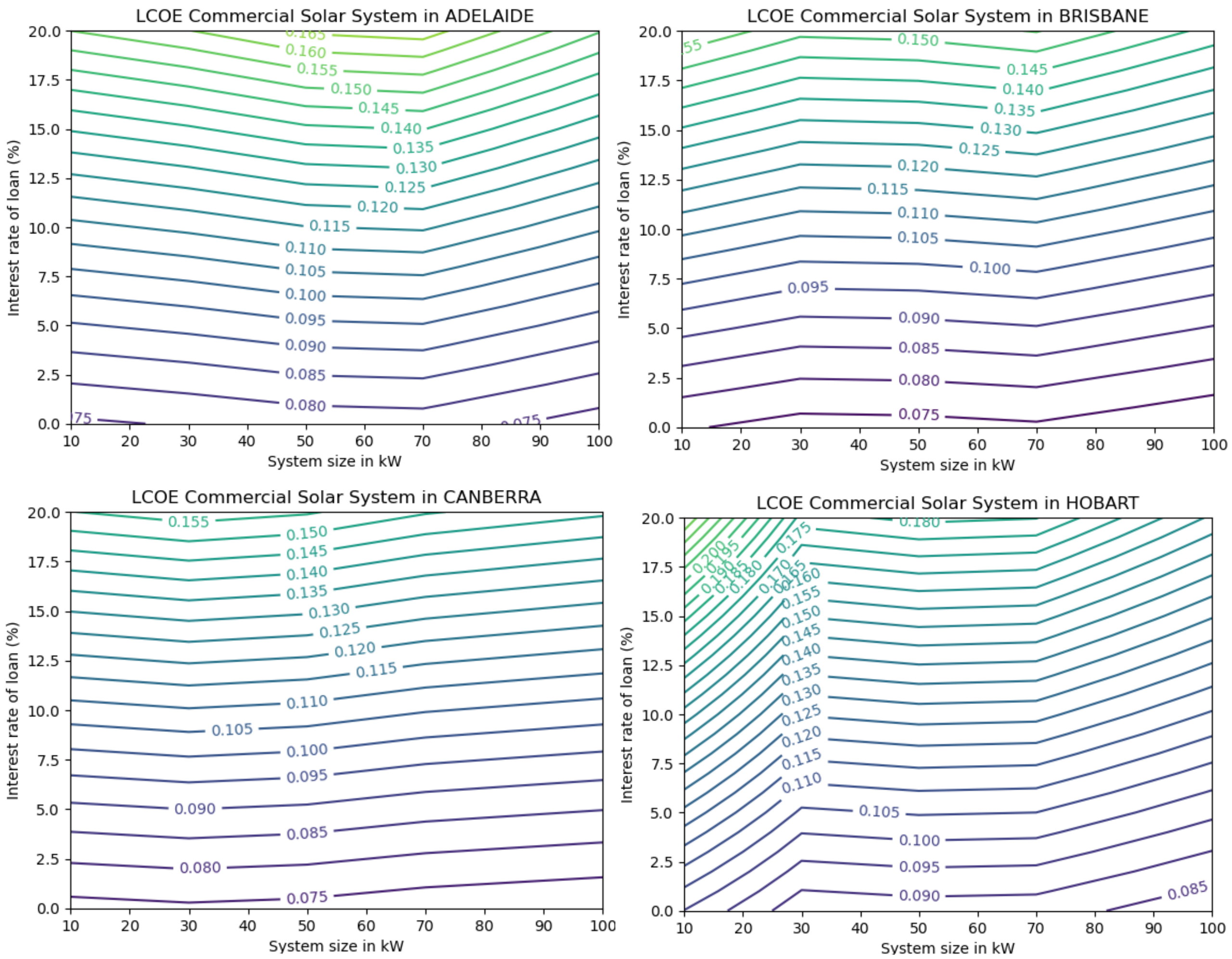
Source: AEC analysis with data from SolarChoice

The retail comparison rates are representative variable rates and do not include supply charges. That is, the rate is an energy-only price. For all capital cities, excluding Perth and Hobart, retail prices are based on the implied usage charges from St Vincent de Paul's tracking of market offers, which was last updated in July 2023. Perth prices are regulated and obtained from Synergy. Hobart prices were obtained from Aurora Energy's Tariff 31, while Darwin prices were obtained from Jacana Energy's regulated residential usage charges.

