



SEIZE THE SUN: HOW TO SUPERCHARGE AUSTRALIA'S ROOFTOP SOLAR

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The Climate Council acknowledges the Traditional Owners of the lands on which we live, meet and work. We wish to pay our respects to Elders, past and present, and recognise the continuous connection of Aboriginal and Torres Strait Islander peoples to land, sea and sky. We acknowledge the ongoing leadership of First Nations people here and worldwide in protecting Country, and securing a safe and liveable climate for us all.



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Key findings

1 Australia is the world leader in rooftop solar, with more than 3.6 million households cutting their power bills and our climate pollution. That's more rooftop solar panels per person than anywhere else in the world.

- › Over the past decade, Australia's solar industry has grown from strength to strength. More than 300,000 systems are installed each year, and some of the largest businesses in Australia have gone solar including Woolworths, IKEA, Bunnings and ALDI.
- › Together, this rooftop solar adds up to 23 gigawatts of affordable renewable energy capacity to Australia's electricity system – about a quarter of all electricity capacity nationally.
- › Cost-of-living relief is a key reason to invest in rooftop solar, with the average household saving more than \$1,500 a year. Collectively, Australian households with rooftop solar are saving nearly \$3 billion a year on their power bills.
- › Households with solar are more insulated from power price increases, and those with a battery are even better off. From 2022 to 2023, households without solar or storage were hit with a \$500 average increase in power bills, compared to \$300 for those with rooftop solar and only \$100 for those with solar and a battery.

2 To cement our place as the world's solar champions, Australia can more than double our rooftop solar this decade by driving uptake across more family homes, social housing and businesses.

- › Australia has the potential to add four million more rooftop solar systems (or 26.4 gigawatts) this decade – by making better use of available rooftop space on owner-occupied homes, social housing and businesses.
- › Slightly more than half of all owner-occupied houses already have solar installed, but there's still another 2.8 million households like them that haven't yet taken it up.
- › Two-thirds of new houses are being built without a solar system. We can unlock solar savings for 537,000 new homeowners this decade by ensuring all new homes have solar from day one.
- › People living in social housing could benefit the most from solar, with tenants saving up to \$270 million a year in power bills and governments saving up to \$84 million in annual bill relief.
- › Nine in 10 small businesses are missing out on the benefits of rooftop solar. An office with 40 workers could halve its electricity bill by installing 24 kilowatts of rooftop solar (equivalent to about four household solar systems).

3 As we ramp up rooftop solar, we need to adapt our grid to soak up all the clean, cheap energy that will be created and help more Australians cash in. That means rolling out more batteries and smart appliances that can tap into reliable solar power around the clock.

- › To maximise the benefits of millions more solar systems, we need to roll out 25 gigawatts of battery storage – to unlock the cost savings of solar power around the clock.
- › We can install two million more batteries in homes and businesses to help Aussie families and business owners store excess solar power during the day, use it at night and drastically cut their energy bills.
- › We can roll out 5,000 community-scale batteries to share the cheap solar power generated by nearby homes and businesses within their neighbourhood.
- › We can encourage households to use more of their solar electricity during the middle of the day when sunshine is most abundant.
- › Collectively, these simple changes will help reduce demand on the grid and build a more affordable and reliable energy system for all Australians.

4 To seize the sun this decade – reaching and improving on our national renewable energy target of 82 percent by 2030 – the Australian Government needs to put rooftop solar and storage at the heart of our national energy plans.

- › Rooftop solar and storage have a critical role to play in Australia’s shift to clean, reliable energy as our coal-fired power stations continue to close. By the end of 2024, Australia’s rooftop solar capacity is set to overtake coal – meaning that at the sunniest times of day, rooftop solar can feed more electricity into our main national grid than coal.
- › The *Aussie Solar Drive* can double the number of solar systems on Australian rooftops by bringing solar and storage to social housing, rolling out more community-scale batteries, helping more businesses go solar, and making sure all new rooftops have solar panels.
- › The *Australian Energy Corps* can skill up a new wave of clean energy workers by providing free, high-quality vocational training for apprentices and experienced energy workers.

INTRODUCTION

By getting more solar onto Australian rooftops, we can unlock the benefits for more Aussies

Australians love solar power and it's not hard to see why. As one of the sunniest countries in the world, harnessing our endless sunshine to power our homes and businesses with clean, affordable energy just makes sense. It's no wonder we're the world leader in rooftop solar.

Already, more than 3.6 million Aussie households have taken control of their power bills by putting solar panels on their rooftops. That's one in three households, and on average each of them are saving

more than \$1,500 per year. As many families struggle with increasing costs of living, rooftop solar is a clear opportunity to help Australians cut their power bills and our climate pollution at the same time.

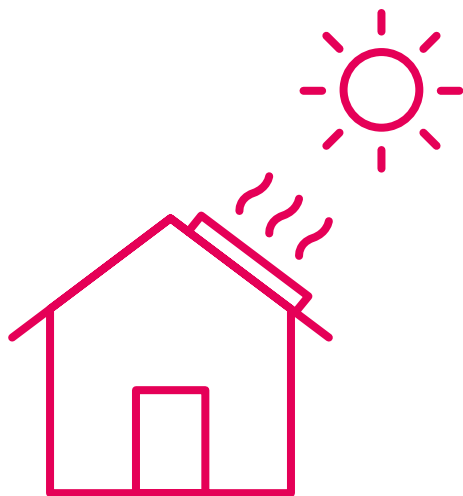
By better using the available space on top of our homes, social housing and businesses, we can double our rooftop solar capacity this decade – and deliver the bill-busting benefits to millions more Australians. But we're missing a trick if we focus on solar panels alone. By ramping up battery storage as well, we can soak up excess solar energy while the sun is shining, and provide reliable, affordable and clean power around the clock.

Supercharging our rooftop solar and storage can also help us build a more equitable energy system. By installing solar on social housing, we can ease the burden of bills on some of the most vulnerable people in our community. By rolling out more community batteries, we can share the benefits of affordable solar power with people who can't install their own panels, like renters and apartment dwellers. And by easing overall demand on our electricity grid, we can make our energy system more affordable and reliable for everyone.

There's huge benefits for our climate, too. Rolling out more rooftop solar and storage will help Australia ramp up our renewable energy capacity as our coal-fired power stations continue to close over the coming years. Cutting climate pollution further and faster this decade will help us stem the rapid rise of dangerous global warming and secure a safer future for our kids.

So what are we waiting for? To seize the sun this decade, the Australian Government needs to put rooftop solar and storage at the heart of our national energy plans, alongside large-scale renewables and transmission infrastructure. State and territory governments can step up too – and many of them already are. It's a win-win situation across the country: easing cost of living pressures for more Australians, and ramping up renewables so we can cut climate pollution.

We have huge potential to keep growing rooftop solar and storage in Australia, and so much to gain when we do: lower bills, less climate pollution and a more reliable grid. It's time to cement our place as the world's solar champions by going even bigger on solar now.



What is rooftop solar?

In this report, 'rooftop solar' refers to solar photovoltaic systems installed on homes, commercial buildings and industrial facilities to directly power their energy needs. More than 95 percent of these solar systems are installed on rooftops, but they can also be attached to the walls or built on the ground where land is available, such as at a mine or industrial facility.

Small-scale household panels often come to mind when talking about 'rooftop solar', as this is the most common kind of installation in Australia today. But there is major potential to expand rooftop solar to commercial and industrial uses as well, to meet the needs of small businesses in our suburbs, office blocks in our cities and industrial facilities like manufacturing plants. In this report, we use the term 'rooftop solar' to capture all of these opportunities.

Some other important definitions

Capacity: The potential output of a solar system under optimal conditions. Capacity is measured in watts (W) or a related unit (like kilowatts, megawatts or gigawatts – see below). Capacity is often used in this report to refer to the size of a solar system. For example, a typical household solar system is about 6.6 kW.

Watt (W): A unit used to measure the amount of electricity produced or consumed in a given moment. For example, a toaster uses about 750 watts of power while it is working. In this report, we also refer to kilowatts (kW, equal to 1 thousand watts), megawatts (MW, equal to 1 million watts) and gigawatts (GW, equal to 1 billion watts).

Kilowatt-hour (kWh): A measure of electricity used or generated over a period of time. If you use one kilowatt of power for 1 hour, you will use 1 kilowatt-hour of energy. For example, a 1 kW solar system in Sydney produces an average of 4 kWh per day. Kilowatt-hours are also commonly used to describe how much energy a battery can store.



1.

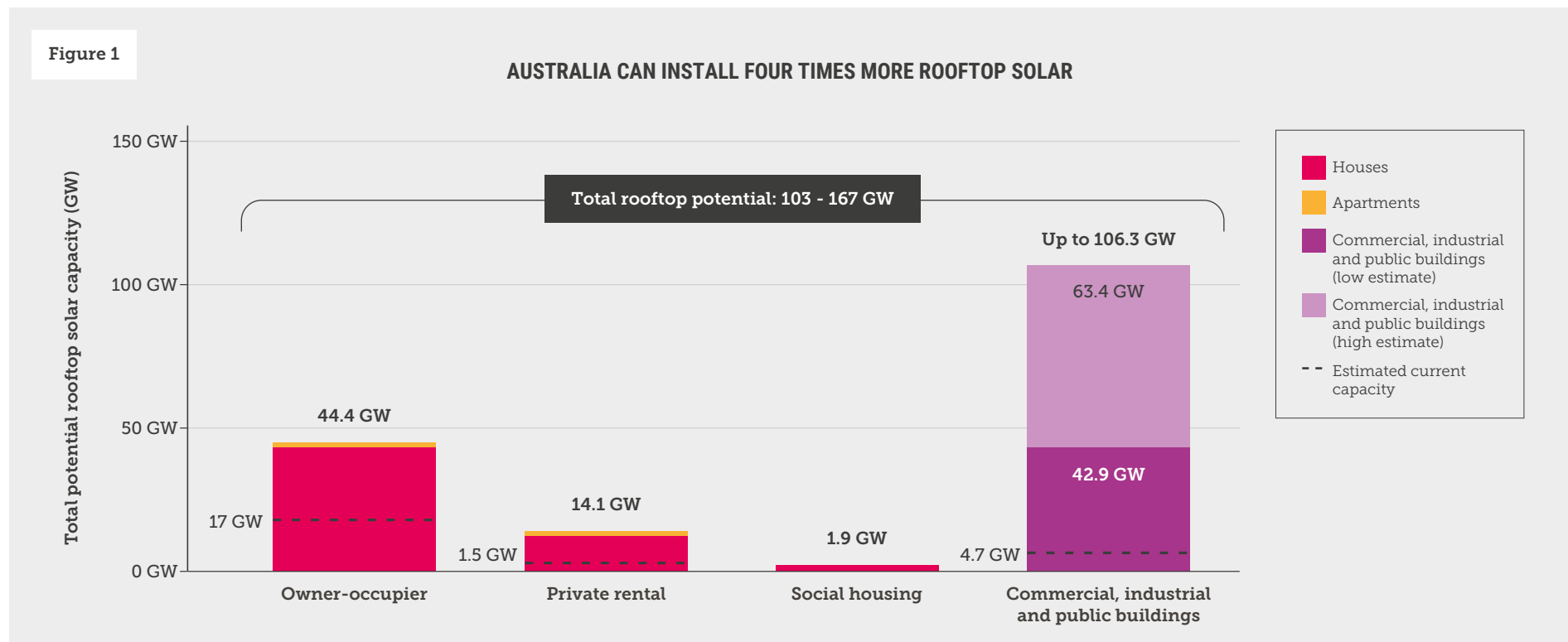
We're just getting started in seizing Australia's rooftop solar potential



Australia is the world leader in rooftop solar. Over 3.6 million homes already have solar panels on the roof (APVI 2024a), saving Aussie families nearly \$3 billion in electricity bills each year (Dehghanimadvar et al. 2024). This rooftop solar adds up to 23 gigawatts (GW) of clean, affordable renewable energy capacity – about a quarter of all electricity generation capacity nationally (APVI 2024b; Climate Council 2024). The amount of installed rooftop solar capacity looks set to overtake the total amount of coal generation capacity around Australia by the end of 2024.

This impressive uptake of rooftop solar is only scratching the surface of Australia’s bright opportunities. Millions more Australian households could be generating electricity on their roofs, using it in their homes and sending it into the grid where others can also benefit. There is also huge untapped potential for Australian businesses, with uptake of rooftop solar much lower for commercial and industrial facilities than households. Figure 1 highlights how much more room there is to grow across these different segments.

Based on total available and appropriate roof space, Australia has the potential to install around 103 GW of rooftop solar – about four times more than is on our rooftops today. This is 1.5 times the capacity of the utility-scale electricity generators in Australia’s National Electricity Market, the grid which powers the entire east coast, South Australia and Tasmania (AEMO 2024). With more homes, businesses and warehouses being built every day, our potential for rooftop solar is only growing.

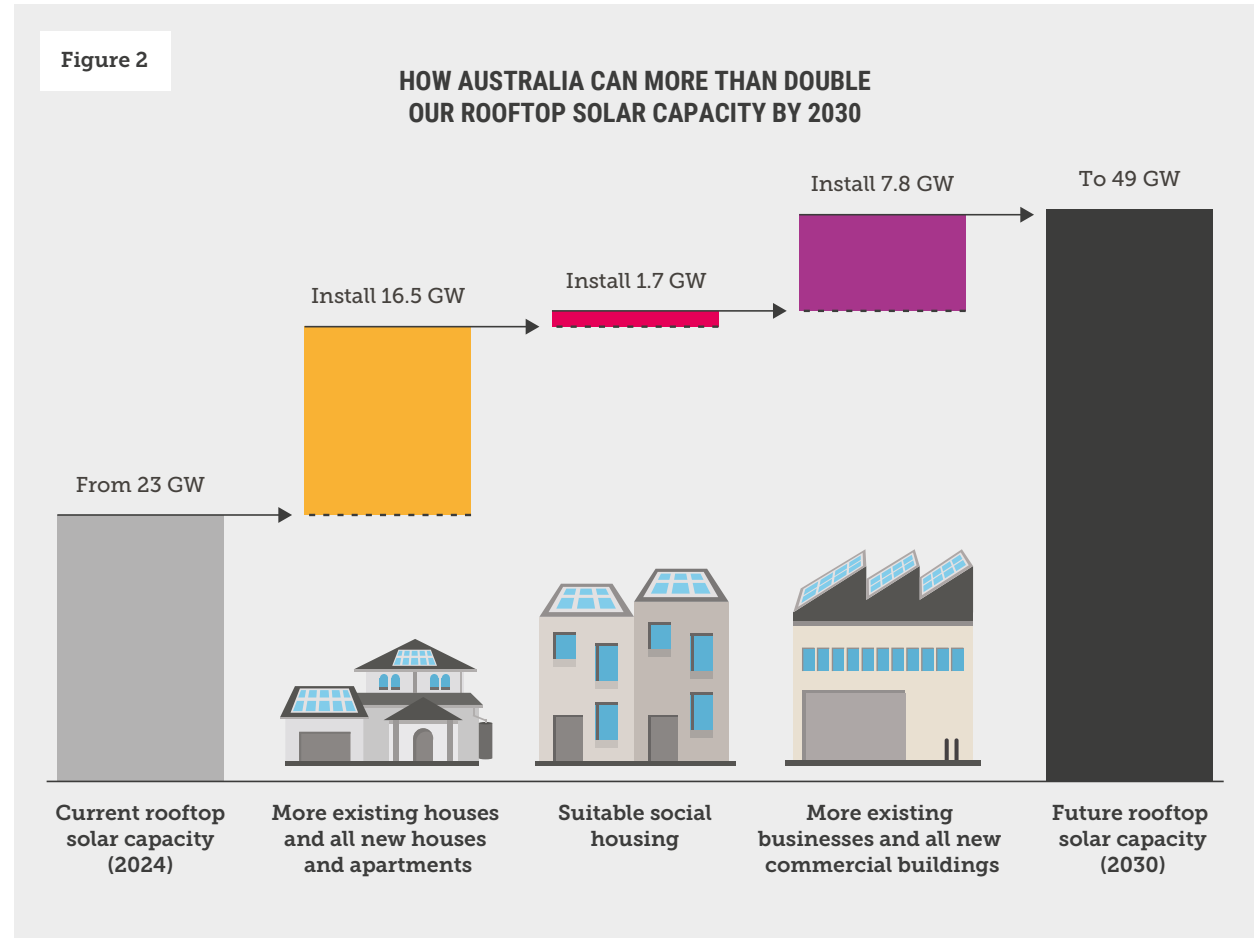


Source: Total potential capacity for residential dwellings is based on average solar potential per dwelling from Dehghanimadvar et al. (2024), applied to 2021 Census Data. Commercial, industrial and public buildings potential from Roberts et al. (2019). The potential for solar installations on vacant land at industrial facilities is not included, but is likely to add even more capacity.