Small and large businesses - Levelised cost of electricity

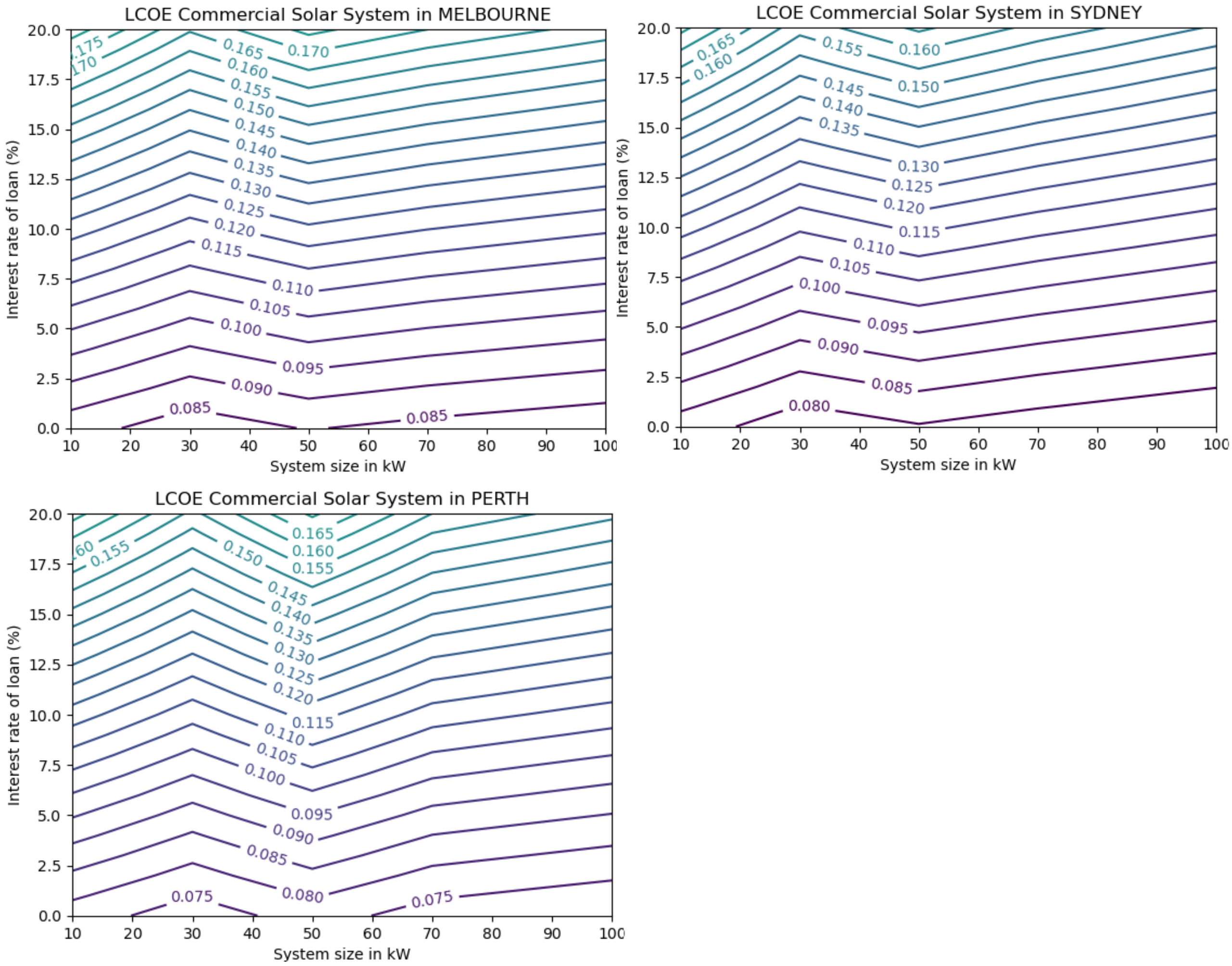
For the cases of commercial-size systems, we generated the **Figure 7** and **Figure 8**. Like residential systems, we present the different costs at different interest rate levels.

Figure 7. LCOE for Commercial solar systems – ADE – BNE – CBR – HBA



Source: AEC Analysis with data from SolarChoice and Sunwiz

Figure 8. LCOE for Commercial solar systems – MEL – SYD – PER



Source: AEC Analysis with data from SolarChoice and Sunwiz

Table 3 below shows the costs used to compute the LCOE in the previous figures. These are statistics provided by SolarChoice.

Table 3. Cost of commercial solar systems in different capital cities.

	System Size				
	10kW	**30kW**	**50kW**	**70kW**	**100kW**
Adelaide	$9,750	$30,480	$53,420	$75,750	$93,580
Brisbane	$10,180	$28,330	$47,580	$68,410	$87,390
Canberra	$10,050	$30,910	$50,590	$67,670	$92,670
Hobart	$12,540	$27,490	$47,100	$65,330	$78,100
Melbourne	$9,890	$25,870	$47,150	$62,620	$84,100
Sydney	$10,520	$26,840	$48,390	$63,480	$83,370
Perth	$11,920	$30,790	$59,130	$72,630	$96,010

Source: SolarChoice

SECTION IV: PAYBACK PERIOD, DETAILED MODEL

The payback period is defined as the year when the cumulative savings are greater than the cumulative costs of a solar PV system. Savings represent the avoided cost of consumption and any revenue received from FiTs. The cumulative cost incurred represents the initial investment and the time value of money. A detailed methodology is contained in **Appendix 2**.

Although installing solar panels typically involves an initial investment, customers who use them, benefit from future reduced electricity bills. This is achieved by lowering their reliance on grid electricity and selling surplus electricity back to the grid in exchange for solar feed-in tariff credits. Nevertheless, it's essential to note that solar feed-in tariff rates have declined in all regions nationwide. When selecting an energy plan, customers with solar panels should assess their choices based on their historical electricity consumption and the amount of solar energy they export. It's important to remember that an energy plan offering the highest solar feed-in tariff may not always be the most cost-effective choice overall, as it could involve higher supply and usage charges compared to other plans.

Table *4* highlights the payback period for different system sizes across Australia. Note: Electricity prices are subject to change with consumer price index (CPI) levels and, therefore, will affect the payback period. The medium-low payback periods across many cities highlight the reason behind customers' continuous support of installing solar PV.

However, Australia's persistent high interest rates show how places with low solar irradiation can quickly reduce the benefits of acquiring a solar system. Canberra, Melbourne, and Hobart show a long payback period at an interest rate of 10 per cent and no return on investment for large systems at that interest rate. With lower energy generation available and higher costs due to interest rates, their payback period drastically increases for residential-size systems.

It is essential to highlight that several factors have been fixed for the analysis in **Table 4**. For example, FiTs have been selected based on the cities' best minimum retailers offer. Higher (but also lower) FiTs are available. Another critical factor is the total consumption *in situ*. We have used Sunwiz's statistics for an average home, but if the case is that a household has high consumption during the day, the exports will fall. This is beneficial and reduces the payback period in general because the cost of a kWh on site is that of the LCOE, while all unused energy is sold at the FiT cost. Generally speaking, a FiT will be lower than the LCOE, but this also varies, as shown in the figures above. The best practice to determine payback periods would be to analyse individual households' consumptions and conditions to provide an accurate number.

Table 4. Payback periods for different rooftop solar system sizes, by region, at various interest rates.