In the Climate Council's *Seize the Decade* plan to cut climate pollution further and faster this decade, we identified that Australia should aim to roughly double our rooftop solar capacity by 2030, to 49 GW of solar backed up by 25 GW of household and community batteries (Climate Council 2024). We have the roof space and abundant sunshine to do this, as well as huge community support for solar and great industry know-how.

Australia's solar industry has built massive momentum, installing an average of 300,000 household solar systems every year for the last five years APVI (2024a). Figure 2 highlights that keeping up this momentum will go a long way towards the goal of having 49 GW of solar installed on rooftops by 2030.

We can then close the gap on installations by switching on the benefits of solar for those who are currently missing out. This includes people living in social housing, those living in new apartment buildings, and Aussie businesses. Targeting the roll-out of more rooftop solar and storage this way will mean lower energy bills, less climate pollution, and greater energy independence for Aussie households and businesses. The following chapter unpacks how we can bring these benefits to millions more Australians in the years ahead.



Source: Climate Council estimates. See the Methodology Notes chapter for full assumptions.



We can switch on the benefits of solar for those who are currently missing out: people living in social housing, those living in new apartment buildings, and more Aussie homes and businesses.

2.

Key opportunities to supercharge rooftop solar across our homes and businesses





Australians have installed a lot of rooftop solar over the past decade, because it makes sense. It cuts energy bills, slashes climate pollution, and puts households in control of their energy bills. We can accelerate this momentum to reach 49 gigawatts of rooftop solar this decade by focusing on a few specific opportunities. These are:

- › continuing to expand uptake by the owners of freestanding homes;
- › ensuring all new homes and commercial buildings are built with solar;
- › bringing the benefits of solar to people living in social housing; and
- › supporting businesses to take it up at much greater rates.

This can add significant renewable electricity capacity quickly, while we continue the important work of rolling out transmission, large-scale renewables and grid-level storage to slash climate pollution from our electricity sector. It can also ease cost of living pressures for more Australians by unlocking the bill-busting benefits of solar power.

OPPORTUNITY #1

Get more owner-occupied houses to take up solar



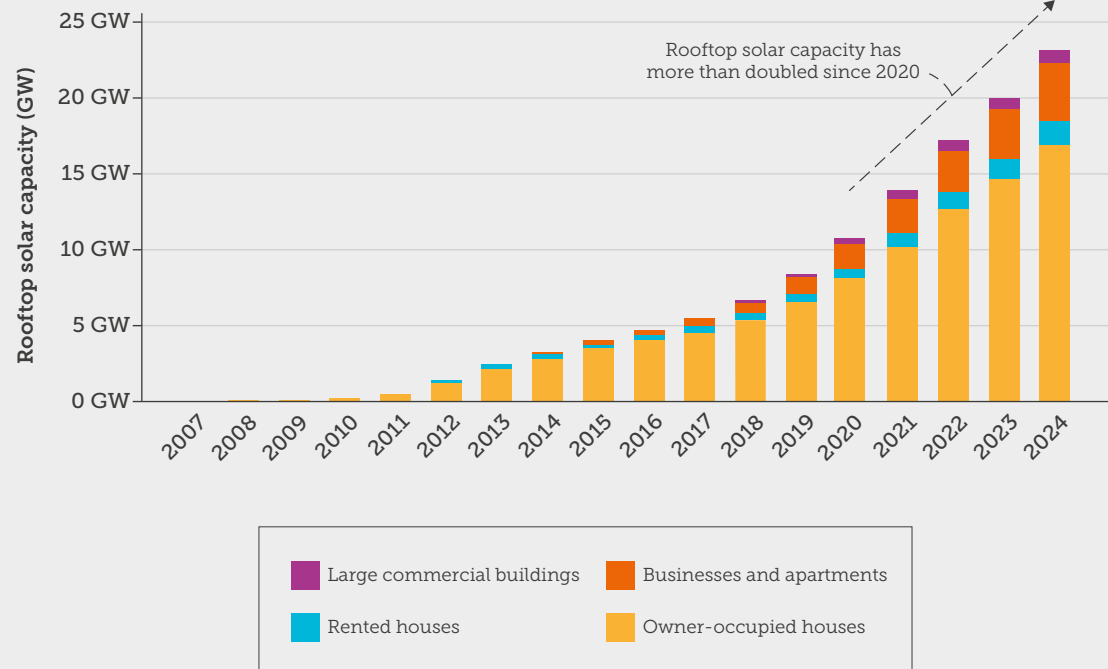
Owner-occupied, freestanding homes have been the backbone of Australia's rooftop solar surge to date. Over four-fifths of residential solar can be found on the rooftops of owner-occupied houses (Energy Consumers Australia 2023).¹ This uptake has been driven by low practical barriers to installation, generous government incentives and a significant drop in upfront costs over time.

Despite high take-up of rooftop solar in this segment, only slightly more than half of all owner-occupied houses have solar installed today. The vast majority of households with solar are yet to add any type of storage to this. There is a clear opportunity to get even more solar and storage onto these rooftops, which means understanding what will motivate and enable homeowners to take these up.

Half of Australia's owner-occupied houses are missing out on the benefits of rooftop solar.

Figure 3

ROOFTOP SOLAR CAPACITY HAS INCREASED SIX-FOLD OVER THE PAST DECADE

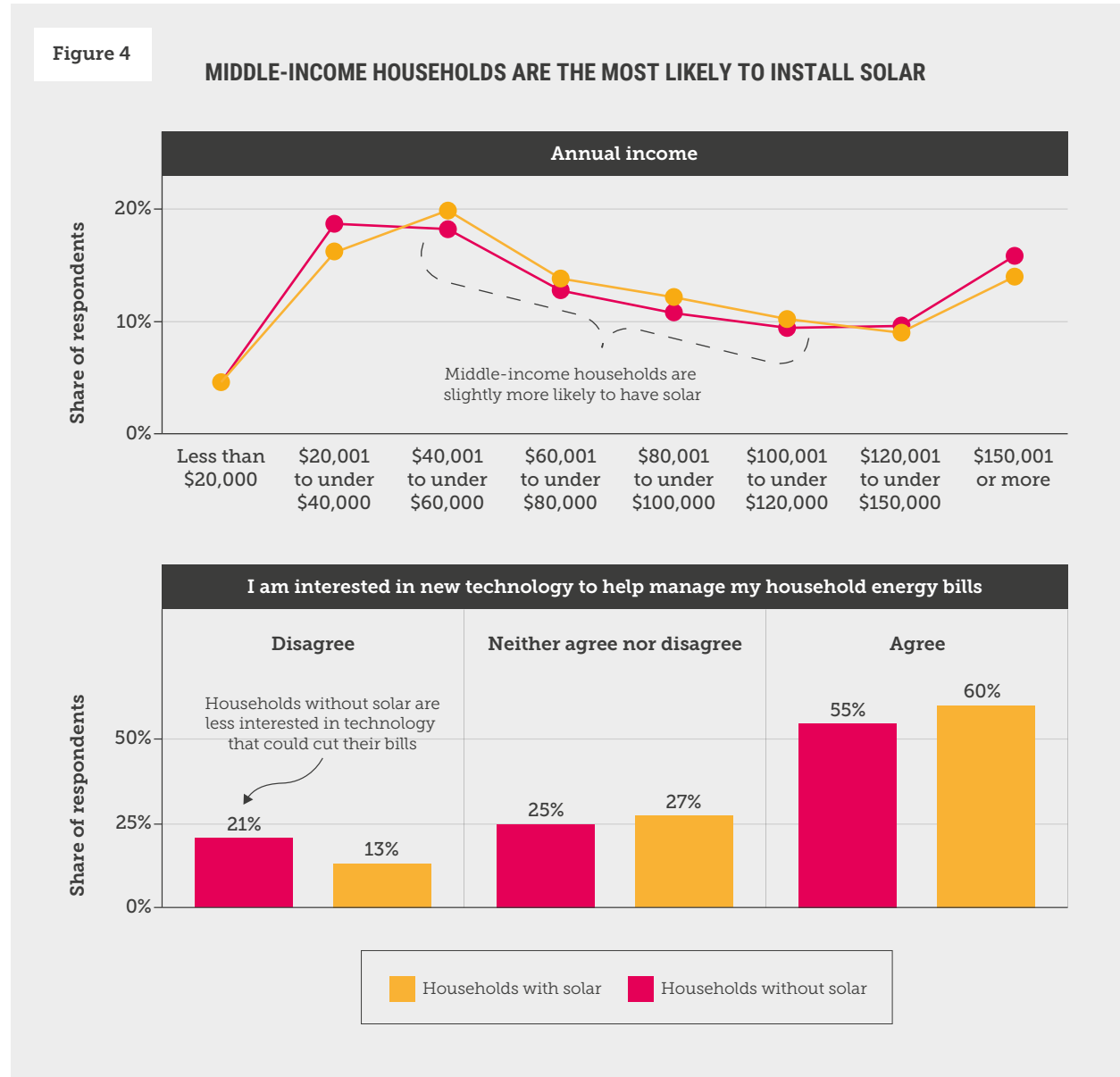


Source: Climate Council analysis of APVI (2024b). Historic solar capacity of rented houses is implied only, based on 2023 survey data (Energy Consumers Australia 2023). **Note:** Years refer to financial years.

¹ 86 percent of households with rooftop solar live in an owner-occupied detached or semi-detached dwelling, with the majority of remaining solar systems on tenanted detached and semi-detached dwellings.

Cost-of-living relief is a key reason to invest in rooftop solar, and people who care about reducing their energy bills are more likely to install solar. Climate Council analysis of the latest *Energy Consumer Behaviour Survey* shows that middle-income households are the most likely to install solar, compared to low-income households (who may not be able to afford the upfront costs) and high-income households (who may have more disposable income and less interest in reducing their energy bills) (see Figure 4, top). People who are interested in new technology to help manage their energy bills are also more likely to install solar. Likewise, people who are *not* interested in technology to cut energy bills are *much less likely* to install solar (see Figure 4, bottom).

Because rooftop solar can reduce energy bills by 40 to 60 percent and save the average household more than \$1,500 a year, an investment in solar pays for itself over time (Vorrath 2023; Dehghanimadvar et al. 2024). However, the upfront costs of solar and batteries are still a barrier for many households. With half of Australians having less than \$1,000 in savings and three-quarters struggling with cost of living (Blackburn 2024), households need help to spread the costs of solar out over time. Zero and low-interest finance is one way to achieve this, by allowing households to install rooftop solar and batteries at a minimal upfront cost to be paid off over time with their bill savings. Zero-interest loans are already available in the ACT (as discussed in Box 1) and Tasmania.



Source: Climate Council analysis of Energy Consumers Australia (2023); counting owner-occupied detached and semi-detached dwellings only.

These programs need to be continued and rolled out in other jurisdictions, providing zero-interest financing to those who need it most, like households on low incomes. Other households can access low-interest finance from commercial providers. Some low-interest options are already available, like [CommBank's Green Loan](#), which provides a low interest rate and fees for purchases of solar, batteries and other clean energy upgrades. More commercial providers need to make these options available for their customers. It's a win-win for banks and homeowners: homeowners are able to save money on energy bills, and banks clean up their lending.

The Australian Government's Home Energy Upgrade Fund (HEUF), while similar, has not yet been implemented appropriately to accelerate the rollout of rooftop solar and batteries. The \$1.3 billion HEUF is designed to provide green loans to help Aussie households make upgrades to their homes allowing the more efficient and clean use of energy. However, the only concessional finance option currently made available through the HEUF has an interest rate of 7.3 percent (Plenti 2024), which is significantly higher than most mortgages or business loans (Reserve Bank of Australia 2024). Despite attracting taxpayer support, this loan is unlikely to be a cost-effective option for most homeowners. There is a significant opportunity for this fund to be reconfigured to provide much lower-interest finance, supporting more households to install rooftop solar and batteries.

BOX 1: ZERO-INTEREST LOANS FOR ROOFTOP SOLAR AND BATTERIES: THE ACT SUSTAINABLE HOUSEHOLD SCHEME

Since July 2021, the ACT's Sustainable Household Scheme has funded over 11,760 rooftop solar systems and 2,676 household batteries for Canberran homeowners, in addition to electric vehicles, water heaters, air conditioning and heating (ACT Government 2023). Overall, the scheme has provided more than \$212 million in finance, through a commercial lending partner.

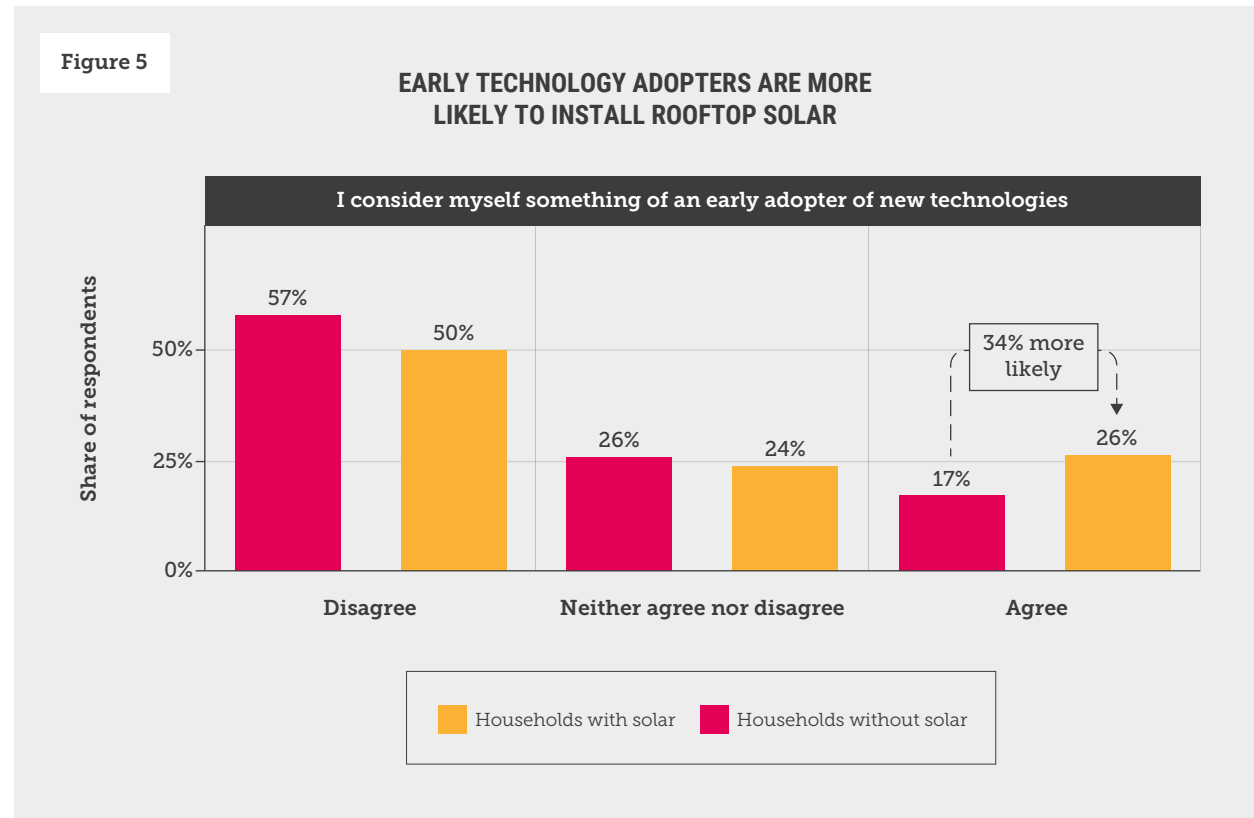
The lending partner can refer homeowners to their network of tradies. After a homeowner organises the installation and it is completed, the lending partner pays the solar installer (or other tradie) directly, reducing friction for all parties.



Aside from a desire to ease cost-of-living pressures, one of the strongest predictors of solar uptake is attitudes to technology. People who consider themselves early adopters of new technologies are 34 percent more likely to have solar panels than those who do not (Figure 5).

Rooftop solar is a proven technology, with more than two decades of deployment in Australia demonstrating its reliability, practicality and benefits. A high-quality public information campaign can help boost awareness of these facts, with a focus on reaching owner-occupiers of freestanding homes who don't consider themselves to be early adopters of new technologies.

Together, access to low- and zero-cost finance for the upfront costs of solar and storage, a public information campaign about the proven benefits of rooftop solar, and improvements to how solar households interact with the grid (discussed in chapter 3) can help drive further uptake among the approximately 2.8 million owner-occupied freestanding homes that don't yet have panels on the roof.² This segment has some of the greatest potential to roll out even more solar and storage quickly and efficiently, building on the strong uptake already seen to date.



Source: Climate Council analysis of Energy Consumers Australia (2023); counting owner-occupied detached and semi-detached dwellings only.

Cost-of-living relief is a key reason to invest in rooftop solar, however the upfront costs are still a barrier and households need help to spread the costs out over time.

² Climate Council estimate, derived from Energy Consumers Australia (2023) and ABS (2021a).

OPPORTUNITY #2

Ensure all new homes have solar from day one



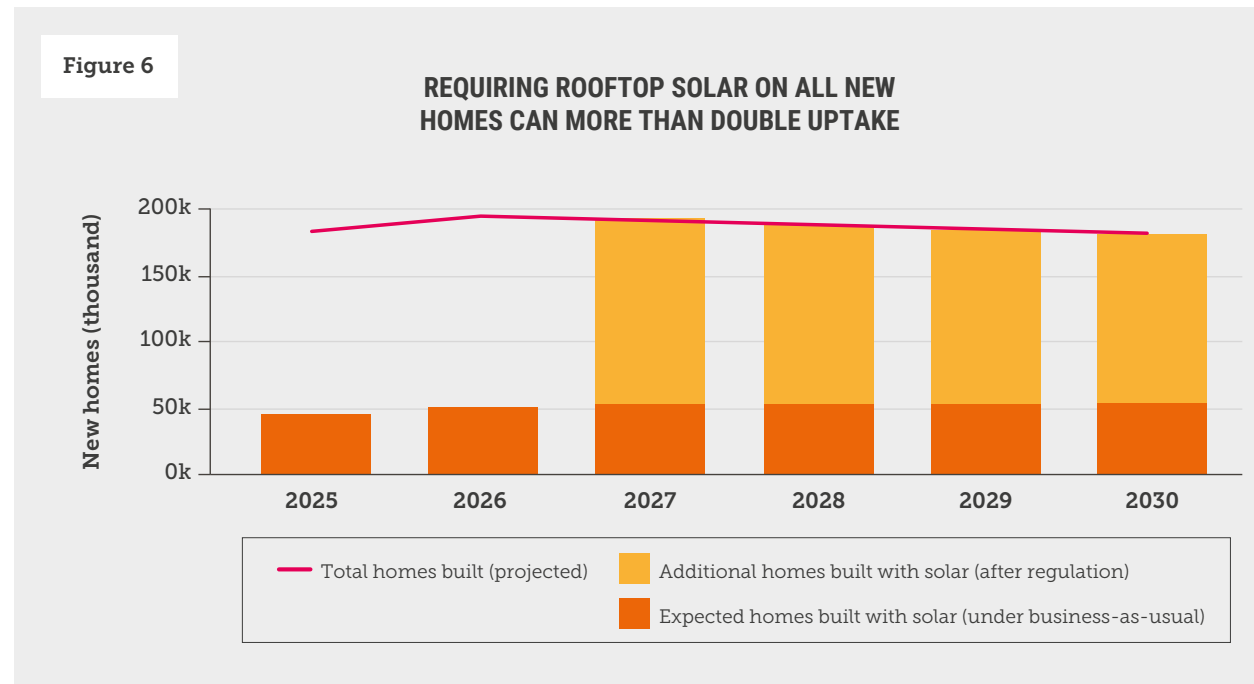
The best time to install rooftop solar and batteries is when building a house. Ensuring solar is considered during construction can lower installation costs while maximising benefits – because solar can be factored into a property’s original design, electrical plans and construction. Solar panel prices are also plummeting as manufacturing capacity ramps up in China, the USA and India (International Energy Agency 2023), making rooftop solar an increasingly cost effective addition to new homes.

Despite these advantages, two-thirds of new houses are being built without a solar system (ACIL Allen 2022). While about 50 percent of existing houses have rooftop solar, only about 30 per cent of new houses do – meaning many new homeowners are missing out (Energy Consumers Australia 2023; ACIL Allen 2022).

There is a significant opportunity to bring the benefits of solar to more people simply by ensuring panels are added as a standard feature to all new and substantially rebuilt properties. This core energy infrastructure can be delivered along with space to install a battery and charge an electric vehicle – making it as easy as possible for households to take up one or both of these technologies if it suits their needs.

Climate Council modelling indicates making rooftop solar standard for all new and substantially rebuilt homes – both houses and apartments – could see panels added to an additional 537,000 homes by 2030, beyond business-as-usual installations (as shown in Figure 6). This would unlock a further 2.7 gigawatts (GW) of clean electricity generation capacity, equivalent to more than half of Victoria’s coal-fired power plants (AEMO 2024).

Putting rooftop solar on new apartment buildings is an especially important opportunity, because there are additional physical, financial and governance challenges to retrofitting solar in these buildings. These barriers are further discussed in Opportunity #5.



Source: Climate Council Analysis, based on ACIL Allen (2022). Assumes all new attached and detached homes are built with a 6.6 kw solar system. In practice some houses could not accommodate a solar system, while many houses will opt to install a larger system, averaging out the expected additional capacity.

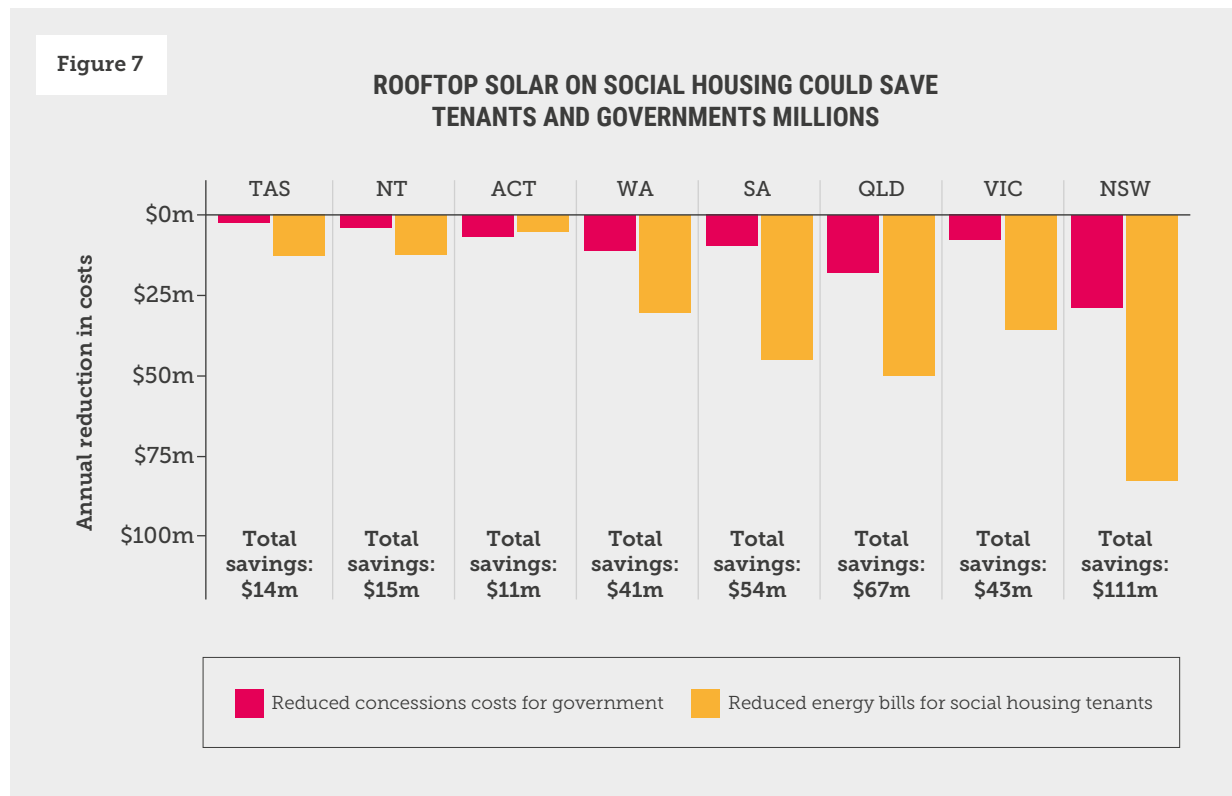
OPPORTUNITY #3

Put solar on most social housing to unlock cost savings for tenants and governments



There are over 260,000 detached and semi-detached social housing dwellings in Australia, representing about 3 percent of all houses (ABS 2021). Social housing is made up of public housing provided by governments, and community housing provided by not-for-profit organisations. People living in social housing are some of the most economically vulnerable Australians, including people who cannot work because of illness and disability, single parents on very low incomes, and others experiencing major disadvantages. Their disposable income is typically half of the national average, and nine of out ten households receive most of their income from a government payment (ABS 2022a).

People living in social housing would therefore benefit the most from the bill savings and cost-of-living relief provided by rooftop solar. Households that receive most of their income from government payments spend 1.5 times more of their income on electricity bills than households that receive their income from employment (ABS 2024b). Being unable to access the benefits of rooftop solar represents a 'poverty premium' for social housing tenants, potentially increasing their energy costs by 20 percent (Anglicare Australia 2023). Climate Council analysis suggests rooftop solar could save these households \$600 to \$1,200 per year, easing the burden of bills on some of the most vulnerable people in our community.



Source: Climate Council estimates, based on average energy cost savings estimated by Dehghanimadvar et al. (2024), social housing dwelling counts from ABS (2021a) and the value of concessions from state and territory government sources. Government savings are presented in gross terms, excluding the cost of rooftop solar systems. See Methodology Notes for full assumptions.

Governments can save money too, with lower energy bills meaning less spending on power bill relief. Federal, state and territory governments spend billions each year on one-off and ongoing energy bill rebates. The Federal Government alone will spend \$5 billion on one-off energy bill rebates between 2022 and 2025 (Chalmers et al. 2024). This is an expensive band-aid solution to an ongoing problem: electricity costs are sometimes too high and volatile for vulnerable, low-income households to manage.

Redirecting the costs of electricity concessions and rebates to installing rooftop solar on social housing is a smarter, long-term way to reduce energy bills and ease cost of living pressures. Plus, it creates more jobs in the solar industry and cuts climate pollution – which energy rebates never will. As shown in Figure 7, Climate Council analysis suggests that installing rooftop solar on all detached social housing properties could save governments up to \$84 million a year, while leaving no household worse off.³ Collectively, households could save up to \$270 million a year, after accounting for the substitution of energy concessions.

To unlock these cost savings, federal and state governments can partner on installing rooftop solar on all 260,000 detached and semi-detached social housing properties, backed up by storage. This would be done as direct capital upgrades to homes, delivered by state housing agencies and jointly funded by the federal government. This kind of collaboration is already happening at a small scale through the \$300 million [Household](#)

[Energy Upgrades Fund](#) (Chalmers et al. 2023). For more information on how governments can scale this up for broader partnerships on the deployment of solar and storage, see chapter 4.

In addition to these community and publicly owned houses, there are approximately 19,000 further indigenous community housing properties which could benefit from solar (AIHW 2024). These properties could also receive solar panels directly, or where concentrated in remote areas, a tailored, centralised solution incorporating larger solar and storage equipment. For example, the Marlinja community is now powered by a central solar and storage system, which efficiently meets their energy needs (Original Power 2024).