	Interest Rate (%)	System Size (kW) 3 kW	4 kW	5 kW	7 kW	10 kW
Assumed Exports		**60%**	**65%**	**74%**	**83%**	**94%**
Adelaide	0.00	3	3	3	4	4
	5.00	4	3	4	4	5
	10.00	5	4	4	6	8
Brisbane	0.00	3	3	3	3	3
	5.00	4	4	4	3	4
	10.00	5	5	4	4	5
Canberra	0.00	6	5	5	5	5
	5.00	8	6	6	6	6
	10.00	15	10	9	10	11
Darwin	0.00	5	5	5	6	6
	5.00	6	7	7	8	9
	10.00	9	11	12	17	No Return
Hobart	0.00	5	5	5	5	6
	5.00	7	6	6	6	7
	10.00	12	10	10	10	No Return
Melbourne	0.00	6	5	5	6	7
	5.00	7	6	7	7	9
	10.00	14	10	11	15	No Return
Sydney	0.00	4	4	4	4	5
	5.00	5	4	4	5	6
	10.00	7	6	6	6	9
Perth	0.00	4	3	3	4	5
	5.00	4	4	4	5	7
	10.00	5	5	5	6	15

Source: AEC analysis with data from Solarchoice.net.au and Sunwiz

SECTION V: METHODOLOGY APPENDIX

1. Solar installation methodology

Analysis from the CER's monthly data allows us to estimate the amount of solar PV installed in Australia. Since November 2015, the CER has consistently released data dated as of the first of each month. The new consistent release date allows us to provide a more accurate estimate of the capacity of recent installations. Due to the lag in reporting of new installations, however, the CER data takes up to 12 months to be finalised.

2. Payback period methodology

This methodology outlines our approach to calculating the payback period for solar panels installed across capital cities in Australia. Our analysis includes the following:

- Initial investment
- Discount rate
- Efficiency
- System degradation rate
- Export rate
- Avoided usage cost
- FiT

Initial investment, discount rate, efficiency and system degradation rate are described in Appendix 1. The key difference to LCOE calculation is that the payback period assumes no annual maintenance cost.

Calculation

The payback period occurs when ∑ savings > ∑ cost

Where:

Savings = (usage cost x $(1+ \text{CPI})^t$ x consumption / 100) + (Export x FiT)

Cost = investment x $(1 + \text{real discount rate})^t$

t = years

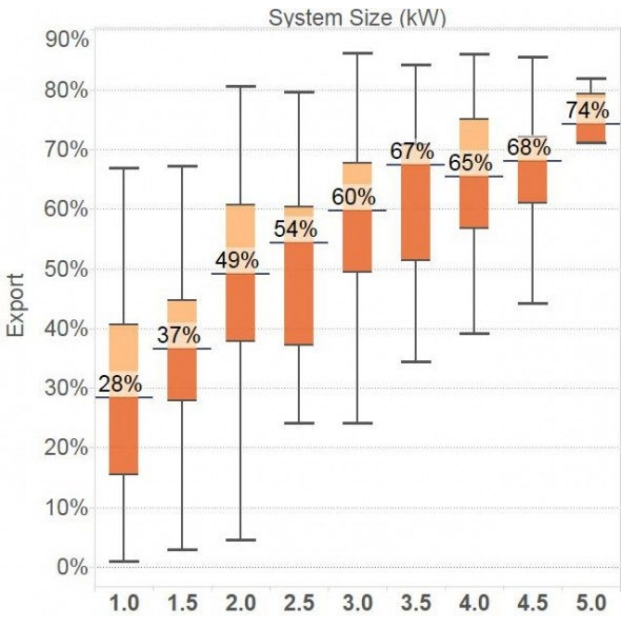
Avoided cost and FiT

The onsite consumption is multiplied by the retailer's usage charges. CPI has been applied to the usage charge to allow for growth in retail prices. The excess energy is exported to the grid, and the customer is expected to receive the mandatory FiT or a realistic market offer where mandatory tariffs are not applicable.

Export rate

The percentage of onsite consumption and electricity sent to the grid is calculated using the median value from Sunwiz's analysis[i]. See **Figure *9*** below. We extrapolated the median values to compute exports for 7 kW and 10 kW systems, by using a fitted logarithmic function.

Figure 9. Export rate of residential solar PV at different system sizes



Source: Sunwiz's analysis, 2015

[i] Sunwiz, Solar Pays Its Way on Networks. Last accessed 17 June 2015.