Installing rooftop solar and storage on social housing can also benefit our grid. Properties owned by a single entity, like a state government or major housing provider, can be more easily networked together into 'virtual power plants'. Virtual power plants (VPPs) combine many smaller batteries into a single, big, on-demand energy source that is visible to grid operators and can be called upon to manage supply and demand throughout the day.



BOX 2: SOUTH AUSTRALIA'S VIRTUAL POWER PLANT

The South Australian Government has partnered with Tesla to install solar and batteries on over 5,500 public housing properties, saving the typical tenant up to \$562 per year. These solar and storage systems are working together to form a virtual power plant, the largest one in Australia. It has already firmed up power supply to the grid when problems have occurred with transmission infrastructure or power stations.

While initial grant funding from the state government set up the South Australia Virtual Power Plant, it is now operating commercially with Tesla bearing the costs of solar and battery installations.

Source: Department of Energy & Mining, South Australia (2022).

Installing rooftop solar on social housing would share solar savings with those most vulnerable to cost of living pressures.

³ Analysis is based on the average social housing dwelling. Average energy bill savings from solar are generally several times the value of energy concessions. Where a rooftop solar system does not provide the expected savings to households, energy concessions should still be available.

This means excess solar generated from social housing properties would be stored for use by residents when the sun goes down, or to be fed back into the grid when it is needed most.

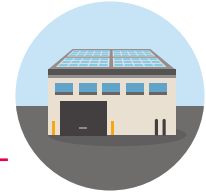
This opportunity is already a reality for over 5,500 public housing tenants in South Australia, who have rooftop solar and a battery working together to cut their energy bills, and provide more clean energy for all South Australians (see Box 2).

Rolling out rooftop solar and storage to social housing is a huge opportunity to keep boosting clean energy generation and make our grid more stable. Installing a solar system on every suitable detached and semi-detached social housing property in Australia could unlock up to 1.7 gigawatts in generation capacity by 2030, equivalent to a medium-sized coal-fired generator. Importantly, it will also make our renewable energy system fairer by sharing the benefits of cheap and reliable solar right across the Australian community, including with those most vulnerable to cost of living pressures.



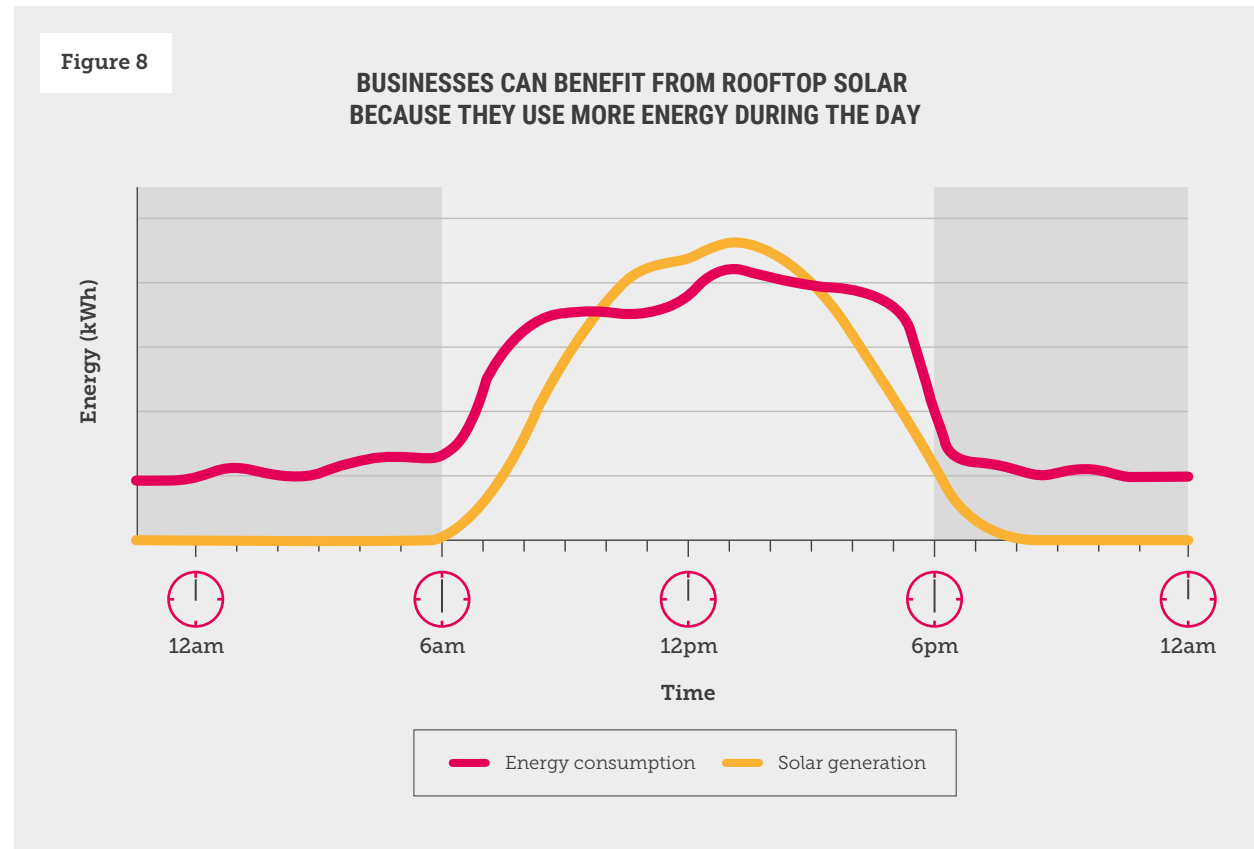
OPPORTUNITY #4

Accelerate rooftop solar and storage for businesses where there is untapped potential



Historically, households have led Australia's solar spree. However, many Australian businesses can actually benefit from rooftop solar even more than households. This is because more of their energy use is centred on the middle of the day – during business hours – when solar generation is also highest. As shown in Figure 8, this daytime energy use is well-suited to rooftop solar.

Given the overlap of business hours and sunshine hours, businesses stand to save significantly on energy costs. For example, an office accommodating 40 people could halve its electricity bill by installing 24 kilowatts of rooftop solar – equivalent to about four household solar systems (Clean Energy Council 2016). Despite these bill-busting benefits, most businesses haven't taken up this opportunity. To date, about 3.8 gigawatts (GW) of commercial-scale rooftop solar has been installed nationally. This represents only about 4-10 percent of available commercial rooftop space, and about one-fifth of currently installed household solar capacity (Roberts et al. 2019, APVI 2024b).

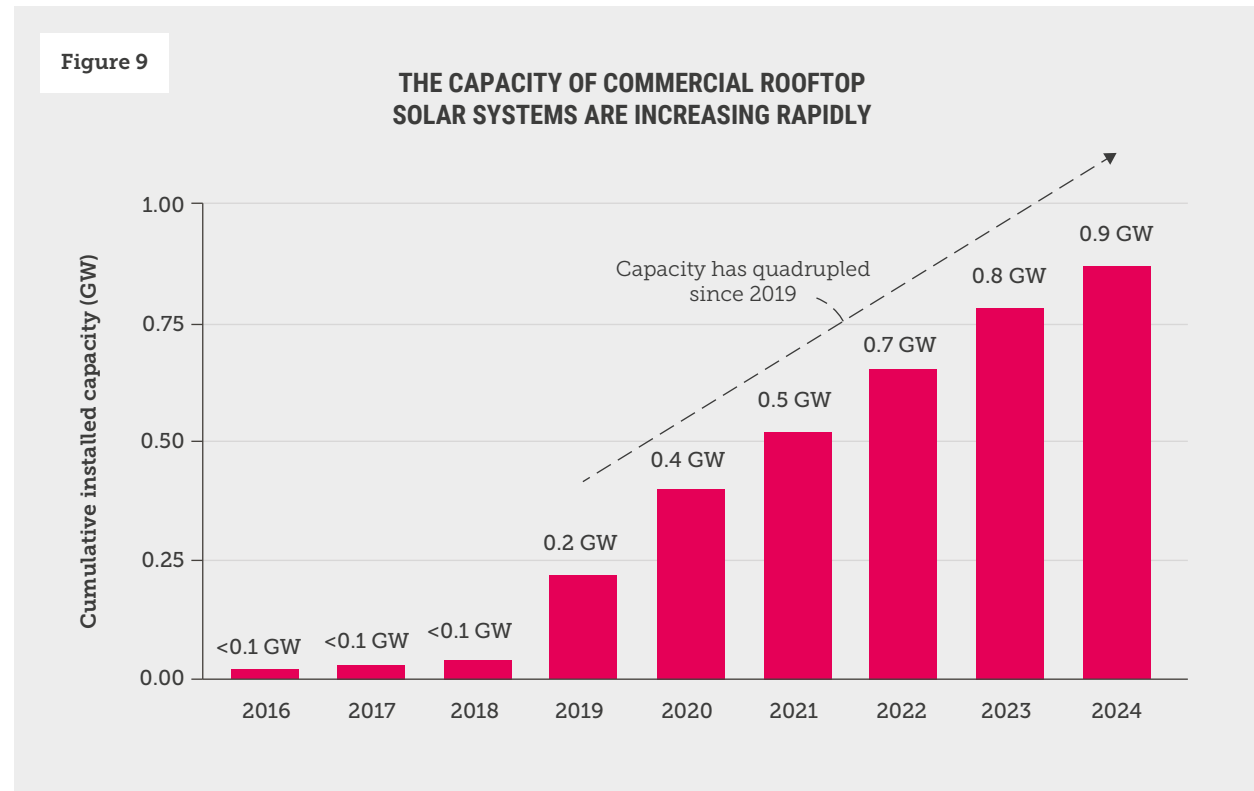


Source: Illustrative example, based on Clean Energy Council (2016).

While there are some challenges in accurately assessing the commercial-scale solar capacity installed to date,⁵ survey data suggests only one in 10 small businesses have rooftop solar installed (Energy Consumers Australia 2023).

In recent years there has also been an increase in the number of very large rooftop solar installations on warehouses and factories, and sometimes mounted directly on the ground at mines and other industrial facilities (APVI 2024b, 2024c). As shown in Figure 9, though this type of rooftop solar is relatively new, it has grown rapidly to just under one gigawatt (GW) of capacity in about six years.

This growth has been driven by some of Australia's largest businesses. Collectively, retailers like Woolworths, IKEA, Bunnings and ALDI have installed rooftop solar capacity equivalent to tens of thousands of homes. As explained in Box 3, these investments can help businesses reach their renewable energy targets and cut their power bills.



Note: Includes solar systems with a capacity of at least 100kW; equivalent is based on a household solar system of 6kW.

Source: Climate Council estimates, based on APVI (2024b, 2024c). Only solar systems developed for behind the meter use are included.

Nine in 10 small businesses are missing out on the benefits of rooftop solar – but large commercial systems are rapidly increasing.

⁵ For the purpose of this report, and consistent with APVI (2024b), rooftop solar systems with a capacity of 15-100 kilowatts are defined as 'commercial-scale'. However many small businesses may only have space or the need for a small, <15 kilowatt system. Conversely, households – especially apartment complexes – may install large, commercial-scale rooftop solar. As a result, the capacity of business and household solar in this report is an estimate only.

BOX 3: ROOFTOP SOLAR SUPPORTS WOOLWORTHS' GOAL OF 100% RENEWABLES BY 2025

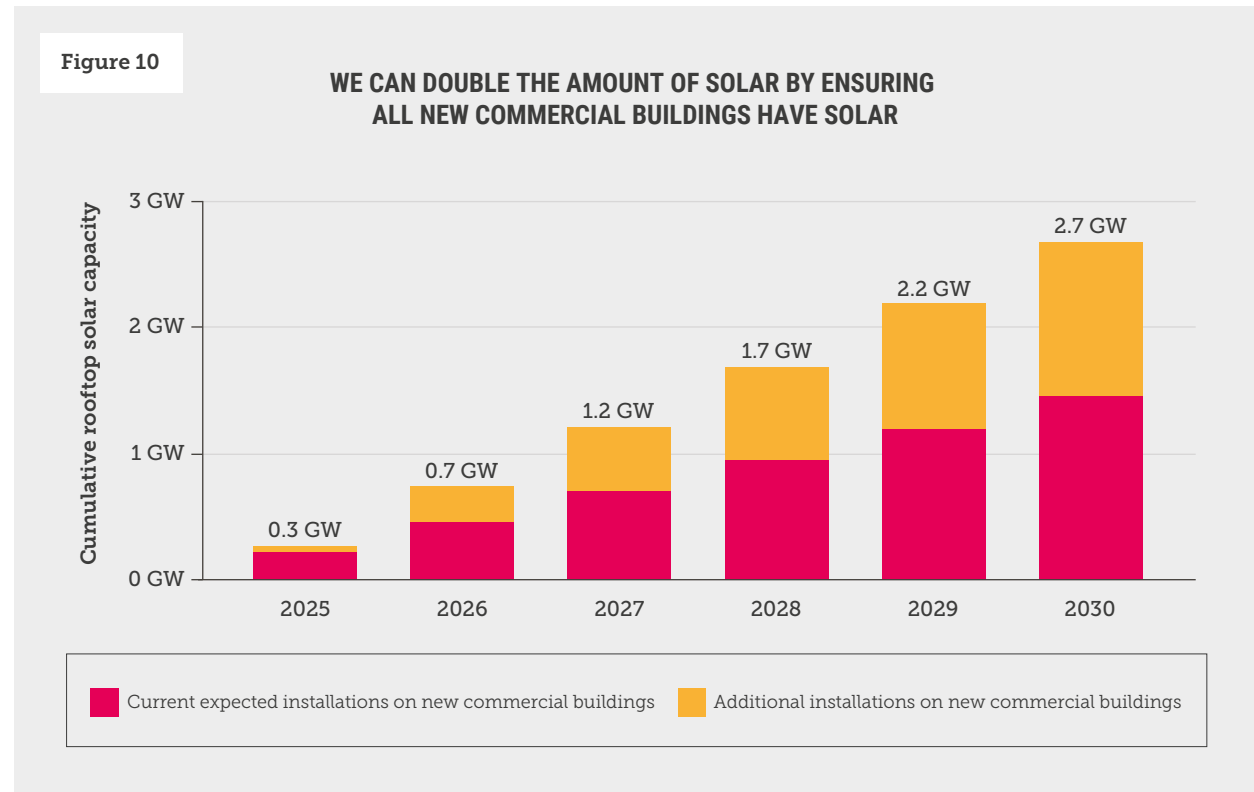
The Woolworths Group is a major energy user, accounting for about 1 percent of Australia's total electricity use (Woolworths Group 2021). In order to support the company's goals of 100% renewable electricity by 2025, 215 rooftop solar systems have been installed on its stores and distribution centres, of which 112 are 'large' systems greater than 100 kilowatts (The Guardian Labs 2023).

This represents over 100,000 solar panels, and typically offsets each supermarket's energy use by 10 to 30 percent (Clean Energy Regulator 2024).



Because large businesses have high energy needs – like heating and cooling, lighting and refrigeration – more of the power generated by rooftop solar is used on-site. This benefits everyone, because businesses have lower energy needs from the grid, which puts downward pressure on electricity prices. When big businesses use less electricity from the grid, this also cuts climate pollution and puts less strain on power distribution networks, reducing the need to invest in upgrades.

New commercial buildings can also put solar on the roof as a standard part of the build, together with storage. As shown in Figure 10, Climate Council analysis indicates that making rooftop solar standard on all new commercial buildings from May 2025 can unlock an additional 1.2 gigawatts (GW) of rooftop solar by 2030, almost doubling the capacity expected at current rates.



Source: Climate Council estimates, see Methodology Notes for details.

When big businesses use less electricity from the grid, this benefits everyone by putting downward pressure on power prices and cutting climate pollution.

OPPORTUNITY #5

Unlock the benefits of solar for more renters and apartment dwellers



Historically, few renters and people living in apartments have had access to the benefits of rooftop solar. There are physical, economic and social challenges which make it difficult or unappealing to retrofit rooftop solar. For these reasons, the Climate Council's plan does not assume any solar retrofitting for rental properties or apartment buildings.

Renters and apartment residents still can – and should – benefit from increasing Australia's solar capacity. If we ensure that all new buildings have rooftop solar, more renters and owners of new apartments and houses will gain access to solar over time. Those who can't install solar on their roof can still access the bill-busting benefits of solar too, thanks to innovations like solar sharing schemes.

Apartments

Rooftop solar on apartment buildings is rare. That's because there are a number of challenges associated with apartment building installations:

- › **Physical challenges:** Roof space on apartment buildings is limited, and may be required for other uses, ranging from swimming pools to heating and cooling equipment. Older buildings may also lack internal space for cabling, inverters, or solar sharing technology. However, as the price of solar panels continues to reduce, mounting solar panels on apartment walls may become viable in some cases.
- › **Governance challenges:** Because roof spaces are usually common property, a special resolution must be passed to install solar. In most states and territories, this requires a 75 percent majority of owners, which can be difficult to achieve in buildings where many apartments are rented, leaving owners without the incentive of bill savings.

- › **Financial challenges:** Whereas individual homeowners can often finance a solar installation through their mortgage, owners corporations have more complicated borrowing conditions. Because owners corporations can only access unsecured finance, interest rates can be twice that of a typical mortgage. Finally, apartment owners generally cannot use the government rebates available for house owners to install shared solar systems, despite these being more efficient.

Not all apartment buildings are suitable for solar. High-rise buildings with more than four storeys generally do not have enough roof space to justify retrofitting solar, because the cost savings are split between so many people. But half of Australian apartment residents live in buildings with less than four storeys (ABS 2021). These apartment buildings can install rooftop solar and reap the benefits of lower energy bills – including for common property uses like elevators.

If we ensure that all new buildings have rooftop solar, more renters and apartment residents will gain access to solar over time.

Shared solar systems can provide efficient power generation for apartment buildings. Relative to a typical installation on a house, a single apartment building can benefit from a larger solar installation using high capacity inverters. For example, a single apartment building with 40 units could install a 70kW solar system, equivalent to the solar capacity of about 10 houses – using resources and labour efficiently (Yarra Energy Foundation 2022).

These shared solar installations are increasingly being supported by smart technology, such as the Australian SolShare, which shares solar generation amongst apartments fairly (Alume Energy 2024). This technology can result in up to 55 percent more solar being consumed on site, increasing energy bill savings, and reducing the load on the distribution network when surplus electricity is exported (Alume Energy 2024).

This greater efficiency helps to overcome the typically higher costs of solar for apartment buildings.

The challenges described above have historically reduced the uptake of rooftop solar by apartment residents, but this is changing. The Federal Government has worked with the ACT and Victorian governments to provide rebates and zero-interest loans directly to apartment owners corporations (ACT Government 2022; Solar Victoria 2024a). These programs level the playing field for apartment owners, ensuring they are able to access comparable rebates to owners of houses. The Victorian program goes further, providing rebates of up to \$2,800 per apartment – twice that available to owners of houses – acknowledging the additional challenges associated with installing solar in apartments (Solar Victoria 2024a).

State and territory governments should review the success of these initial programs to assess the cost-effectiveness of solar for apartments. In the meantime, solar should be required on all new apartment buildings, as proposed for commercial buildings in the 2025 update to the *National Construction Code* (NCC). People living in apartment buildings that don't have solar could also benefit from models for community solar, like WA's "Sunshine Saver", discussed in Box 4 on the following page.



Renters

Australians who rent are three times less likely to have access to solar than people living in owner-occupied homes (Energy Consumers Australia 2023). While saving money on energy bills encourages owner occupiers to install solar, this benefit is not relevant to landlords, because their tenants are responsible for paying electricity bills. And while tenants may wish to reduce their electricity bills with a rooftop solar system, they do not have the right to install this equipment.

Some state and territory governments have already stepped in to help address this issue. For example, the Victorian Government offers up to \$2,800 in rebates and zero-interest loans to encourage landlords to install rooftop solar (Solar Victoria 2024b). However, uptake has been low, with only 306 applications approved in the first five months of 2024, compared to nearly 18,000 applications for owner-occupied properties (Solar Victoria 2024c).

Ensuring Australian renters can share in the benefits of rooftop solar is important for ensuring our clean energy system is also a fair one. Over time, more landlords may choose to install solar to take advantage of increases in property values, government rebates, and reductions in the cost of solar. But bringing the benefits of solar directly to more rental properties is likely to take time. The split in incentives for renters and landlords makes it harder to increase solar installations for renters, while there are other, more straightforward opportunities to get more rooftop solar into our grid this decade.

The mandatory inclusion of solar on new and substantially renovated houses and new apartment buildings will ensure that over time, more of the properties available in the rental market come with solar as a standard feature. In the meantime, there are other ways to bring the benefits of solar power to Australians who rent, like community solar banks and solar gardens. For renters, our focus should be on ensuring they can access the benefits of cheap, reliable solar in lower bills, but this does not necessarily need to be on their own rooftops in the near term.

BOX 4: COMMUNITY SOLAR BANKS

Community solar banks allow households who can't install solar on their roofs to benefit from a solar farm located elsewhere. Members of community solar banks can either pay a subscription fee, or make an upfront investment. They then receive credits on their energy bills, which are based on how much revenue the community solar farm earns.

The Australian and West Australian Governments are operating "Sunshine Saver", a community solar bank model for low-income households and renters.

The program is available in Esperance and a selection of other small towns serviced by large solar farms. Eligible households subscribe for \$1 per day, and receive an automatic daily bill credit of \$1.5, plus 10 percent off the cost of power used between 6am and 6pm. This saves households about \$40 on their energy bill. The program is structured so that no household is worse off, but the time-of-use savings are an additional incentive to use power at times when electricity is available from cleaner and more affordable solar farms.

Source: Horizon Power (2024).

Community solar banks allow renters to benefit from a solar farm located elsewhere.

Everyone has a role to play on the journey to double our rooftop solar. People living in a house they own will continue to lead the way, while Aussie businesses increasingly reap the benefits of rooftop solar and storage. Governments have a role to play too, by putting rooftop solar on social housing, and supporting households and businesses to install solar with policies, investment, and high-quality, trusted information.

As we build this new rooftop solar capacity, we also need to make sure our grid is ready to accommodate it. This doesn't just mean poles and wires: it means new, smarter ways to store and use electricity which will benefit Australian families and businesses – as discussed in the next chapter.



3.

Key opportunities
to deliver a grid that
soaks up more solar





As we expand the rollout of rooftop solar, we need to adapt our electricity grid to ensure Aussie homes and businesses get the full benefit of all the clean, cheap energy that will be created.

To make the most of the electricity generated by millions more solar systems on household and business rooftops by 2030, we need a grid that can:

- › Maintain stability and resilience so that power is always available when it's needed;
- › Provide benefits and returns to households and businesses that invest in solar and batteries;
- › Share the benefits of abundant, affordable solar power with the whole community, including people who don't have solar;
- › Be safely, efficiently and affordably managed by energy system operators.

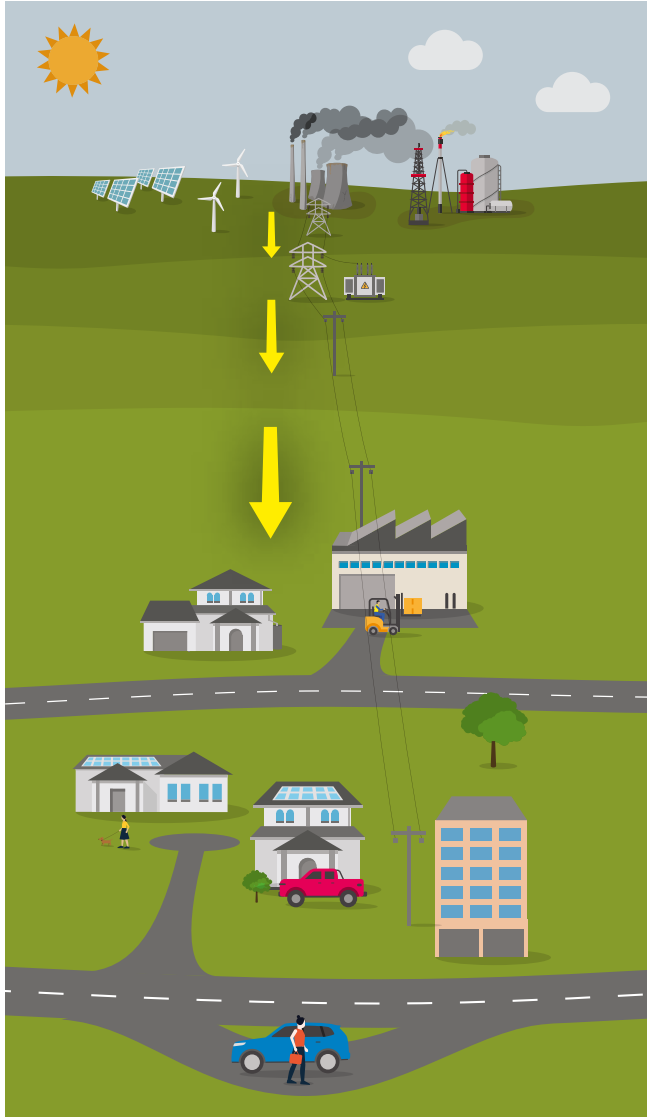
As a world leader in rooftop solar, Australia is dealing with challenges that most other countries have not yet had to face. Improving how our grid works is essential for maintaining and accelerating our momentum in installing even more rooftop solar and delivering an affordable, reliable energy system that works for all Australians. In the process, we can show the world how it's done to help other countries with high rooftop solar uptake keep building on their own momentum.

Three priority areas will help us build the grid that we need to maximise rooftop solar potential in Australia. There is a significant body of policy work underway across all levels of government and with energy system regulators to advance the many practical actions needed to deliver on these. The priorities identified here are the end goals that governments, regulators, industry and communities should be striving towards together.

		OPPORTUNITIES		
		Shift electricity use to when we generate the most solar power	Use household batteries to store extra solar power for use later	Use community-scale batteries to expand the benefits to the local network
OUTCOMES	Maintain stability and resilience so that power is always available when it's needed	✓	✓✓	✓✓✓
	Provide benefits and returns to households and businesses that invest in solar and batteries	✓✓	✓✓✓	✓✓
	Share the benefits of abundant, affordable solar power with the whole community, including people who don't have solar		✓	✓✓
	Be safely, efficiently and affordably managed by energy system operators.		✓	✓

Improving how our grid works is essential for supercharging rooftop solar and delivering an affordable, reliable energy system for all Australians.

THE SHIFT IN OUR ENERGY SYSTEM



GENERATION

From:
Inflexible coal-dominated utility-scale power generation

To:
Renewable energy-dominated utility-scale power generation, backed up by utility-scale storage

TRANSMISSION

From:
Many large power lines delivering power in one direction

To:
Optimised number of large power lines delivering utility-scale power to distribution networks and across regions

DISTRIBUTION

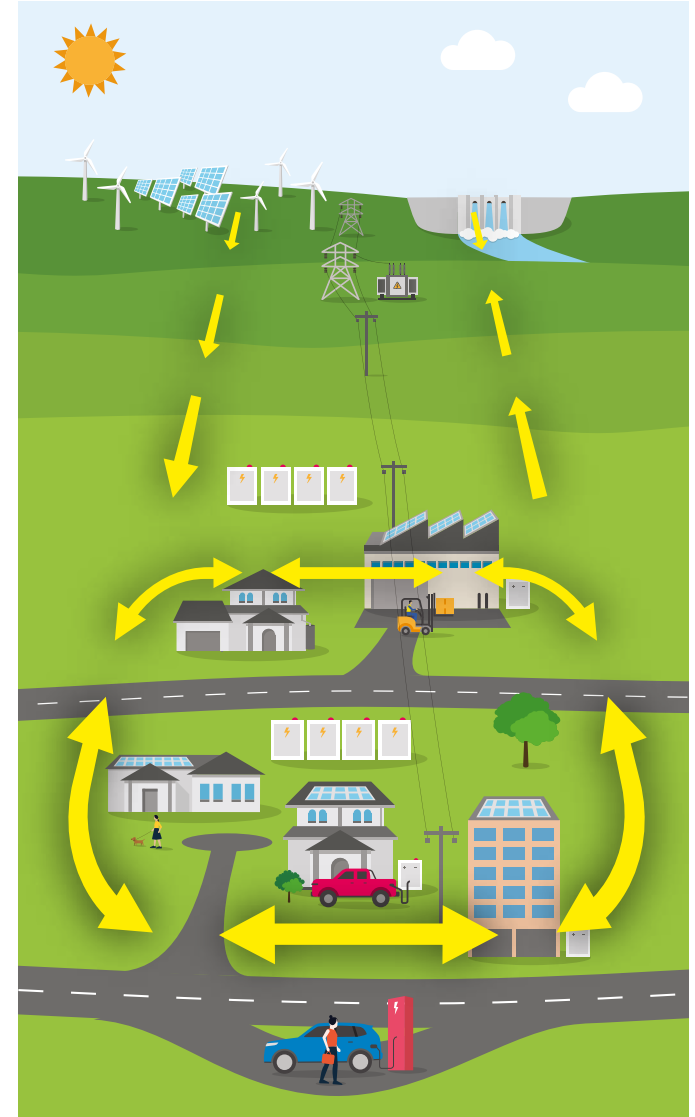
From:
Many smaller power lines built out for peak demand delivering power in one direction

To:
Optimised number of smaller power lines to match utilisation and support two-way power delivery across distribution networks

COMMUNITY

From:
Households, businesses and industry only consume electricity passively

To:
Households, communities, businesses and industry with solar and batteries consume, generate, store and supply cheap, locally-generated electricity to their local community



OPPORTUNITY #6

Shift electricity use to when we generate the most solar power

Shifting electricity use to align with peak rooftop solar generation can help maximise our uptake of this clean, cheap and abundant power and reduce strain on the electricity grid. Smart strategies like daytime water heating, pre-cooling buildings, and charging electric vehicles while the sun is shining can help to boost cost savings for households and businesses, by better balancing supply and demand to avoid cheap rooftop solar being curtailed.

TO DO THIS, WE CAN



Electrify household and commercial building appliances, particularly for water heating.



Shift water heating to peak solar generation hours between 11am and 3pm.



Shift household cooling during summer to between 3pm and 5pm, to pre-cool our homes for the evening.



Charge electric vehicles during the day between 10am and 4pm.



Continue rolling out smart meters and time of use tariffs across Australia to intelligently detect and reward the use of electricity during times of low prices.



Provide mobile apps and digital tools for households and businesses to better understand their solar power generation, energy use and pricing throughout the day, to encourage other behaviour shifts where possible.

THIS WOULD



Shift electricity demand from nighttime to daytime when sunshine is abundant, to use more solar power and avoid homes and businesses having their solar systems shut down by networks to avoid oversupply.



Increase the value of solar power generated during the day, which would increase the reward for energy exported to the grid from homes and businesses.



Cut energy bills of households without solar by shifting more of their use to times of the day when energy is most abundant and cheaper.



Slash bills even further for those with solar, who can meet most or all of their energy needs entirely from their own rooftop generation.

HOW IT WORKS

David and Angie

David and Angie* live in a house without solar panels or batteries, but they do have smart household appliances that switch on during the day. This allows them to:

- › Heat water in the late morning and store it in insulated tanks;
- › Charge their electric vehicle throughout the day (either at a community charger near their work or at home);
- › Pre-heat or cool their home just before the sun sets.

This allows them to shift as much as 20 kilowatt hours (kWh) of electricity use from nighttime to daytime when electricity prices are lower.

If David and Angie got a 5 kilowatt (kW) rooftop solar system, they'd be able to generate the energy needed to cover most of their home energy needs. By using most of their electricity when their solar panels are generating, they'd maximise their energy bill savings.

If they got a solar panel that was even larger, they could make further savings by exporting excess solar generation to the grid to offset their electricity bills.



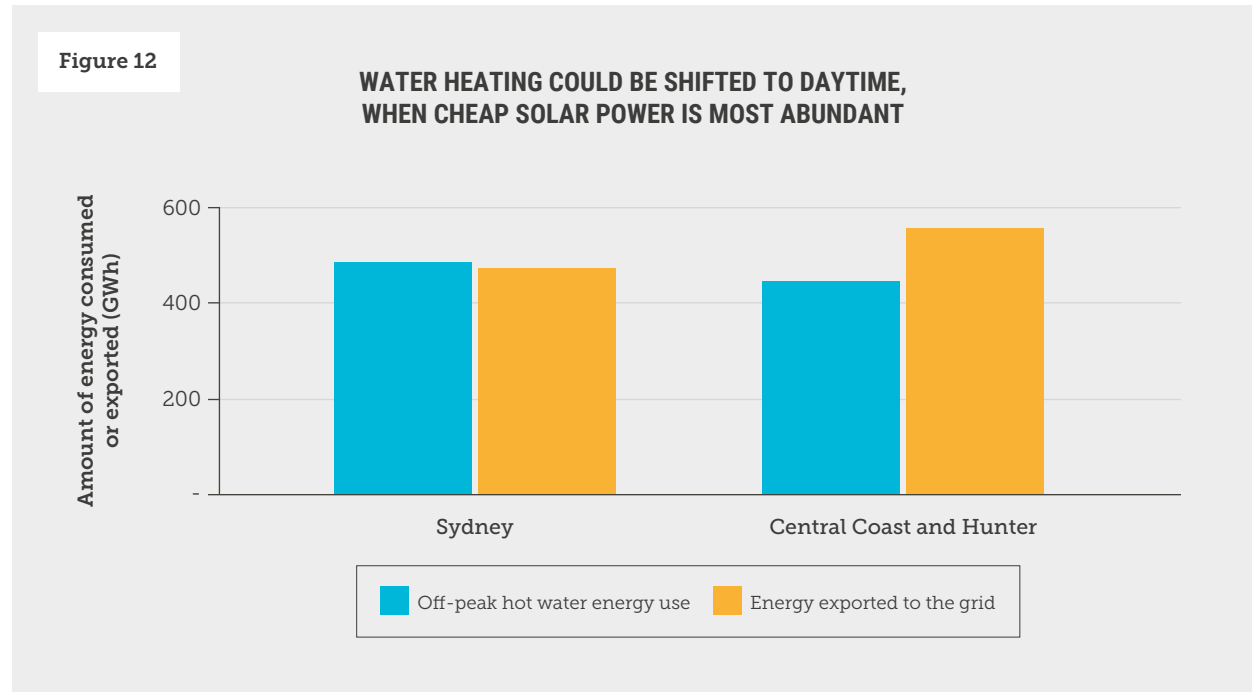
*These scenarios are included for illustrative purposes and are not based on real people.

HOW DOES THIS HELP US MAKE THE MOST OF ROOFTOP SOLAR?

Shifting electricity demand to when solar power is generated, allows us to use cheap and abundant daytime electricity.

As even more rooftop solar and storage comes online, households and businesses should be finding every opportunity to take advantage of cheap, abundant solar energy in the daytime. Three big opportunities to do this in our homes are through daytime water heating, pre-cooling spaces, and electric vehicle charging.

At the moment, many electric water heating systems operate overnight, which misses the opportunity to use abundant daytime solar generation. Figure 12 shows the overnight electricity consumption for hot water and the exports of distributed solar in Sydney and the Central Coast of NSW. It shows that in the Central Coast, more solar is being exported to the grid in the middle of the day than the amount of electricity that is being used overnight for heating water. This is almost the case in Sydney as well. If water heating happened during the day, that rooftop solar energy could instead be used immediately – cutting demand at night and saving households money by using energy when it is cheapest and most abundant. That's almost 930 gigawatt hours (GWh) of energy shifted in just these two regions in one year.



Source: Average electricity consumption by Local Government Area in the Ausgrid distribution network 2022-2023, (Ausgrid 2023).

The ability for the electricity system to intelligently detect and reward the use of electricity during times of low prices is enabled by smart meters and time of use tariffs. These mechanisms are being rolled out across Australia. The Australian Energy Market Commission (AEMC) is aiming for 100 percent smart meter uptake by 2030 (up from 30 percent in 2020) (Australian Energy Market Commission, 2023). Time of use tariffs are also increasingly common

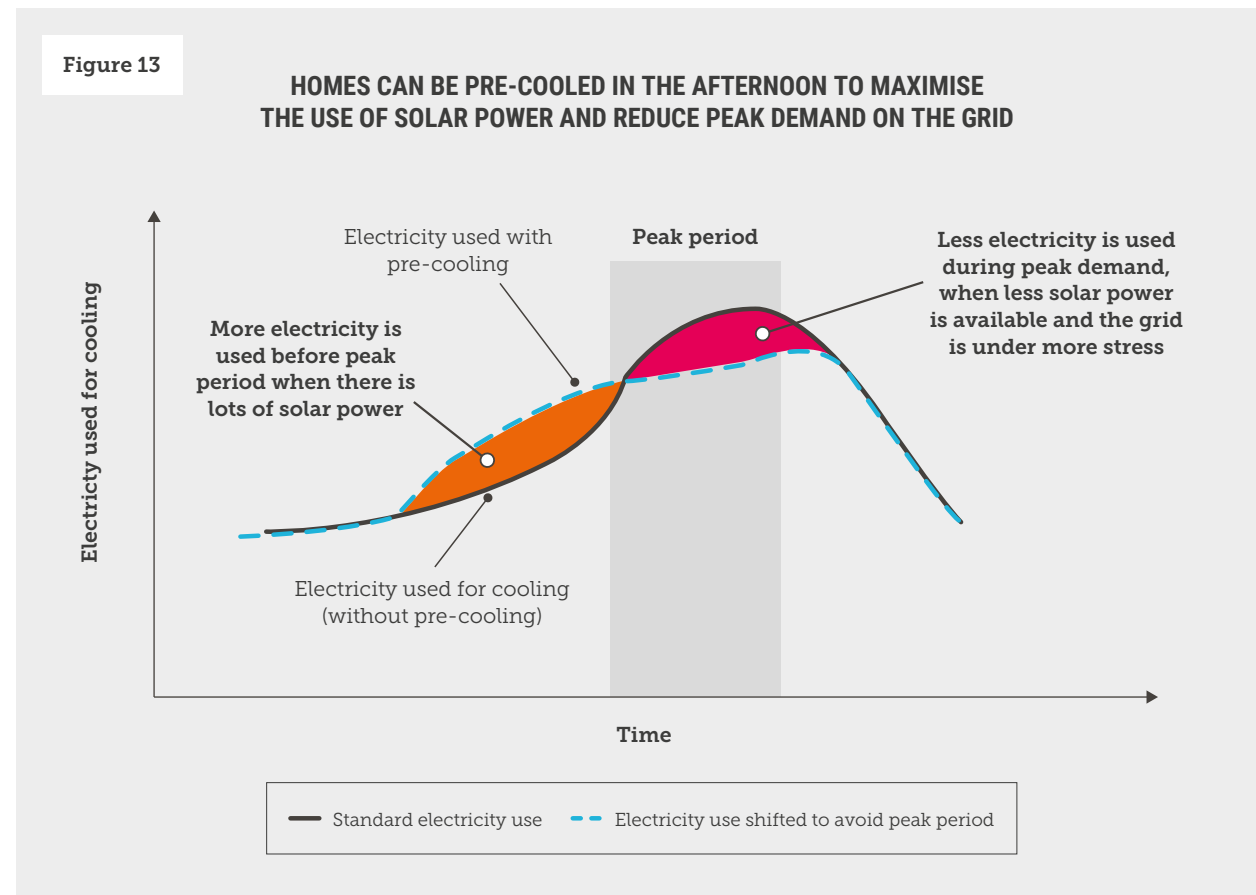
throughout the National Electricity Market (our main national grid). About 30 percent of electricity customers are on time of use tariffs in June 2023, which was a 5 percent increase from 2022 (Australian Energy Regulator, 2023). Energy system regulators and retailers need to ensure that smart meters and time of use tariffs are carefully implemented with consumer protections in place to prevent negative impacts on households and businesses.

Pre-cooling is another way to shift electricity consumption to off-peak hours, particularly in hot climates. This involves cooling a building or space more than usual during periods of high solar generation, and allowing the building walls, floors and furnishings to absorb and store this coolness. The stored coolness is gradually released after the air conditioning system gets turned off before peak electricity demand periods. This allows us to shift energy use away from high-demand, high-cost periods to times when electricity is cheaper. Figure 13 shows how energy demand can be shifted through the use of pre-cooling. The blue dashed line shows a flattening of demand throughout the day.

When water heating and air conditioning units can be coordinated across many different households, network operators can efficiently allocate the amount of energy used to manage any potential strain on the grid during times of peak demand. As of 2022, Energy Queensland had direct control of the air-conditioning units of more than 136,000 homes or small businesses through the PeakSmart scheme, providing up to 150 megawatts (MW) of flexible load that could be shifted by implementing pre-cooling (Kuiper 2023).

Charging electric vehicles during periods of peak solar generation is the third important way to make the best use of cheap and abundant solar energy. Electric vehicles can have battery capacity ranging from 40 to 100 kilowatt hours (kWh), which can comfortably absorb any excess energy generated from solar panels during the day. Even if electric vehicles are not being charged at home and are instead charged in a

public charging station, they can help to absorb the abundant electricity from nearby commercial and industrial facilities with solar. Since electric vehicles are essentially batteries on wheels, they provide further benefits, especially with the introduction of vehicle-to-home (V2H) or vehicle-to-grid (V2G) capabilities, which are discussed in the following chapter.



Source: Adapted from Naderi et al. (2022).

OPPORTUNITY #7

Use household batteries to store extra solar power for use later

Storing excess rooftop solar power in batteries is increasingly important as more electricity is generated from rooftop solar.

Solar households and businesses with batteries can capture their own clean energy and then use it when the sun isn't shining, reducing their reliance on grid power during peak evening hours when electricity is most expensive. This 'behind the meter' electricity use provides the cheapest power for households and businesses as it bypasses network charges, wholesale costs and retailer profits. Household batteries maximise the cost-of-living relief provided by rooftop solar while reducing evening peaks and contributing to a more resilient energy system.

If rooftop solar and battery owners agree to connect their systems into a virtual power plant, network operators will be able to more accurately control energy generation, storage and use to maintain grid stability and help households and businesses save more in their power bills.

TO DO THIS, WE CAN



Install batteries in households and businesses – initially aiming for two million additional units by 2030.



Charge batteries with excess solar power before it is exported to the grid as a default.



Charge batteries from the grid during peak solar generation hours between 10am and 4pm.



Supply homes and businesses with electricity from 'behind the meter' batteries before drawing from the grid.

THIS WOULD



Allow households and businesses to generate free electricity in the daytime, store it and then use it in the evenings.



Drastically cut energy bills of households because they purchase less power during the evening, and even more so for those that can meet their needs entirely from their own generation and storage.



Reduce evening peak demand, which helps with grid stability and enables energy independence for communities who can generate, store and then discharge their own local energy.



Increase the value of solar power generated by solar owners, which would increase the return on their investment.



Enable more efficient allocation of network capacity without breaching safe operating limits – enabling solar owners to continue using their systems.

HOW IT WORKS

Jessica and Liz

Jessica and Liz* live in a house with solar panels and a battery. This allows them to:

- › Generate free solar power for daytime energy use;
- › Store excess daytime solar power in their battery;
- › Once their battery is full, export excess daytime solar power to the grid, to offset their power bills;
- › Use the energy stored in their battery in the evening to power their home's needs, then export any remaining energy back to the grid while electricity demand is high, further offsetting their bills.



Justin

Justin* doesn't have a battery in his home, but he does have an electric vehicle with vehicle-to-home capabilities. This allows him to:

- › Use his vehicle as a battery for storing excess rooftop solar power;
- › Drive his car to work and charge his car at a charging station that is drawing energy from rooftop solar on commercial buildings nearby;
- › Drive home with a fully-charged battery that can provide electricity for his household evening activities.



*These scenarios are included for illustrative purposes and are not based on real people.

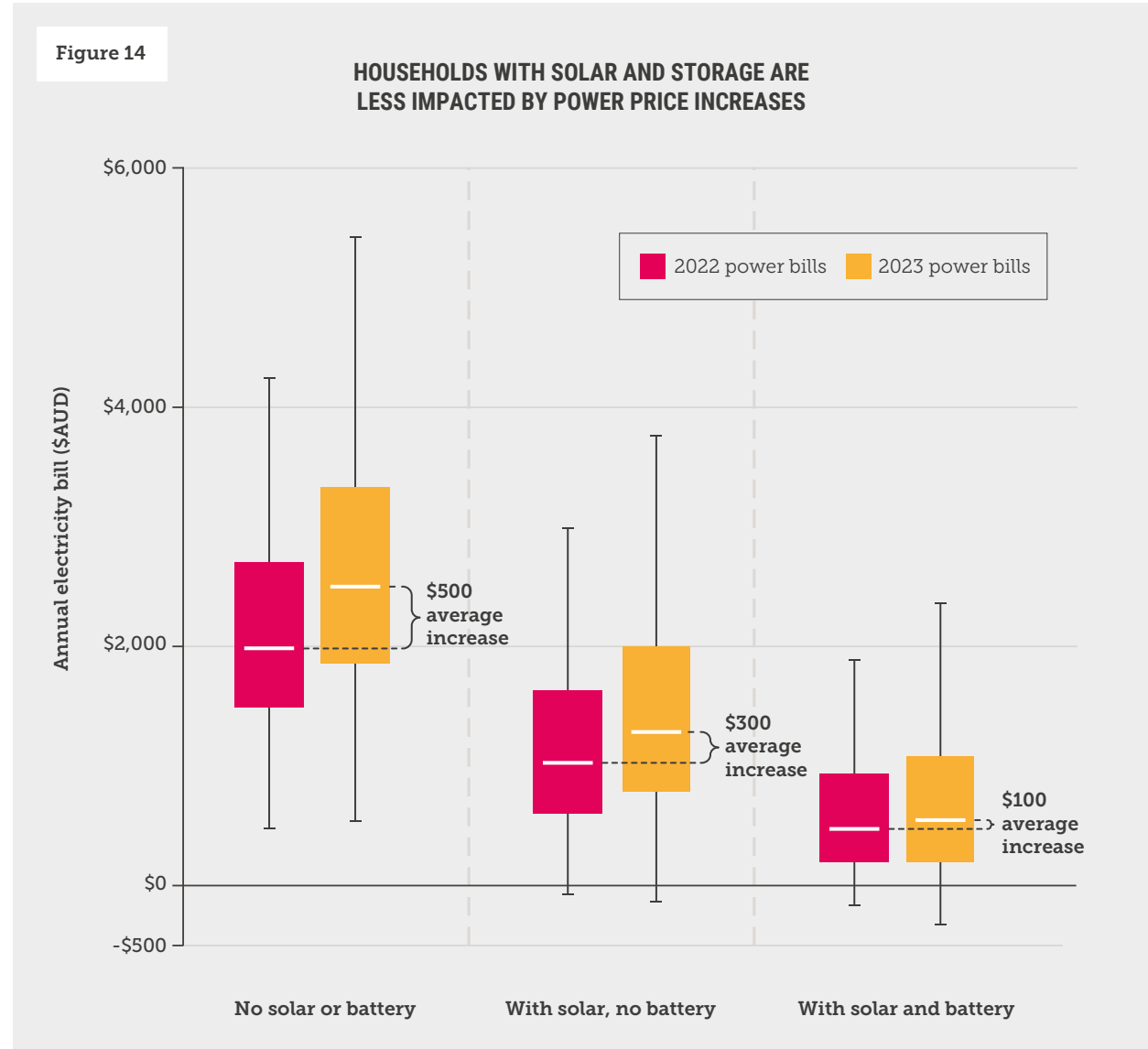
HOW DOES THIS HELP US MAKE THE MOST OF ROOFTOP SOLAR?

Household batteries maximise the benefits of solar panels for households and businesses.

Rooftop solar panels and storage work together to minimise how much power households and businesses need to draw from the grid. This not only insulates them from high and variable power prices, but also reduces network and retail costs which are part of every energy bill.

Modelling of electricity price changes over 2022 to 2023 by UNSW showed that households without solar or battery systems in their homes were the most vulnerable to electricity price changes. Shown in Figure 14, these households experienced a \$500 increase in their power bills on average, compared to the \$300 or \$100 average increase experienced by those with solar panels, or solar panels and batteries respectively (Ashby et al. 2023).

Households with solar are more insulated from power price increases, and those with a battery are even better off.



Source: Adapted from Ashby et al. (2023). **Note:** The lines around each box represent the range of reported bill values, while the box represents the range of the middle 50% of values.

Enabling a smarter, more coordinated rooftop solar and storage system helps to ensure households and businesses maximise their investment in solar.

Investing in smart solar and storage systems can help network operators ensure voltage in the grid stays within technically safe ranges. Currently, network operators can readily instruct power companies to dispatch electricity from large-scale generators. But they do not have direct control over rooftop solar generation, which can lead to challenges in balancing the grid.

To manage this problem, network operators would historically disconnect rooftop solar systems from the system when voltage got too high, which also disabled them for generating power for household appliances and batteries. This also caused network providers to put limits on new installations, capping them to smaller systems than properties could otherwise accommodate. For example, Western Power in WA limits new solar installations to 1.5 kilowatt (kW) systems in some areas. Both of these technical fixes disadvantage households and businesses who could be benefiting more from investing in rooftop solar and battery systems.

Thankfully, more sophisticated solutions are now being rolled out. 'Dynamic operating envelopes' allow flexible, real-time adjustment to the amount of energy rooftop solar owners can export to the grid when it is necessary to maintain grid security, without shutting systems down altogether. This can also avoid the need to restrict the size of new solar installations, so that homeowners and businesses can install larger systems that maximise their investment in rooftop solar. Installing batteries alongside implementing dynamic operating envelopes can ensure household and business rooftop solar systems can generate to their full capacity, and the energy can be used efficiently.




OPPORTUNITY #8


Deploy more community-scale batteries to expand the benefits of rooftop solar


Community-scale batteries act as a bridge between households, businesses and our grid. These large batteries can store excess rooftop solar energy generated by nearby homes and businesses which don't have their own storage. This stored energy can then be accessed by all households and businesses connected to the local network, including those without their own solar panels.

These systems can have a capacity ranging from 100 to 1000 kilowatt-hours (kWh) and are designed to support a few hundred homes and businesses. They can be located in convenient areas like local government depots and community facilities, or alongside existing grid infrastructure like transformer stations which are already located throughout our cities and suburbs. Community batteries are a key way to share the bill saving benefits and cost-of-living relief provided by local solar power with more of the community.


TO DO THIS, WE CAN


 Install 5,000 community-scale batteries in locations that maximise value for the community and provide stabilising services for the grid.


 Provide a reduced local use of service price when local homes and businesses use electricity from community-scale batteries.


 Allow local energy exchange between households and businesses, facilitated through a local community-scale battery.

THIS WOULD

 Provide households and businesses that don't have rooftop solar with access to locally-generated solar power, resulting in cheaper bills and avoided distribution costs.

 Enable household rooftop solar power to be sold to nearby businesses or community scale batteries that can either use the electricity in real time, or soak it up for later use. This ensures greater use and value of solar power generated by the household.

 Store 5000 kilowatt hours (kWh) on average of locally-generated solar energy in each neighbourhood, and provide that energy to around 250 households at night.

 Soak up peak solar generation and manage evening peak demand in the community.

HOW IT WORKS

Dan and Priv

Dan and Priv* are renting a townhouse that doesn't have rooftop solar or batteries. However, the house is connected to their local community-scale battery, which means they can:



- › Access electricity generated by their neighbours;
- › Pay reduced prices for the electricity they use from the local community battery that avoids the additional transmission and distribution fees that would normally be included from purchasing electricity generated from far away.

This way, even though Dan and Priv don't have their own rooftop solar, they can still benefit from the expansion of rooftop solar in their neighbourhood.



Michael and Felipe

Michael and Felipe* have a rooftop solar system, but no battery. However, since their house is connected to their local community battery, they can:



- › Generate solar energy in the day and export excess power to the local community-scale battery. Even if there is low demand during the day, this energy is still valuable as it can be stored and discharged later when demand is high. The electricity they export helps to offset their power bills;
- › Draw electricity from the local community-scale battery at a reduced price in the evening. Like Dan and Priv, their electricity costs would be lower than if they needed to draw electricity from beyond their local network.



*These scenarios are included for illustrative purposes and are not based on real people.

HOW DOES THIS HELP US MAKE THE MOST OF ROOFTOP SOLAR?

Community-scale batteries can help to match energy supply and demand directly within local communities, so more power gets stored and used close to where it is produced in the first place. By installing more community batteries, we can soak up abundant rooftop solar power without every solar home or business needing to have their own battery.

Each neighbourhood has a mix of residential, commercial and sometimes industrial buildings, each with their own energy generation, storage and use profiles. Connecting all the local rooftop generation to a community-scale battery can efficiently supply solar energy to households and businesses when they need it.

For example, households with solar panels may generate far more solar power during the day than they need. Their excess generation can be absorbed by the community-scale battery. The stored energy can then be discharged back to households in the evening when solar energy generation is low and demand is high. This means community-scale batteries can act as an energy 'buffer' by providing energy locally during times when demand spikes.

Community-scale battery pilots around the country are testing different business models to see which can deliver the best value and benefits for the community. This is why the regulatory environment governing the operation of community-scale batteries has been changing over the past several years (Zsuzsanna et al. 2024). As we learn more about using community-scale batteries, regulators need to ensure community benefits are at the centre of their policy and market design criteria.

Community-scale batteries can share the cheap solar power generated by nearby homes and businesses with their neighbourhood.



Image: Totally Renewable Yackandandah is a community-led initiative that aims to power the Victorian town of Yackandandah with 100% renewable energy. Locals who don't have their own solar panels can still buy affordable, locally-generated solar power from the community-scale battery via a local retailer.

4.

Policies to help
Australia shine
bright





Aussie Solar Drive

We have huge potential to keep growing rooftop solar and storage in Australia, and so much to gain when we do: lower cost of living, less climate pollution and a more flexible, resilient grid. That's why it's time for a bold national push to double solar capacity on Australian rooftops and deliver more community and household storage by the end of the decade – reaching almost 50 gigawatts (GW) of reliable, affordable clean energy and 25 GW of supporting storage.

This big national push, the *Aussie Solar Drive*, can support the next big wave of rooftop solar and storage on homes and businesses around the country. This will cement our place as the world's solar champions and bring the benefits to even more Australians. A major new training initiative, the *Australian Energy Corps*, can roll out alongside the *Aussie Solar Drive* to boost the number of skilled energy workers in Australia. Training more workers for great energy careers will help to deliver this big step-up in rooftop solar and storage, while also enabling the ongoing and essential rollout of transmission infrastructure and large-scale wind, solar and storage projects.

Roll out rooftop solar and storage for all social housing

As mentioned in Opportunity #3, Australians living in social housing will benefit the most from the bill savings provided by rooftop solar, because they are facing some of the toughest cost-of-living challenges. The Australian Government is already partnering with state and territory governments to provide energy efficiency upgrades for up to 30,000 social housing properties through the [Household Energy Upgrades Fund](#). While these upgrades will help to make properties cheaper, safer and more comfortable to live in, providing tenants with access to rooftop solar and storage would slash bills and climate pollution even further.

Governments can finance some of this investment by rethinking how energy bill support is provided to social housing tenants. Australian Government or state government green bonds can be used to finance the upfront cost of installing rooftop solar and storage. This model has been demonstrated by Singapore's Housing and Development Board in delivering sustainability upgrades and energy-efficient new builds across its property portfolio (Housing and

Development Board 2022). With rooftop solar and storage slashing their energy bills, social housing tenants will then have less need for ongoing energy bill rebates which currently cost governments hundreds of millions of dollars each year. The savings on these rebates (see Opportunity #3) can be used to meet the returns on the green bonds, reducing the total cost of delivering this new rooftop solar and storage.

A similar approach was briefly piloted in recent years in New South Wales through the *Solar for Low-Income Households* scheme. Eligible households who were receiving the \$285 a year energy bill rebate could opt to swap this for a fully-installed 3 kilowatt (kW) solar system, which the NSW Government estimated could deliver bill savings of up to \$600 a year. Participating residents agreed to trade off the energy bill rebates for 10 years to reflect the cost of the system. While this pilot has now ended, it provides an important real-world example of how rooftop solar and storage could be rolled out to many more Australians living in social homes.

Alongside helping financially disadvantaged Australians cut their energy bills, rolling out rooftop solar and storage on social housing also has the potential to support several other national energy priorities. For example, the Australian and state governments could partner with local manufacturers of solar panels and batteries to purchase the necessary equipment, helping to kick-start domestic manufacturing through the *Solar Sunshot* and *Future Made in Australia* policies.

Because a large number of these homes will be owned by a single state government agency or community housing provider, there is also significant potential to network many solar systems together to form a virtual power plant. A pilot of this approach, delivered in partnership between the South Australian Government and Tesla (see Box 2, p. 16), demonstrates the potential of innovative models like this to help deliver a resilient and reliable grid powered by far more rooftop solar.

There is significant potential to network the rooftop solar systems from social housing into a virtual power plant, to help deliver a more resilient and reliable power grid for everyone.

Accelerate 'solar soaker' community batteries

Ensuring households continue to experience genuine benefits in lower power bills is essential to maintaining and accelerating solar uptake rates. Australian Government investment in community batteries can help households and businesses maximise the benefits of installing rooftop solar, as well as sharing lower power bills and cost-of-living relief with the wider community.

The Australian Government has made an initial \$200 million investment in 420 community batteries around the country from 2022 to 2024. The *Community Batteries for Household Solar* program has been significantly oversubscribed, demonstrating appetite and capacity to incorporate many more community-scale batteries into our grid. The Climate Council's [Seize the Decade](#) plan identified a need for approximately 5,000 community batteries around the country by 2030, to firm up rooftop solar generation alongside household batteries. As part of the *Aussie Solar Drive*, the Australian Government can deliver more co-investment with local governments, businesses and utility networks to keep growing the number of community batteries in our grid.

This investment is an affordable alternative to more significant network upgrades, which may otherwise be needed to ensure Australians who already have rooftop solar – and those who install it in future – can get the most out of their panels. It can also be rolled out quickly and efficiently because the Australian Government has already

built the necessary grant and delivery systems through the first round of the *Community Batteries for Household Solar* program. A second stage of the program could focus on partnering with local governments to deliver community batteries in areas with significant potential to expand solar uptake. In Queensland, the Noosa Council's community battery provides a practical example of how local governments can get involved in the

delivery of this important infrastructure. The council owns the battery, which is operated by a specialist energy firm to buy and sell power into the National Electricity Market. As well as supporting local homes and businesses to make the most of their solar in one of Australia's sunniest regions, the council uses any profits to invest in other projects that cut climate pollution in their community (Noosa Council 2023).



Refocus the Small-scale Renewable Energy Scheme to support commercial solar and storage

Australian businesses have plenty to gain from rooftop solar and storage, but at the moment uptake lags behind households. The Australian Government can drive a big expansion of commercial solar and storage by refocusing the *Small-scale Renewable Energy Scheme* to specifically support business uptake – particularly among the small and medium businesses that create good local jobs.

The first wave of the *Small-scale Renewable Energy Scheme* established a requirement for energy retailers to purchase clean energy generation certificates, which were created through rooftop solar installed on Aussie homes. The scheme has played an important role in driving uptake of household rooftop solar during the early development of this technology, and is a proven market-based model.

A refocused *Small-scale Renewable Energy Scheme* could require large corporations operating in Australia to meet legislated renewable energy targets. Many big companies – like major banks, supermarkets and airlines – have already set their own voluntary renewable energy targets as part of corporate sustainability commitments. These companies would be required to meet a legislated share of their energy needs with renewables, which could be achieved either by installing rooftop solar and storage on their own facilities, or by purchasing renewable generation certificates. Small and medium businesses could produce these renewable generation certificates and sell them to

reduce the cost of installing solar, in the same way as the first wave of the scheme has – primarily for households. Big businesses which have already set voluntary renewable energy targets would also benefit from a clear and consistent framework for demonstrating their progress, and a level playing field with the same requirements applying to all major corporations. Administration of this scheme could leverage the existing energy reporting mechanisms of the National Greenhouse and Energy Reporting Scheme, which large corporations are already part of.

With the *Small-scale Renewable Energy Scheme* now winding down towards the policy's 2030 end date, there is an opportunity to update this proven market-based model to seize the potential of rooftop solar for Australian businesses. This could incentivise far more uptake of solar across Australia's warehouses, workshops and commercial buildings, adding more gigawatts of clean generation to our energy mix.



Ensure rooftop solar is added to all new and substantially renovated homes, apartments and commercial buildings

Around 170,000 new homes are built in Australia each year – including both freestanding properties and apartments (ABS 2024a). Governments are working to accelerate this build rate to around 250,000 new homes a year, as part of tackling the nation’s housing affordability and availability challenges.

There is a significant opportunity to bring the benefits of solar to more people simply by ensuring panels are added as a standard feature to all new and substantially rebuilt properties.

The National Construction Code sets out the minimum requirements for how new homes and apartments must be built. After extensive negotiations between the Australian states and industry, the latest update in 2022 set new ‘whole of home’ energy efficiency requirements which aim to ensure new properties are comfortable to live in and affordable to run (Australian Building Codes Board 2022). This update has seen some progress on making rooftop solar a more frequent inclusion for newly-built homes and apartments, but does not go far enough. Australia already has a big retrofit job ahead of us to extend the benefits of rooftop solar and energy efficiency to existing buildings. Every new and rebuilt home delivered now without solar panels and capacity for storage is simply adding to this challenge. Federal and state governments should work together to set a new bar in the National Construction Code, making rooftop solar a standard feature of all new housing delivered in Australia, wherever this is practically possible.

For commercial buildings, energy efficiency rules in the National Construction Code are encouraging an increasing number of newly-built offices, warehouses and factories to install rooftop solar (Strategy.Policy.Research 2022). The Australian Building Codes Board has proposed that these rules be strengthened to make installing a rooftop solar system a standard requirement for all new commercial buildings by 2025 (Australian Building Codes Board 2024). This would slash climate pollution and reduce energy bills for all kinds of businesses, from healthcare centres to shops and warehouses. Over the period 2025 to 2035, this improvement has been estimated to deliver \$4 billion worth of benefits in reduced energy costs, network costs and emissions (Centre for International Economics 2024).

Australian governments have been making incremental improvements to building standards for years, slowly edging towards homes and businesses which are cheaper to run and produce less climate pollution. It’s time to go all the way by making rooftop solar and capacity for storage a standard feature of all new and substantially renovated properties.

Deliver a national information campaign about the benefits of proven, reliable rooftop solar

Because Australia’s rooftop solar revolution has happened so quickly and often seamlessly, many people aren’t aware of how rooftop solar has become increasingly efficient, affordable and reliable. A national information campaign about rooftop solar can help more Australians understand the proven benefits and tackle common questions about how to get the right solar and storage for their needs.

There is a lot of content out there about rooftop solar, but Australians need clear and reliable information from a reputable source they can trust. The Australian Government’s *Solar Consumer Guide* is a good initial model of collating trusted information, but needs to be better promoted to consumers. Together with a range of more direct government actions through the Aussie Solar Drive, a national information campaign can help break down barriers of knowledge or perception that may be standing in the way of more households and businesses taking up rooftop solar and storage.



Australian Energy Corps

Doubling the amount of solar on Aussie rooftops by 2030 is a big job, particularly alongside the ongoing delivery of large-scale transmission, renewable generation and storage projects around Australia. That's why we need a major new national investment in energy skills alongside the *Aussie Solar Drive*.

Clean energy jobs can offer great, long-term careers for people starting out in the workforce, and for those who are already working in other parts of the energy sector. The *Australian Energy Corps* can skill a new wave of clean energy workers to power up Australia, including helping to roll out more rooftop solar and storage. The Climate Council recommends Australian governments work together to deliver this major boost to energy skills as an essential enabler of our move to clean, reliable and affordable renewables.



Provide free vocational training and upskilling for workers in electrical, plumbing, gasfitting, large-scale renewable energy and relevant building trades

Free vocational training is a key way to attract more workers to the clean energy sector, and help them find the right specialisation for their skills and interests. Whether that's installing rooftop solar and storage, working on large-scale generation projects or doing building retrofits to make homes all-electric and efficient, there are going to be tens of thousands of great new jobs available for energy workers in the years ahead.

The Australian Government has already started down this path with direct financial payments for an initial 10,000 New Energy Apprentices. Now we can scale this up and give aspiring and experienced energy workers access to fully-funded vocational courses so they can gain the classroom knowledge needed to start building or diversifying their careers.

Invest in capital upgrades for energy training facilities at public TAFEs and not-for-profit training providers

Today's energy workers need to train with the latest equipment and technologies they'll be working with on the job. A dedicated capital upgrades fund supporting the *Australian Energy Corps* can ensure training facilities around the country have the right gear to provide quality, up-to-date training, including on assessing and installing rooftop solar and storage to meet a range of household and business needs.

Ensure safe, supervised and high quality on-the-job placements for workers

Apprentice and upskilling workers can contribute to Australia's energy workforce as they learn. The *Australian Energy Corps* can be set up as a dedicated apprenticeship support network for energy workers, connecting them to union- and industry-led Group Training Organisations (GTOs) as their primary employer. Quality GTOs give workers a stable and reliable employer throughout their apprenticeship, while supporting them to gain experience on a range of work sites and types of projects through diverse placements.

Companies that need energy workers – like those delivering our next big wave of rooftop solar installations – can then easily engage with the *Australian Energy Corps* to find workers with the right level of experience and skills for their job. Mandatory apprentice ratios on publicly-funded energy infrastructure projects, like the roll-out of rooftop solar on social housing properties, can also help ensure there are plenty of interesting and diverse jobs for training workers, so they gain the hands-on experience essential for becoming a fully qualified tradesperson.

Provide dedicated streams for new apprentices and upskilling or reskilling workers

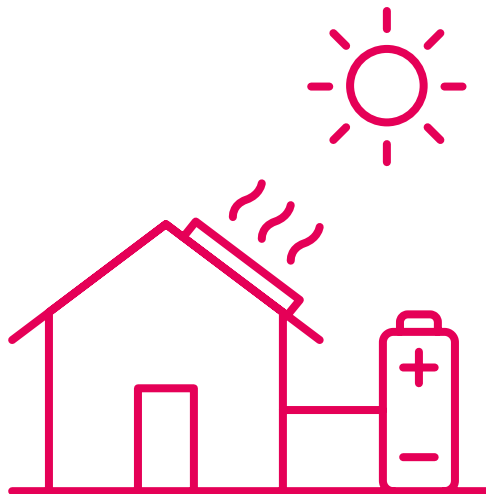
The *Australian Energy Corps* can connect workers with great training opportunities no matter where they are up to in their careers. Australia's existing energy workforce is a huge resource with relevant skills and experience for renewable energy jobs. The *Australian Energy Corps* could support the upskilling and reskilling of existing trade-qualified energy workers from related industries like fossil fuel energy generation, through tailored training programs and supervised work placements, as well as providing full apprenticeships for workers at the start of their energy careers.



CONCLUSION

As one of the sunniest places on earth, it's time to seize the sun.

Australia has already come a long way in rolling out rooftop solar, with around 3.6 million households and thousands of businesses — big and small — already sharing the benefits. As one of the sunniest places on earth, we have so much more potential and there's plenty we can still do to bring these benefits to more Australians.



Together, the *Aussie Solar Drive* and the *Australian Energy Corps* can be the catalysts for Australia's next big wave of rooftop solar and storage on households, businesses and in communities. Rooftop solar is popular around the country because families and communities understand its huge potential to cut electricity bills, give households more control over their energy needs, and slash climate pollution. A renewed push to share these benefits with more households and businesses can directly respond to the cost-of-living and energy pressures Australians are feeling now.

Beyond its benefits for households and businesses, rooftop solar has a central role to play in the clean energy system we're building to replace Australia's ageing and unreliable coal-fired power generators. All three levels of government have major investment and action underway to build the large-scale transmission, generation and storage we need to power past the end of fossil fuel energy. Big plans are also in train to grow new clean industries which can underpin the next era of Australian prosperity through the Future Made in Australia agenda.

A bold national drive to deliver and enable more rooftop solar and storage is the missing piece of the policy puzzle to bring more renewable energy capacity online quickly, cleaning up our grid and meeting our growing electricity needs this decade.

Our shared goal must be to ensure everyone has access to clean, reliable and affordable electricity. If we get the policies right, for two in three Australian homes and many more businesses, this can be delivered directly from their own roofs. For millions more, this clean and affordable power can come from a grid boosted by abundant electricity made cheaply during our sunny days, captured and stored in communities close to where it will be used. This is the bright future that rooftop solar and storage offers, that we can seize with the *Aussie Solar Drive* today.

Methodology notes

Rooftop solar capacity

This report uses solar installation data collated by the Australian Photovoltaic Institute (APVI) to estimate the capacity of three types of rooftop solar. The capacity of household rooftop solar (systems 15 kW or smaller) and commercial rooftop solar (systems sized 16 to 100 kW) is sourced from APVI (2024b).

Some large solar systems greater than 100 kW are also included as rooftop solar, where it is designed for use behind the meter (rather than as a power plant, generating energy primarily for export into the grid). As noted in Opportunity #4, businesses including supermarkets and hardware stores are installing these very large rooftop solar systems to meet their on-site energy needs.

Large solar systems of 100 kW are registered with the Clean Energy Regulator individually by name, and so can be individually filtered. To isolate behind the meter installations the list of registered systems was filtered to exclude registrations with names including 'station', 'farm', 'solar', or 'energy'. A subset of the list was then manually reviewed to validate this filtering. After filtering, the remaining eligible large, behind the meter solar systems represent 7 percent of total capacity.

Cost savings for social housing tenants and government

Annual savings for social housing tenants and governments are based on total typical bill savings from Dehghanimadvar (2024). It is assumed that governments reduce energy bill concessions available to households in line with energy bill savings, up to the total annual concession value. Any bill savings after the value of concessions is then retained by tenants. As shown in Table 1, potential energy bill savings are greater than annual concessions in all states and territories.

Total cost savings for tenants and governments are based on multiplying the value of concessions and tenants' remaining energy bill savings by the count of detached and semi-detached social housing dwellings from the 2021 Census (ABS 2021). Given it is assumed that all concessions would no longer be paid and that all dwellings could accommodate solar, this estimate should be considered as the total potential savings from solar installations.

Table 1: Cost saving analysis assumptions.

Jurisdiction	Estimated annual electricity bill saving	Annual energy bill concession value	Concession characteristics	Source
ACT	\$1,372	\$800.00	Lump sum	ACT Revenue Office
NSW	\$1,372	\$350.00	Lump sum	Service NSW
NT	\$1,755	\$422.67	Lump sum, fixed component only	Northern Territory Government
QLD	\$1,459	\$372.20	Lump sum	Queensland Government
SA	\$1,623	\$274.85	Lump sum	Government of South Australia
TAS	\$1,394	\$173.30	Lump sum	Tasmanian Government
VIC	\$978	\$171.15	17.5% of bill value, does not apply to first \$171.60	Department of Families, Fairness and Housing
WA	\$1,292	\$334.49	Lump sum	Government of Western Australia

Increase in capacity from installing solar on all new social housing:

The total increase in rooftop solar capacity is based on installing an 8 kW system on each detached social housing dwelling, and a 4 kW system on each semi-detached dwelling, with system sizes based on Dehghanimadvar (2024), and dwelling counts based on the 2021 Census (ABS 2021).

Increase in capacity from installing solar on all new commercial buildings:

Currently commercial buildings are incentivised to install rooftop solar due to energy efficiency requirements, but not required to do so. However, the proposed NCC 2025 makes solar installation mandatory for all commercial buildings, covering 100 percent of available roof space, or meeting a minimum capacity per m² of conditioned floor area.

Projected construction of new commercial building stock by climate zone and building type was sourced from Strategy.Policy.Research. (2022a). New commercial stock is measured as m² of conditioned floor area, in line with the proposed requirements of NCC 2025. Under the current state, solar systems are installed on 47 to 69 percent of new commercial buildings, with specific survey data from Strategy.Policy.Research. (2022b) used where available for a given building type, and 50 percent used as a default assumption otherwise.

Under both current regulations and the proposed NCC 2025, new buildings with solar are assumed to install solar capacity equivalent to the watts per m² parameter from Australian Building Codes Board (2024). These parameters are based on achieving a 50 percent level of on-site consumption to maximise energy cost savings (DeltaQ 2024). In practice, some high-rise buildings will not have enough roof space available to support this level of solar, while other buildings, such as warehouses and aged care facilities, are likely to install more solar than required given abundant roof space and high energy use. As a result, the amount of solar per m² is considered an average response.

In the absence of regulation, only the current rate of solar installations is expected to occur. All new commercial buildings are assumed to install rooftop solar from May 1 2025.

Increase in capacity from installing solar on all new residential buildings:

Currently, only about one-in-three new houses are built with solar. While data is not collected for apartments, anecdotally very few are built with solar. While the 2022 reforms to the *National Construction Code* (NCC) will incentivise rooftop solar installation, the impact of these regulations is not yet clear.

For the purpose of this report, the increase in rooftop solar has been modelled based on the current base case, which has not yet seen the impacts of NCC 2022. Current rates of rooftop solar installation and projections for new dwelling construction were sourced from ACIL Allen (2022). Solar is assumed to be installed on all new properties from July 1 2027.

Houses were assumed to install 6.6 kW of rooftop solar, based on the industry standard system size for houses on single phase power, but it should be considered an average. Homeowners may choose a larger or smaller system to suit their property and energy needs.

Given the range in apartment buildings, from low-rise two storey buildings to high rises, there is a large variation in the amount of rooftop solar capacity available. The apartment solar capacity of 2.5 kW per dwelling is based on a middle value of the range of potential capacities for apartments of different size, as estimated by Dehghanimadvar (2024).

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